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YOUTH. SOCIETY. MODERN SCIENCE, TECHNOLOGIES & INNOVATIONS

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Сборник издается в соответствии с оригиналом, подготовленным редакционной коллегией, при участии редакционно-издательского отдела.

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Dear participants!

This year we conduct our annual international conference in challenging conditions caused by external reasons as humanity experiences an important period now. It's substantial to emphasize the importance of maintaining a high level of scientific international cooperation in the conditions of isolation. A current situation addresses the problem of integrating faculty and students into the global educational and research environment. Universities globally are challenged both to keep a high level of education and continue cross-cultural scientific communication.

We are pleased to present the results of your scientific research in this edited volume of works. We truly believe that your participation in the conference is a successful investment in a bank of your soft skills and professional qualifications necessary for your future market competitiveness.

Natalia Shumakova, Head of Department of Foreign languages
for Business Students

We are glad to welcome all our participants to the annual International Scientific Conference. Communication, exchange of experience, ideas and knowledge, support the development of innovative activity and professional growth of young specialists is, definitely, the main goal of our conference. And such interesting events contribute to involving young people for the opportunity to work in international teams, to implement international cooperative projects and also to solve the problems of modern science. We are trying to attract as many talented, purposeful bachelor students and young specialists as possible to discuss actual issues of the economic and humanitarian areas. And we appreciate, that the participants with their supervisors have done their best together to share information about their research with peers.

Ksenia Khvorostova, senior teacher of Department
of Foreign Languages for Business Students

Communication in a foreign language is an integral part of training a specialist. For the scientific and technical sphere, knowledge of a foreign language is crucial in the context of growing scientific cooperation between countries and competition in the labour market. The active exchange of ideas and scientific experience in the professional field is a prerequisite for professional growth and development, a foreign language being an important tool for transferring this knowledge.

I sincerely wish all the participants fruitful work, new discoveries and approaches that will contribute to the solution to the tasks assigned to our society and the formation of the scientific potential of young scientists. I wish you good luck in mastering scientific issues and foreign languages!

Tatyana Vladimirovna Strekaleva, Candidate of Philological Sciences,
Associate Professor of the Department of Foreign Languages for Engineering Students

Deutsch ist nicht nur die "Sprache" der Hochtechnologien. Er ist eine der anerkannten Sprachen der Weltwissenschaft in der modernen Gesellschaft und verfügt über alle notwendigen Werkzeuge, um dringende wissenschaftliche Probleme sowohl im sozioökonomischen als auch im technischen Bereich des wissenschaftlichen Diskurses zu lösen. Für langfristige wissenschaftliche Kontakte sind Menschen, die Deutsch können, besonders unverzichtbar.

Wir freuen uns, die Autoren der deutschen Beiträge, auf der Sprache von Kant, Röntgen, Max Planck, Heinrich Hertz, Robert Koch, Gottfried Leibniz, Ernst Schröder und anderen großen deutschen Wissenschaftlern begrüßen zu dürfen. Die Autoren tun zusammen mit ihren wissenschaftlichen Leitern ihr Bestes, um Informationen über ihre Forschung mit Kollegen zu teilen.

Wir hoffen, dass diese Materialien eine solide Grundlage für neue gemeinsame Projekte bilden können. Gerne tragen wir zur Bildung internationaler Wissenschaftlerkollektive junger Forscher und zur Entwicklung ihrer Zusammenarbeit bei!

Natalja Podporina, senior teacher of Department
of Foreign Languages for Engineering Students

The articles, which are being published, are considered to be the first step in science of the bachelor students, and more fundamental results are expected to be shown by the senior ones. Preparing the article for publication is really a serious and difficult process, which requires intellect, deep knowledge of the problem, patience, diligence, responsibility. Such features of character and specific approach to solving a problem will greatly help future scientists in their scientific investigations.

The conference is a special and very important step towards opening new and promising horizons, what imposes responsibilities on the participants and sets more difficult and interesting tasks for future specialists in their scientific investigations.

Olga Maslova, Associate Professor of the Department
of Foreign Languages for Engineering Students

It is an honour to say a few words about a good tradition. Since the very start our conference mission is to unite young researchers, highlight their new achievements, and support them in their effort to continue the thorny but fruitful path in science. It is a really hard way because it takes your energy, and, sometimes, all your time; it is worth going as you enrich your knowledge, skills, and enwiden you life horizons.

This year the conference gives young researchers the floor for the 19-th time. Our conference is 19, it means that the event has become as mature as many of you, however, it is still young and it is developing. Every year we, as the conference organizers, could feel that your research and presentations contain new ideas reflecting the spirit of science. Fortunately, we could state the pariticipants demonstrate their improving skills and really profound research, therefore, the conference meets its mission and tasks.

We consider our every year conference to be a useful tradition; paraphrasing Jonah Goldberg a bit, we could say "the traditions grow cultures and generations". We wish you follow right traditions and become successful researchers!

Marina Savelyeva, Head of Department
of Foreign Languages for Engineering Students

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УДК 681.883

THE PYHUM LIBRARY FOR ANALYZING HYDROGRAPHIC DATA

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The PyHum library written in the Python programming language is used to analyze Humminbird sonar data. The library's built-in modules enable analyzing data obtained with the help of a low-cost sonars. This article discusses the features of working with this software.

Keywords: PyHum, geophysics, Humminbird sonars, hydro-log data, Daniel Buscombe method.

ПРИМЕНЕНИЕ БИБЛИОТЕКИ PYHUM ДЛЯ АНАЛИЗА ГИДРОГРАФИЧЕСКИХ ДАННЫХ

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Библиотека РуHum, написанная на языке программирования Python применяется для анализа данных эхолотов фирмы Humminbird. Встроенные в библиотеку модули позволяют анализировать полученные эхолотом данные. Рассмотрены особенности работы с программным обеспечением.

Ключевые слова: РуHum, геофизика, эхолоты Humminbird, гидрографические данные, метод Даниэля Баскома.

Today there is a surge of hydroacoustic devices available on the market, with applications far exceeding fishing and boating. These appliances can be used for a wide range of scientific tasks in the field of geophysics, such the study underwater objects [1], and the study of underwater topography (bathymetry) [2].

Humminbird has been producing sonar devices for over 40 years [3]. In 2018, an inexpensive and portable Onix 8 cxi SI Combo model manufactured by Humminbird was purchased

by Reshetnev Siberian State University of Science and Technology. It has been used to study the Yenisei River as part of the GIS "Yenisei–Arctic" project. For a better understanding of the Onix 8 cxi SI Combo characteristics [4] (see Table), we compared the Humminbird series to a similar product by Garmin [5]. As can be seen from Table, price does not significantly affect the parameters of these devices.

While the operation of a conventional sonar [6] is based on acoustic waves emitted in one beam, side-scan sonar emits sound waves in 4 beams in different direction, which, in turn, have different angles and frequencies. One beam is vertical, while the other beams are directed sideways from the transcuder [7].

Examples of programs used to decode the recorded data from Humminbird sonars include Reefmaster, HumViewer, and PyHum.

Comparison of different sonar models

Models of sonars	Himminbird ONIX 8 cxi SI Combo	Himminbird ONIX 10 cxi SI Combo	Garmin EchoMAP PLUS 92sv
Price (roubles)	129000	155000	110800
Frequency of the sonar, Hz	200/83/455/800/50	200/83/455/800/50	50/77/83/200
Quantity of beams	4	5	4
Power of radiation, W	1000/8000	1000/8000	500/4000
Maximum depth, m	3000	3000 with an additional sensor SM3000	690, freshwater 330, saltwater

PyHum is an open-source program designed to analyze the file format associated with Humminbird side-scan sonar recordings. PyHum has a modular set of tools based on the Python programming language, which currently supports several models of Humminbird (700, 800, 900, and 1100 series, HELIX, MEGA and ONIX) [8]. The program has a GUI that allows the simple operation of PyHum modules, with the selection of the desired parameters for further calculations.

The echograms on the side-scan sonar are encoded into files with the extension DAT, SON, and IDX. DAT contains basic information on the sonar (time, position, and settings). SON contains 8-bit recorded echograms. IDX is created under one SON file, contains indices of successive pings (fan-shaped acoustic pulses perpendicular to the heading) in the corresponding SON file, which simplify the readings of SON files [9].

Then this data is processed using the PyHum modules [10].

1. "Read"– read Humminbird DAT and associated SON files, and export data in various formats.

2. "Correct" – read output **read**, perform radiometric corrections and produce a series of rudimentary plots.

3. "Remove Shadows" – read output **correct**, and remove dark shadows in scans caused by shallows, shorelines, and attenuation of acoustics with distance.

4. "Map Sidescan" – map module is used to project the corrected and filtered echogram into a known coordinate system using location and navigation information collected using the attached GPS antenna in units of decibels watt (dBW). In [11] there are details of the data processing methods and acoustic corrections encoded in the software.

5. "Texture" – read the radiometrically corrected Humminbird data (output from **correct**), perform a textural analysis using the spectral method of Buscombe et al. [11] (forthcoming) and produce some rudimentary plots.

6. "Map Texture" – script to generate a point cloud (X, Y, texture lengthscale), save it to ascii format file, grid it, and make a raster overlay for a kml file for Google Earth.

7. "Bed Class" – script to analyze the first (e1, 'roughness') and second (e2, 'hardness') echo returns from the high-frequency downward looking sonar, and generate the generalized acoustic

parameters for the purposes of point classification of submerged substrates/vegetation. The processing accounts for the absorption of sound in water, and does a basic k-means cluster of e1 and e2 coefficients into a specified number of acoustic classes. This code is based on a code by Barb Fagetter (blueseas@oceanecology.ca). Georeferenced parameters are saved in csv form, and optionally plots and kml files are generated.

Thus, we have found that PyHum is a program that has more opportunities than other similar programs (Reefmaster and HumViewer), allowing scientific research in the field of geophysics. Besides, there exists and opportunity of editing the code, its further improvement and modernization, which is not the case for other programs. Certainly, commercially available and specialized professional programs similar to Reefmaster are not inferior in their graphical interface; however, they do not contain the functions that are available in the PyHum modules. With regard to sonar models with a range of prices, in article [12], an investigation was performed, which concluded that the results of data processing do not differ from expensive models by more than 3 %. Thus, the use of low-cost devices and free software enables broader access to sonar technology and thereby a wide range of opportunities for research in the field of geophysics.

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УДК 556

ANALYZING UNDERWATER IMAGERY OBTAINED
BY SIDE-SCAN SONAR ON THE LOWER YENISEI RIVER IN 2018

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This paper examines how remote sensing systems such as side-scan sonar function. Factors influencing the end data during the side-scanning process are also considered. A sample sonogram from a section of the Yenisei River is studied in the paper.

Keywords: side-scan sonar, remote sensing.

АНАЛИЗ МАТЕРИАЛОВ, ПОЛУЧЕННЫХ ГИДРОЛОКАТОРОМ
БОКОВОГО ОБЗОРА НА НИЖНЕМ ЕНИСЕЕ В 2018 г.

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Рассмотрен принцип работы такой системы дистанционного зондирования, как гидролокатор бокового обзора. Также рассмотрены факторы, оказывающие влияние на конечные данные, при сканировании гидролокатором. Произведен анализ нескольких снимков, полученных при помощи гидролокатора бокового обзора с участка реки Енисей.

Ключевые слова: гидролокатор бокового обзора, дистанционное зондирование.

Nowadays, the concept of remote sensing has become a commonplace notion. It is typical to associate remote sensing exclusively with the observation of Earth's surface through an assortment of aerial and space photography tools. Furthermore, remote sensing is thought of as a costly activity that is inaccessible to the layman. However remote sensing is much broader concept. It is a process or method of obtaining information about an object, surface area, or phenomenon by analyzing data collected without contact with the object under investigation. Therefore, as follows from its definition, remote sensing should emphasize on the study of the object, without direct contact with it. Therefore, remote sensing in not the unambiguous use of expensive equipment and can be carried out on the ground, or, as in the case of this paper, underwater. One example of a remote sensing instrument is the side-scan sonar (SSS).

Aquatic environments are among the most difficult. For their study classical remote sensing techniques based on the laws of optics are not suitable; here, another field of physics, acoustics, comes to the rescue. It is known that in water, sound extends to a much greater distance than in air. It is on this law of hydroacoustics that the principles of the SSS are based. This system allows to obtain images of the seabed by converting the amplitude values of the generated acoustic signal reflected from objects into successive rows of pixels that constitute the image of the bottom of the

studied reservoir. In other words, this system translates values into the tone of the pixels of the future image by measuring the amplitude of the signal. Solid and dense objects reflect more sonar signal than soft and loose ones. Therefore, by analyzing the tone or color of the pixel, it is possible to describe an underwater object. However, there are other factors, which affect the tonality of pixels in the final image (e. g.: the characteristics of the underwater object, i.e., the composition of the water, its density, temperature). Scan parameters, such as scanning range (scan strip width), the frequency of the emitted signal, signal trajectory, the speed of the SSS transducer, and other factors, the occurrence and influence of which cannot always be anticipated or prevented, for example, the various motions of currents at the surface and underwater and weather conditions affecting water movements. Based on our knowledge of the causes and factors, which affect the scanning process, as well as the parameters and settings of the equipment, it is possible to study images obtained by SSS to investigate the sea or riverbed.

In this paper, we examine data collected using a Tritech Starfish 990F, a SSS designed to search for various submerged objects at depths of up to 30 m. Depending on the frequency used, the SSS can be used for surveying harbors, inland reservoirs, and fisheries.

For this study, we have analyzed a section of the lower part of the Yenisei River (Fig. 1), which was investigated using SSS during an expedition by Reshetnev University of Science and Technology in 2018.

Fig. 2. Track of study area

Fig. 2. General view of the scan strip image

In Fig. 2, we have considered the encountered objects together with the characteristics of the study area. In the image, the riverbank is immediately visualized as the transducer nears land; it is in the form of a clear line on the left side of the image. We can also see a light object, the shadow of which is situated at a much greater distance ; thereby the object is suspended in the water, and does not lie on the bottom. Estimating the size and shape of the shadow, it can, with a great degree of certainty, assumed to be a fish. In the right-hand side of the image, there is a shaded area. Such areas occur as a result of a lack or partial loss of data, which can occur due to the roughness of the riverbed surface. In this case, a shadow is produced and the acoustic signal is not reflected back to the transducer (towfish). In Fig. 2, the objects casting the shadow are most likely large rocky formations. As the depth values in the image (left to right) increase, the data becomes less informative.

From the sonar data it is clear that the depth in the study area is not constant. This can be determined by the width of the "black area" in the center of the image, which increases as the water depth under the towfish becomes greater (this happens if the towing depth is not adjusted). In this acoustic shadow it is possible to visualize objects that are closer to the towfish, as fish and floating debris. Thereby it is possible to determine the number of large suspended objects in the water. The fluctuations in elevation along the track are significant: there are both shallow areas and large recesses. For the most part, the bottom material is homogeneous, presumably a fine river silt. There are large boulders closer to the riverbanks.

Let us consider another example where submerged objects are easily recognized by their shadow and silhouette, which give us information on the position and size of the objects. Moreover, a significant amount of information arrives from the form and strength of the reflected signal. For

example, in the left-hand side of the image, there is a fixed object, the reflectivity of which is greater than that of the surrounding objects, indicating to a difference in its composition (material type). It may be problematic to recognize such objects and distinguish them from their surroundings; for instance, in our case, the object on the left side of the image is barely discernible as it has an unnaturally angular form. Thereby, based on the correct rectangular shape and high values of reflectivity, we can assume that the object is manmade. On the contrary, the log in Fig. 3 is easily recognized by its elongated shape.

The data in the discussed echogram (sonogram) can be described as follows:

1. The study area has an uneven riverbed surface with many variations in the depth of different formations.

2. There are multiple traces of human activity, long furrows, or embankments, possible produced by ship hulls or dragging anchors.

3. There are many submerged objects at the river bottom or suspended in the water, such as solitary logs, flooded woody vegetation, boulders, solitary fish, and schools of fish, and manmade objects.

Fig. 3. A screenshot of the echogram

Thus, the further development of interpretation and processing methods for data obtained by SSS can contribute to the dissemination of similar, relatively inexpensive, and available equipment. Overall, SSS is formidable instrument in the study of the underwater world. The results of such investigations can contribute to the development of navigation, fishing, facilitate search and rescue operations, construction, etc.

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THE STRUCTURE OF A FILE CONTAINING SIDE-SCAN SONAR DATA AND THE PRINCIPLE OF IMAGE BUILDING

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This paper touches upon the structure of a file containing side-scan sonar data. A more detailed study of the data block responsible for interpreting the set of acoustic signals into an image, together with the mechanism of this transformation is considered.

Keywords: side-scan sonar, data conversion.

СТРУКТУРА ХРАНЕНИЯ ДАННЫХ ГИДРОЛОКАТОРА В ФАЙЛАХ И ПРИНЦИП ПОСТРОЕНИЯ ИЗОБРАЖЕНИЯ

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Рассматривается общая структура и строение файла с данными, записанные гидролокатором бокового обзора. Более детально изучен блок данных, отвечающий за интерпретацию набора акустических сигналов в изображение, а также механизм данного преобразования.

Ключевые слова: гидролокатор бокового обзора, конвертация данных.

As computers dominate more areas of human activity, new software complexes and information systems are being developed. Many of them have their own specific file formats for convenience. However, this may be convenient only in a specific environment, with untrained users facing problems during exporting data from one software to another. Without knowledge of the file structure it may be impossible to convert the file into common formats. In this case, the user will have to independently learn the structure of the data and execute the conversion. Let us, for instance, consider Tritech Starfish 990 side-scan sonar (SSS) data.

StarFish ScanLine software allows collecting and storing SSS data. During the operation of the sonar equipment, hydroacoustic images are displayed in real time and recorded, along with data arriving from other devices, such as a GPS receiver, compass, and speed sensor. The program's main window displays imagery as a standard streaming sonogram (echogram). The software can record and playback the sonograms, however it does not provide a wide range of tools for data processing. Consequently, the data has to be imported into a software product which has the necessary tools and functions. There is, however, a problems: SSS data is recorded in a LogDoc-resolution file that is not supported by many processing software products. However, StarFish

ScanLine allows us to convert data into a CSV or XTF-enabled file, resulting in a huge number of files. To convert this data into a workable format, such as JPEG, it is necessary to understand how the data is stored.

Let us consider the structure of a file converted to CSV with commas as dividers. The first line of the file must be written down as the names of the fields to determine the location of the necessary information. All information is divided into several blocks received from one of the devices:

– "DPT" – Depth Data;
– "DG" – Heading Data;
– "POS" – Position Data;
– "SSS" – Side-scan Data;
– "LEV" – Velocity Data.

Of particular interest is the data needed to build the image; it is contained within the SSS block; this file occupies most of the block. It stores the date and the time of its recording, contrast, displacement and amplification values, meter range, a number of data points on the scanning line, and the sheer number of data points that represent a separate element on the scan line, which is given in unprocessed decibels. The "P" and "S" letterers determine on which half of the sonogram the information is recorded (port or starboard). This data recording is based on the principle of SSS: it sends an acoustic pulse to the left and right of itself and receives acoustic signals reflected from underwater objects. The resulting values in decibels are converted into successive rows of pixels, which constitute the image of the riverbed surface.

Thus, to build an image it is necessary to convert acoustic pulses into pixel colors. To achieve this, each value of the reflected acoustic signal (the strength of the echo) must be obtained. These values range from 0 to 1. Echo strength is calculated, using the following formula with the addition of amplification and displacement and the subsequent use of contrast when displayed on the palette:

$$Echo\ strenght(x) = \frac{\left(\dfrac{Raw\ Data(x)[dB]}{2} - Offset[dB] + Gain[dB] \right)}{Contrast[dB]},$$

where, Echo strength (x) falls in the range of 0:1; RawData (x) are the raw data values; Offset is the bias value; Gain is value of amplification; Contrast is the value of the contrast.

Once the reflected acoustic signal is received for each value, the echo strength value is received and can be translated into pixel color values. The simplest way is to get an image encoded in 8 bits, i. e. 256 shades of gray. Levels range from 0 to 255. Therefore, each echo strength value for the reflected acoustic signal is multiplied by 255. The result will be an array of data, with each element representing the color encoding of one pixel.

For further work with the image, it is convenient to position it. Data from the POS block, which contains latitude and longitude in decimals, zone number in the WGS 1984 projection, distance within meters from the center of the zone to the north and east. However, it is impossible to obtain the exact coordinates at several points of the image, as in space photographs. Only the coordinates obtained from the GPS receiver are updated every few seconds. This makes it paramount to consider the width of the sonogram. Based on this, it is possible to calculate the position of each pixel. It is important to note that one pixel covers a specific area of the terrain. Moving away from the center of the image produces a distortions and the size of the area displayed on one pixel increases. The distortion can also be in broken shooting routes, when the elements of the image overlap the inner corners, and break onto the outer corners. In this case, the positioning accuracy is reduced, despite the discreteness of the GPS data and a large number of pixels assigned the same coordinates. All of these factors need to be taken into account in order for the data to be transferred into the necessary format.

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COMPARISON OF MODULAR PRINCIPLES OF CNC MACHINES CONSTRUCTION

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This paper discusses two main ways to build CNC machines based on the modular principle. The paper analyzes the advantages and disadvantages of each method and shows the most effective method in our opinion.

Keywords: CNC machine, organization of production, modular construction of CNC

СРАВНЕНИЕ МОДУЛЬНЫХ ПРИНЦИПОВ ПОСТРОЕНИЯ СТАНКОВ С ЧПУ

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Рассмотрены два основных способа построения станков с ЧПУ на основе модульного принципа. Анализируются преимущества и недостатки каждого способа и показан наиболее эффективный на наш взгляд принцип.

Ключевые слова: станки с ЧПУ, организация производства, модульное построение ЧПУ.

The purpose of our study is to analyze 2 main ways to implement the modular principle of CNC machines construction. The level of our research is theoretical. The following tasks were solved:

1) to consider the first method of constructing CNC machines;
2) to show the features of the second way of building CNC machines;
3) to express our point of view about the advantages and disadvantages of these methods.

Today, there are two ways to implement the modular principle of constructing CNC machines:

1) each machine-tool company independently develops a limited range of modules of the main units of the produced standard size of the machine, using which specific modifications are then developed by order of the consumer;

2) machine-tool companies design the necessary modifications of CNC machines based on the use of a wide range of various finished units and mechanisms (in the form of modules) developed and manufactured by specialized companies.

The first method of the modular principle of constructing CNC machines can be implemented in two versions. In the first version of modular construction, the machine tool company develops a basic model of the CNC machine with its full possible configuration and a limited set of basic

modules. For example, two or three versions of the main motion drives, different versions of turrets heads and tool magazines of different capacities, the presence and options of turntables, the availability and options of counterspinders in CNC lathes, etc [1, p. 65].

Then, on the basis of the basic model, the necessary modifications of this machine are created due to additional installation, removal, replacement or change of the relative position of these modules depending on the requirements of the customer.

In the second version of modular construction of CNC machines (in particular medium and heavy), the company develops a nomenclature of a limited number of modules of all units and mechanisms of the proposed type of CNC machines, including their basic units. Then, the modification of the machine is completed using the available modules at the request of the customer [1, p. 66].

In our opinion, the second way of implementing the modular principle of the construction of these machines becomes more promising, since there is an increase in the centralized development and manufacture of a variety of unified and standardized units and mechanisms for various CNC machines by specialized firms.

In this case, the machine-tool company practically develops only the layout of the proposed CNC machines and the design of their basic parts and assemblies (base, bed, column housing of individual units). The company buys the necessary components and mechanisms that determine their technical and technological characteristics on the market of ready-made modules, based on the wishes and requirements of the customer.

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CHOMSKY HIERARCHY IN THEORY OF COMPUTATION

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This article presents the typification of formal grammars according to the structure of their rules according to the classification proposed by Noam Chomsky, and their practical application.

Keywords: Chomsky, grammar, language, rules.

ИЕРАРХИЯ ПО ХОМСКОМУ В ТЕОРИИ ВЫЧИСЛЕНИЙ

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Приводится типизация формальных грамматик по структуре их правил согласно классификации, предложенной Ноамом Хомским, и их практическое применение.

Ключевые слова: Хомский, грамматика, язык, правила.

Grammar is the ultimate description of a formal language. A formal language, in turn, is an arbitrary set of chains made up of the characters of a finite alphabet. The arbitrariness of the set here is understood in the sense that it can be infinite, finite or empty.

The formalism of generative Chomsky grammars was introduced by Noam Chomsky in the late 50s of the last century. In a short time, this formalism has gained extraordinary popularity. For a while, generating grammars were considered as a panacea – a universal approach for setting all kinds of languages, including natural ones (i. e. languages that people use for everyday communication among themselves). But time has shown that generative grammars for describing natural languages are not very convenient. Now generative grammars are mainly used to describe the syntax of formal languages like programming languages and other computer languages.

According to the classification proposed by the American linguist Noam Chomsky, professor at the Massachusetts Institute of Technology, formal grammars are classified according to their rules. If, without exception, the rules of grammar satisfy some given principle. It is enough to have one rule in the grammar that does not meet the requirements of the rule structure, and it no longer falls into the specified type. According to the Chomsky classification, four types of grammars are indicated.

Type 0.

Type-0 grammars include all formal grammars. These languages are also known as the Recursively Enumerable languages. Grammars that are only of type 0 and cannot be assigned to other types are the most complex in structure. Grammars related only to type 0 have no practical application.

Grammar Production in the form of $\alpha \to \beta$, where

α is $(V + T)^* V (V + T)^*$

β is $(V + T)^*$.

V: Variables

T: Terminals

In type 0 there must be at least one variable on Left side of production.

For example,

Sab –> ba

A –> S.

Here, Variables are S, A and Terminals a, b.

Type 1: Context Sensitive Grammar.

Type-1 grammars generate the context-sensitive languages. When constructing compilers, such grammars are not used, since the syntactic constructions of programming languages considered by compilers have a simpler structure and can be constructed using grammars of other types.

In Type 1

1. First of all Type 1 grammar should be Type 0.

2. Grammar Production in the form of α–>β.

$|\alpha|<=|\beta|$

Id est count of symbol in α is less than or equal to β.

For example,

S –> AB

AB –> abc

B –> b

Type 2: Context Free Grammar.

Type-2 grammars generate the context-free languages. Context free grammars are widely used in the description of syntactic constructions of programming languages. The syntax of most well-known programming languages is based on context free grammars.

In Type 2:

1. First of all it should be Type 1.

2. Left hand side of production can have only one variable.

$|\alpha| = 1$.

There is no restriction on β.

For example,

S –> AB

A –> a

B –> b

Type 3: Regular Grammar.

Type-3 grammars generate regular languages. These languages are exactly all languages that can be accepted by a finite state automaton. Regular grammars are used to describe the simplest constructions of programming languages: identifiers, constants, strings, comments, etc. These grammars are extremely simple and convenient to use, therefore, compilers based on them build functions of the lexical analysis of the input language

Type 3 is most restricted form of grammar.

Type 3 should be in the given form only:

V –> VT* / T*.

(or) V –> T*V /T*

For example: S –> ab.

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INVESTIGATION OF CAVITATION PROCESSES IN CENTRIFUGAL PUMPS OF LIQUID ROCKET ENGINES

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Cavitation is the process of breaking the continuity of the liquid flow in the zone of low pressure, which consists of the formation of cavities filled with steam and gas released from the liquid. In the area of low pressures tensile stresses arise which lead to the rupture of the liquid.

Keywords: cavitation, research, consequences of cavitation.

ИССЛЕДОВАНИЕ ПРОЦЕССОВ КАВИТАЦИИ В ЦЕНТРОБЕЖНЫХ НАСОСАХ ЖРД

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Кавитация – это процесс нарушения целостности потока жидкости в зоне пониженного давления, заключающийся в образовании полостей, наполненных паром и выделившимся из жидкости газом. В области пониженных давлений возникают растягивающие напряжения, которые приводят к разрыву жидкости.

Ключевые слова: кавитация, исследование, последствия кавитации.

In pumps cavitation occurs at a pressure before entering the pump that is substantially higher than the vaporization pressure at a given liquid temperature (Rp). This means that the minimum pressure area is located inside the flow part of the pump. The pressure drop inside (compared to the inlet pressure) is primarily due to the flow around the blades. When flowing around the blades, as well as when flowing around any profile, an area of reduced pressure is formed. At positive angles of attack, usual for pumps, the area of reduced pressure arises from the non-working side of the inlet part of the blades. In a centrifugal wheel, the minimum pressure area is determined not only by the pressure distribution resulting from the flow of the blade, but also by the pressure arising from the action of Coriolis and centrifugal forces of inertia [1].

First of all the development of cavitation in liquids is also affected by the amount of free and dissolved gases released in areas of low pressure. Gas reduces the strength of the liquid (gas cavitation). In the presence of a two-phase medium, the speed of sound greatly decreases. The crises that occur in cavitation flows (flow restriction) can be crises of sound flows. In addition the thermodynamic properties of liquids can affect the degree of development of cavitation.

Cavitation leads to three main negative consequences for hydraulic machines:

– to the failure of the machine operation mode, that is, to a sharp decrease in the main output parameters;

– to the erosion destruction of the impeller of the machine;
– to the possibility of unstable work [1].

Fig. 1. Areas of minimum pressure on the blades of the axial wheel:
a – the meridional cross-section of the wheel; *b* – the lattice of blades

Fig. 2. Areas of minimum pressure on the blades of a centrifugal wheel:
a – meridional section of the wheel; *b* – circular lattice of blades

The wheel grating, which has a pressure drop at a lower input pressure, has better anti-cavitation properties. The greater the vacuum on the back of the blade the greater the pressure (Pвх) occurs pressure drop. Therefore, you should avoid large angles of attack a large load on the blade (a large difference in pressure on the blade), a small density of the lattice, that is all that can lead to a large rarefaction on the blade. The greater the speed of the flow that flows around the blade the greater the vacuum on the blade. Based on this, the point farthest from the axis of rotation of the input edge of the blade can be the center of the origin of cavitation (point A in Figure 1 and 2)

Note that in the centrifugal wheel the cavitation that has begun in the area of the entrance to the blades will develop rapidly due to the fact that the movement to the periphery by inertia of the liquid, denser than the vapor-gas caverns, increases the vacuum. The dependence of the pump head on the inlet pressure at a constant flow rate and constant speed is called the breakdown cavitation characteristic [2].

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USING DATABASES FOR WEB-PAGES PARSING

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The article deals with problems arising while developing a bot program that optimizes the interaction between a student and information during the education process. The design of the working algorithm is presented. The main problems have been identified and described.

Keywords: databases, parsing, timetable.

ИСПОЛЬЗОВАНИЕ БАЗ ДАННЫХ ПРИ СИНТАКСИЧЕСКОМ АНАЛИЗЕ WEB-СТРАНИЦ

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Описаны выявленные проблемы в процессе развития программы-бота, оптимизирующей взаимодействие с информацией в учебном процессе. Проанализированы различные методы их решения, описаны алгоритмы её функционирования.

Ключевые слова: база данных, парсинг, расписание.

While working with big amount of data there is a problem of structuring and, as a consequence, the problem of processing these data. Using various database systems significantly simplifies these processes, therefore they are so widespread.

After developing the bot for receiving a timetable from the website of Reshetnev Siberian State University of Science and Technologies (SibGU), in social network VKontakte [2] the problem of storing and using many user's identifiers and their group numbers was detected. Firstly, they were kept in python dictionary in the text file. But it appeared that the selection of the group number for more than 300 identifiers was immediate. In this way, more important reason of transition to the database was periodic failure of the timetable website. During this time the bot did not work as well. The parsing files were not available for reusing.

In particular, an open-source relational database management system MySQL and its compact offline version SQLite were considered [3]. The methods for recording, storing and reading the information from tables (INSERT, SELECT, UPDATE and others) were studied. In the process of implementation and testing of database capabilities, we came to the following conclusion: using databases with the current amount of information that is processed by the bot every day is impractical for the following reasons:

1) the necessity of writing an additional piece of code in a program that is already massive;

2) the need to connect the sqlite3 library when using SQLite or to establish the interaction between the bot and the database when working with MySQL. Both options led to the undesirable complication of the program;

3) as mentioned before, the current amount of information that passes through the program does not entail the need for its hard structuring using tables. We would have duplicated the schedule database on the site, which is not rational.

All these factors made us look for a different solution. It became possible due to the changes on the timetable website. The modified parsing algorithm made it possible to use files with the markup of the web pages repeatedly, without any complicating of the source code of the program. Now, when you try to connect to the site for more than 1 second, the bot parses the files that already exist.

The updated main stages of the algorithm are presented in Figure.

Flow chart of the bot

The algorithm is always executed, regardless the operability of the Siberian State University timetable web-site [3], but there is a dependence on the operability of the bot server.

In the future, it is planned to transfer the parsing of the timetable directly from existing files, which will be updated automatically, with a given frequency, which will speed up the output of the timetable to the user. Thus, the developed system is a more stable and perfect complement to the original source.

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THE STUDY OF UNIVERSITY APPLICANTS' TYPICAL PORTRAITS WITH THE HELP OF A VIRTUAL ASSISTANT

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A solution to the problem of identifying typical portraits of applicants of Reshetnev Siberian State University of Science and Technology is presented. The work of the Virtual Assistant was tested. The task of clustering on the collected data set is solved.

Keywords: applicants, clustering, virtual assistant.

ИССЛЕДОВАНИЕ ТИПОВЫХ ПОРТРЕТОВ ПОСТУПАЮЩИХ В ВУЗЫ ПРИ ПОМОЩИ ВИРТУАЛЬНОГО ПОМОЩНИКА АБИТУРИЕНТА

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Предложено решение задачи выделения типовых портретов абитуриентов СибГУ им. М. Ф. Решетнева. Протестирована работа Виртуального помощника абитуриента. Решена задача кластеризации на собранном наборе данных.

Ключевые слова: абитуриент, кластеризация, виртуальный помощник.

Every year school graduates are facing the problem of choosing a future path. Most of them choose to continue their education in higher education institutions according to their interests and abilities. However, during the process of becoming university entrants, future specialists discover that they are not so sure of what exactly they want to do and which branch to choose. It turns out that everything is not as simple as they thought. Names and descriptions of specialties do not give the applicants a clear understanding of the future learning process. Unfortunately, not all applicants have the opportunity to seek the advice of teachers or graduates of the university, who could describe in simple words what the essence of each specialty is. That is why the issue of creating an automatic mechanism that could help an applicant to determine exactly in which course he will be most interested in learning is relevant.

Such a mechanism is the Applicants' Virtual Assistant (AVA), presented on the website of Reshetnev Siberian State University of Science and Technology. The system was launched recently, therefore, it requires serious improvements and correction of some errors, as well as analysis of the data obtained for possible adjustment of further work.

The AVA is a test with a set of questions, the answers to which are numbers from 0.1 to 0.9. The AVA interface consists of several main pages: the start page for final school exams selection, a page with questions about interests and abilities, and a page with test results, on which

percentages of compatibility with the specialty are located. When changing certain parameters, the AVA can be used in any institution of higher education, but the version presented on the website (https://abiturient.sibsau.ru/undergraduate-and-undergraduate) is configured to the existing specialities of the Reshetnev Siberian State University of Science and Technology.

The AVA work is based on fuzzy logic mechanisms [1]. Each question is a linguistic variable, and the assigned grade from 0.1 to 0.9 is its value. In addition, for each specialty, the variable can be classified as **primary** or **secondary** by an expert. For example, for the specialty of systems analysis, the main one will be the "Math" variable, corresponding to the question "Do you want to do in-depth study of mathematics?", and the additional one is «Sis», corresponding to the question "Would you like to develop artificial intelligence systems?" Such a separation is necessary for a conceived system of rules. The output linguistic variable is Confidence. The terms corresponding to the variables and used in the program are "**small**" and "**large**". Rules (there are two of them for this system) are as follows:

IF (PRIM = *large* ^ PRIM = *large* ^...) || (SEC = *large* ^...) THEN (CONF= *large*)

IF (PRIM = *small*) THEN (CONF = *small*)

On the basis of this a fuzzy conclusion by the method of center of gravity is made.

Now that we have reviewed the principles of the VPA, we can begin to review the study itself. The basis for it was the assumption that it would be helpful to consider the answers of applicants as a whole to reveal hidden relationships and common features, to combine applicants in some unobvious general groups. To do this, data on the answers of applicants were downloaded from the university website and a dataset table was created. Only the results of applicants who passed the Russian language, mathematics and informatics were selected for analysis, 1028 people and 11 questions that must be answered in this set of exams in the AVA were examined.

	EAH *	Computer networks	Hard ware	Satellite imagery	Math	Applied math	Progra mming	EEAS*	Secu rity	AAI *	Econo mics
1 1	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.5	0.9	0.5	0.9
2 2	0.3	0.8	0.5	0.3	0.5	0.8	0.5	0.7	0.7	0.7	0.9
3 3	0.5	0.9	0.5	0.5	0.5	0.5	0.9	0.5	0.9	0.9	0.9
…	…	…	…	…	…	…	…	…	…	…	…
1 028	0.2	0.3	0.2	0.9	0.2	0.3	0.9	0.3	0.9	0.8	0.9

Notes. *EAH – enterprise automation hardware; *EAS – enterprise automation software; *AI – artificial intelligence

For cluster analysis the *k*-means method was applied. To select the right number of clusters, a dendrogramm was built, making sections of which it was decided to try dividing into 3, 5, 6 and 7 clusters.

Dendrogramm

The analysis itself was carried out as follows: since it was not possible to visualize the data due to the large dimension, it was decided to consider the centers of the clusters for each of the pa-

rameters. Thus, a table was created with rows – clusters (type of applicant) and columns – criteria. Carrying out an empirical analysis of such tables for different partitions, it was concluded that the partition into 6 clusters is optimal.

EAH	Com-puter net-works	Hard-ware	Satel-lite imagery	Math	Applied math	Pro-gram-ming	EAS	Secu-rity	AI	Economics	%
0.25	0.541	0.376	0.232	0.177	0.191	0.754	0.352	0.539	0.689	0.758	13
0.287	0.234	0.256	0.277	0.334	0.306	0.261	0.264	0.334	0.303	0.302	8
0.52	0.514	0.487	0.515	0.495	0.494	0.504	0.521	0.533	0.550	0.517	38
0.363	0.654	0.286	0.207	0.599	0.601	0.790	0.434	0.696	0.706	0.763	12
0.696	0.817	0.587	0.667	0.682	0.714	0.836	0.755	0.810	0.829	0.815	11
0.611	0.74	0.587	0.392	0. 381	0.373	0.779	0.649	0.667	0.722	0.794	18

Each of these 6 clusters represents a specific group of applicants, who have some common features, which were identified by AVA. Based on these common features each group can get more detailed and specific recommendations from an expert in selection committee, which might be really helpful for a future student to choose a right specialty.

A detailed description of these features and recommendations are the following:

Cluster No. 1: Programmers. The applicants in this category are really into computer engineering and science. As the table shows, they are fond of computer security, programming and computer networks, as well as AI and economics, however they clearly hate math in any form. **Recommendation**: a selection committee expert should arouse interest through AI and economic disciplines and specialties for later application in programming.

Cluster No. 2: Picky. These young fellows aren't very interested in studying any of provided branches, the numbers in all columns are quite low. **Recommendation:** an expert should describe the capabilities of other institutions of university, in which an applicant might be interested.

Cluster No. 3: Know-nothing. These applicants haven't made their choice yet and are equally interested in all spheres. **Recommendation**: this cluster is the hardest one to analyze; the authors' concern is that the AVA in current version is not specific enough to divide those individuals into clusters, so it needs to be fixed in the future.

Cluster No. 4: Mathematicians. These applicants have the largest values in Math and Applied Math column, as well as in Programming, AI etc. **Recommendations:** an expert should describe math-application areas (AI, economics, etc.)

Cluster No. 5: Enthusiasts. Unlike the picky ones, enthusiasts are interested in each and any branch that is provided at this institution. **Recommendation:** while working with them we should bet on earlier involvement in scientific research

Cluster No. 6: Engineers. They are pretty much the only ones interested in EAH, EAS and hardware, and also in programming, AI and economics. **Recommendation**: an expert should out-line the prospects for the joint use of hardware and programming.

On the basis of these results, the following conclusions can be drawn: unfortunately, most of the applicants who come to universities have no idea what they want to do. They can find it out only through a conversation with a specialist, who during a conversation with an applicant can highlight some interests in his speech. Therefore, it will be useful for specialists to create personalized rec-

ommendations for people from each cluster in order to interest them. The continuation of this work in the field can bring good results both for the university and for each applicant.

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MODERN SPACE TECHNOLOGIES: CLOSED BIOSYSTEMS

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The paper considers the most famous developments in the field of closed biosystems, experiments conducted in them, and their significance for the space industry and science in general; it also touches on how such developments began.

Keywords: closed biosystem, space, experiment, biosphere.

СОВРЕМЕННЫЕ КОСМИЧЕСКИЕ ТЕХНОЛОГИИ: ЗАМКНУТЫЕ БИОСИСТЕМЫ

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Данная работа повествует о наиболее известных разработках в области создания замкнутых биосистем, проведенных в них экспериментах, и их значении для космической отрасли и науки в целом, а также затрагивает то, с чего начались подобные разработки.

Ключевые слова: замкнутая биосистема, космос, эксперимент, биосфера.

In connection with the first-ever human spacewalk, the problem of life support for astronauts who have been outside the Earth for a long time arose. It is inconvenient to carry a large amount of food inside the spacecraft, and it is difficult and expensive for astronauts to bring it regularly. Therefore, the best way to solve this problem is to create closed life support systems. It became clear after the first Yuri Gagarin's flight. But even at the stage of the idea, the question arises: how to provide a person in space with everything necessary? People tried to answer this question in the second half of the last century, and similar developments are still underway. It is even planned to test closed systems on Mars. In addition, the problem of life support on our planet is becoming more acute, and it is vital that mankind can create closed systems based on the laws of nature in order to live in harmony with the environment and with maximum comfort. This problem is also present in remote places of the Earth – in the Arctic, deserts, mountain areas, etc. Therefore, the purpose of our work is to examine how closed bio systems were matured, and how they influenced and continue to influence the further development of the space industry and science in general.

The relevance of the topic is due to the aggravation of the problem with life support on Earth and the prospect of long-term interplanetary expeditions.

The subject of the study is the chronological aspect of creating closed systems.

It all started with the work of Krasnoyarsk scientists Ivan Terskov and Iosiph Gitelzon to study the laws of functioning of blood cell populations. The applicable approach was later extended

to single-celled organisms and served as the basis for the theory and technique of continuous cultivation of single-celled algae and bacteria under controlled conditions. These studies allowed us to formulate the problem of managing biological systems at different levels of their organization. The problem of controlling single-celled biosynthesis using physical and technical devices was formulated by Terskov in a paper published in 1957, and implemented later, when creating biologically closed systems, with a scope that speaks of Ivan Terskov's extraordinary gift of foresight. He expanded the range of objects and shifted attention to populations of single-celled organisms. In the red blood system, a cell population that is in a stationary state maintained by the body is studied. For a population of single-celled organisms, a continuous culture is created artificially and maintained by technical regulators. Such a system, consisting of a biological "working body" and technical regulators, equipped with cell state sensors to provide feedback to devices, is analogous to natural systems and allows experimental studying their fundamental properties. This direction received the name of the controlled biosynthesis.

The ideas formed during the creation of such syntheses made it possible to justify the possibility of creating a closed system of human life support. And in 1964, the closed system "man-chlorella" (single-celled algae) was implemented. It was possible to achieve a closed gas exchange, but the issue of providing food has not yet been raised.

The following year, a complete water closure was achieved.

Finally, in 1968, experiments were conducted in the three-link system "man-microalgae-higher plants", and as a result of these experiments in 1972 a closed system of human life support with autonomous management of BIOS-3was created. It had an area of 315 square meters and consisted of four compartments.

The first compartment was a household one, where the crew of three people lived.

The second compartment contained algae, whose main function was to absorb carbon dioxide and release oxygen.

In the third compartment, the crew grew wheat with shortened stems, from which bread could be baked. Each crew member accounted for about 200 grams of grain.

The fourth section was intended for growing vegetables: carrots, radishes, beets, potatoes, cabbage, cucumbers, sorrel, lettuce, dill, onion and chufa (a Central Asian herb used for making vegetable oil). Each crew member received 400 grams of fresh vegetables. All compartments were connected by sealed doors.

Thus, the crew was provided with oxygen, water and crop products. Animal products were used only in the form of canned food stored in advance. This may have been a design flaw, but it did not prevent further progress of the idea.

Ten experiments were conducted in the system with the participation of 1 to 3 people. The longest of them lasted 180 days – from 1972 to 1973, it was possible to achieve complete closure of the system for gas and water, and 80 % of the needs for food. Engineer Nikolai Bugreev lived in the installation for the longest period of time – about 13 months.

During the perestroika period, the system was closed down temporarily and experiments were stopped.

What was happening across the ocean in the meantime?

In the Arizona desert in the early 90's, the closed system "Biosphere-2", the brainchild of the company "Space Biosphere Ventures" and billionaire Edward Bass, was built. The number 2 in the name emphasized that the first biosphere is the Earth. The design of this system took about 10 years, and during this time, groups of scientists tried to achieve a balance within the structure from a biological point of view. The system was an airtight glass dome that contained five landscape compartments: rainforest, savanna, desert, mangrove swamp, and ocean with a beach and coral reef. Among all this was an agricultural block and living quarters for eight people. In addition, about 4,000 different species of fauna were launched into the system.

However, the situation with this structure was sad. The experiment began on September 26, 1991, and at first the crew was doing well. But after a week, people began to notice that the oxygen concentration inside the dome is reduced, and if this continues, life in the installation will become

impossible. In addition, pests began to reproduce in huge numbers. As a result, by the autumn of 1992, oxygen levels had dropped by 14 %, people were suffocating, many plants were rotting, and all vertebrates were dead. It was decided to run oxygen inside the dome. However, this did not improve the state of the biosphere, and it was already clear that the experiment failed.

It turned out that the oxygen released reacted with the cement coatings of the walls and settled on them, and it was also absorbed in large quantities by microorganisms living in the fertile black soil. Journalists recognized these discoveries as the only achievement of the "Biosphere".

On one of the inner walls, a few lines are still preserved: "Only here we felt how dependent we are on the surrounding nature. If there are no trees, we will have nothing to breathe, if the water gets dirty, we will have nothing to drink".

Since 1996, the development was managed by Columbia University, which continued research, but without human involvement. In 2005, the building was put up for sale. It can be judged from these photos what remains of the "Biosphere" in 2010.

The Soviet system is also empty now, but the results of experiments carried out in it were not wasted: in 1991, the international center for closed ecological systems was created, which is a structural division of the Krasnoyarsk Institute of Biophysics. In 2005, the updated bio system was launched with the support of the European space Agency. Research is being conducted in the field of waste processing and growing plants in closed ecosystems. It is hoped that these studies will help in creating better life support systems.

Summing up, it is worth noting that the most significant contribution to the creation of closed life support systems was made by Soviet scientists, and this course of events is quite understandable: at that time, the topic of space exploration was gradually moving to the fore, and the Soviet Union contributed to this. In the United States, they tried to copy the idea of a closed system and did not take into account many aspects when creating their project, so Biosphere has such a tragic fate, and there is probably no chance of reviving this construction. But I would like to finish this story optimistically, so let's remember that the research of Krasnoyarsk scientists gave a serious impetus to the further development of this topic, and, perhaps, in the near future, new bio systems can be tested not only in remote areas of the Earth, but also beyond its borders.

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COMPILER STRUCTURE

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Compiler is a program or technical tool that performs compilation. Compilation is a translation of a program compiled in a high-level source language into an equivalent program in a low-level language similar to machine code. The input to the compiler is a description of the algorithm or a program in a problem-oriented language, and the output of the compiler is an equivalent description of the algorithm in a machine-oriented language.

The article describes the main stages of compilation and describes in detail the features of each stage.

Keywords: compiler, compilation, analysis, phase, optimization.

СТРУКТУРА КОМПИЛЯТОРА

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Компилятор – программа или техническое средство, выполняющее компиляцию. Компиляция – трансляция программы, составленной на исходном языке высокого уровня, в эквивалентную программу на низкоуровневом языке, близком машинному коду. Входной информацией для компилятора является описание алгоритма или программа на проблемно-ориентированном языке, а на выходе компилятора – эквивалентное описание алгоритма на машинно-ориентированном языке. Описаны основные этапы компиляции и подробно описаны особенности каждого из них.

Ключевые слова: компилятор, компиляция, анализ, фаза, оптимизация.

In the initial phase of lexical analysis, the input program, which is a stream of letters, is divided into tokens – words in accordance with the definitions of the language. The main formalisms underlying the implementation of lexical analyzers are finite state machines and regular expressions. The lexical analyzer can work in two main modes: either as a subroutine called by the parser to obtain the next token, or as a full pass, the result of which is a token file.

In the process of marking lexemes, the lexical analyzer can both independently construct tables of objects (numbers, lines, identifiers, and so on), and produce values for each token when it is accessed again. In this case, the tables of objects are built in subsequent phases (for example, in the process of parsing).

At the stage of lexical analysis, some (simplest) errors are detected (invalid characters, incorrect record of numbers, identifiers, and others).

The main task of parsing is to study the structure of a program. As a rule, structure is understood as a tree corresponding to parsing in a context-free grammar of a language. Currently, either LL (1) analysis (and its variant is a recursive descent) or LR (1) analysis and its variants (LR (0), SLR (1), LALR (1) and others) are most often used. Recursive descent is most often used in manual programming of the parser, LR (1) – when using automatic parsing systems.

The result of the parsing is a syntax tree with links to tables of objects. Errors associated with the structure of the program are also detected during parsing. At the stage of context analysis, dependencies between program parts that cannot be described by context-free syntax are revealed. This is mainly the description-use relationship, in particular, the analysis of object types, the analysis of visibility areas, the correspondence of parameters, labels, and others. In the process of contextual analysis, tables of objects are replenished with information about descriptions (properties) of objects.

The result of contextual analysis is the program tree. Information about objects can be either dispersed in the tree itself or concentrated in separate object tables. In the context analysis process, errors related to improper use of objects can also be detected.

Then the program can be translated into an internal representation. This is done for optimization and/ or convenience code generation purposes. Another goal of transforming a program into an internal representation is the desire to have a portable compiler. Then only the last phase (code generation) is machine-dependent. As an internal representation, a prefix or postfix notation, oriented graph, triples, quadruples, and other methods can be used.

There may be several phases of optimization. Optimizations are usually divided into machine-dependent and machine-independent, local and global. A certain part of machine-dependent optimization is performed during the code generation phase. Global optimization is trying to take into account the structure of the entire program, local – only its small fragments. Global optimization is based on global stream analysis, which is performed on a program graph and essentially represents a transformation of this graph. In this case, program properties such as inter-procedural analysis, inter-module analysis, analysis of areas of life of variables and so on can be taken into account.

Finally, code generation is the final phase of translation. Its result is either an assembler module or an object (or boot) module. In the process of code generation, some local optimizations can be performed, such as register allocation, selection of long or short jumps, accounting for the cost of commands when choosing a specific sequence of commands. Various methods have been developed for code generation, such as decision tables, pattern matching, including dynamic programming, various syntactic methods. Of course, certain phases of the translator can either be completely absent or combined. In the simplest case of a one-pass translator, there is no explicit phase of intermediate representation generation and optimization, the remaining phases are combined into one, and there is no explicitly constructed syntax tree.

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REVISIYING THE OPERATION EFFICIENCY OF Yak-42 AIRCRAFT AT "KRASAVIA" AIRLINE

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The article presents an algorithm for evaluating technical operation efficiency of the airline aircraft park using real statistics as the data source. The calculation is performed on the basis of Markov processes and Kolmogorov equations.

Keywords: technical operation, process state, state and transition graph, utilization factor.

К ВОПРОСУ ОБ ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ САМОЛЕТА Як-42 В АВИАКОМПАНИИ «КРАСАВИА»

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Приведен алгоритм оценки эффективности процесса технической эксплуатации самолетного парка авиапредприятия на основе реальных статистических данных посредством применения Марковских процессов и уравнений Колмогорова.

Ключевые слова: техническая эксплуатация, состояние процесса, граф состояний и переходов, коэффициент использования.

The article is an example of analysis of the aircraft park operation efficiency based on the airline statistics data.

The paper analyzes the efficiency of the Yak-42 fleet operated by "KrasAvia" airline according to the statistical database from 2016 to 2018. The statistics contains quarterly data on 9 Yak-42 aircraft operation in specified working conditions within a given period. The efficiency analysis for every aircraft was performed with mathematical methods of Markov processes theory [1–3].

The technical operation was modeled on a generalized graph of states and transitions of the entire period selected for the analysis (Figure 1). Each state (Figure 1) has its own designation, namely: F – flight; P – preparation for the flight; T – unused time; R – in reserve; M – maintenance (forms B, F1, F2, F3); I – after-incident repair period; E – engines dismantled; W – delay due to weather conditions and curfew. The generalized graph includes 7 vertices; for some specified sets of quarters, several states were not marked on the graphs.

The graph is accordingly marked, the probabilities of transition from state to state are indicated, the intensities of state-to-state transitions are calculated, the vertices with several transitions are also included.

The following system of Kolmogorov differential equations was set up:

$$\frac{dN_F(t)}{dt} = a_{P-F} \cdot N_P(t) - N_F(t) \cdot (a_{F-P} + a_{F-M});$$

$$\frac{dN_M(t)}{dt} = a_{E-M} \cdot N_E(t) + a_{F-M} \cdot N_F(t) - N_M(t) \cdot (a_{M-E} + a_{M-RT} + a_{M-I});$$

$$\frac{dN_E(t)}{dt} = a_{M-E} \cdot N_M(t) - N_E(t) \cdot a_{E-M};$$

$$\frac{dN_I(t)}{dt} = a_{M-I} \cdot N_M(t) - N_I(t) \cdot a_{I-RT};$$

$$\frac{dN_{RT}(t)}{dt} = a_{I-RT} \cdot N_I(t) + a_{M-RT} \cdot N_M(t) - a_{RT-P} \cdot N_{RT}(t);$$

$$\frac{dN_P(t)}{dt} = a_{RT-P} \cdot N_{RT}(t) + a_{F-P} \cdot N_F(t) + N_W(t) \cdot a_{W-P} - N_P(t) \cdot (a_{P-W} + a_{P-F});$$

$$\frac{dN_W(t)}{dt} = a_{P-W} \cdot N_P(t) - N_W(t) \cdot a_{W-P}.$$

Fig. 1. A graph of marked states and transitions
of Yak-42 aircraft technical operation
as to "KrasAvia" airline statistics from 2016 to 2018

Similarly, systems of differential equations were set up for each of the graphs. Since technical operation gradually becomes steady-state, a transition of the differential equations system to a system of algebraic equations was performed, and a normalization equation was introduced.

To calculate the model parameters, the data on the period within every state of the process and on the number of entering these states were taken as initial. On account of that, the average period within each state of the process and the intensity of transitions were calculated. Further, the system of algebraic equations was solved with respect to the probabilities of being in the process states.

The evaluation of the process efficiency parameters was performed with respect to the operation factors K1 and the specific total downtime factors K2; that also includes maintenance and repair works in the form of:

$$K_1 = \frac{P_K \cdot \mu_K \cdot H_C}{\sum_{i=0}^{N} P_i \cdot \mu_K \cdot 24}, \tag{1}$$

$$K_2 = \frac{\sum_{j=1}^{N} P_j \cdot \mu_j \cdot 24}{P_K \cdot \mu_K \cdot H_C}, \tag{2}$$

where P_i – is the probability of getting into the i – state of the technical operation process; μ_i – is the average period within the i-th state; H_C – the average daily flight hours of an aircraft on the airline balance; P_j – the probability of entering the state of the processes M, I, E, P, W, RT; μ_j – the average time within the periods: M, I, E, P, W, RT; P_K – the probability of entering state F; μ_K – the average period within state F.

The calculation results allow to compare the criteria variations with those of the same aircraft operated by other airlines and draw certain conclusions concerning the airline efficiency.

The analysis of the factors variation for each quarter shows that the Yak-42 operation efficiency criteria vary according to the time of the year and other external factors. However, the operation factor is lower in comparison with "Utair" and "Norilsk Avia", and the specific downtime factor connected with maintenance and repair exceeds 1, which means that airplanes are out of flight most of the time. Mostly, 1 average flight hour corresponds to 1.7–4.09 hours of maintenance and repair, which accounts for drawbacks of the airline maintenance process.

Fig. 2. Graph of changes in indicators K1 and K2 quarterly

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MODULA-2 PROGRAMMING LANGUAGE

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This article gives a basic introduction to the technology of programming Modula-2 and a detailed description of this system, as well as the advantages and disadvantages analysis of this programming language and history of its development.

Keywords: software, definition module, implementation module, syntax.

МОДУЛА-2 ЯЗЫК ПРОГРАММИРОВАНИЯ

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Приведено элементарное введение в технологию программирования Модула-2, и подробное описание ее системы. А также анализ преимуществ и недостатков этого языка программирования и история создания.

Ключевые слова: программное обеспечение, модуль определения, модуль реализации, синтаксис.

For the beginning, we have to emphasize Modula-2 is a general-purpose programming language based on Pascal.

The Modula-2 language was developed by Niklaus Wirth to create the Lilith computer system software. This development began in 1977 at the Zurich Institute of Informatics. The language was originally designed as a tool for industrial system programming. By means of this language programmer can access the hardware directly, develop specific system programs, such as interrupt handlers and device drivers, support programming of parallel-running interacting processes, but at the same time it is a high-level language with typification.

A program is a set of modules, independent compilation units that can be compiled separately. In this case, a software module can be divided into two parts. They are a definition module and an implementation module. A definition module is an external interface of the module. That is a set of exported names of constants, variables, types, procedure headers and functions that are available to external modules. An implementation module contains program code and concretizes what is available in the definition module.

Advantages of Modula-2 are as follows:

A language is easy to define. A complete definition of the syntax in the EBNF(Extended Backus–Naur Form) notation takes less than 3 pages, full syntax diagrams is 12 pages, the official "language message" has a volume of 40 pages.

There are no redundant constructions and elements in syntax. Modula-2 is the first of the directive programming languages where the GOTO operator is absent.

The mechanism of dividing the program into modules with explicitly described interfaces and controlled import allows to import both whole modules and individual elements. There exists the possibility of qualified and unskilled use of the names of imported objects

Input/ Output and most standard procedures and functions are excluded from the language and transferred to libraries. It is issued in the form of standard modules.

A language includes low-level programming mechanisms, i. e., a direct operation with memory and un-typed data and pointers.

There are elementary parallel programming tools.

Disadvantages of Modula-2:

Weakness of parallel programming mechanisms, in particular, organization of interaction of parallel processes. The implementation of these tools is transferred to system libraries, and in the standard library there are only the simplest parallelization management tools. A parallel program on Module-2 that uses parallelism controls what go beyond this framework automatically loses portability.

Mechanisms for controlling the mapping of abstract types to memory are absent.

Due to the support for local modules, compilation becomes more complicated. The reason for using nested modules is to limit the scope and highlight high-priority parts of the program to ensure synchronization during parallel processing.

Explicit separation of the implementation module and the definition module. It complicates the work of the compiler and forces the programmer to synchronize changes in different files.

The absence of a number of possibilities in Module-2, which can be attributed to both the advantages and disadvantages of the language:

There are no dynamic arrays and strings of variable size.

There are no built-in exception handling tools.

There are no generalized programming tools.

In Russia (the USSR), the first compilers for Modula-2 appeared in 1982-83 for the SM-4 and Elec-tronica-60 computers. At that time, programming technologies were developed and the first ap-plication software packages were created on Module 2.

Modula-2 did not receive much distribution and recognition, but this language gained some pop-ularity in the academic environment of Europe, was quite popular among programmers of the USSR, but could not press its predecessor – new implementations of the Pascal language, which included means for organizing modules, and later – object programming tools, always bypassed Modula-2 in popularity. Also, the Lilith system, for which Modula-2 was created, did not receive wide publicity.

Currently, the language of Modula-2 is used to program the on-board software for satellites launched as part of the GLONASS (Global Navigation Satellite System) project. At the end of 2010, the GNU(GNU's Not UNIX) Modula-2 compiler was officially included in the GCC (GNU Compiler Collection).

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УДК 004.4

A SHORT ANALYSIS OF CURRENT TRAFFIC SIGN DETECTION AND RECOGNITION SYSTEMS AND THEIR PROBLEMS

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In modern automobile industry, TSR (traffic sign detection and recognition) system is an important part. This paper analyses 3 proficient TSR system and explore problem in them.

Keywords: traffic sign detection and recognition, Opel Eye, Active Speed limit assist, Road Sign Information.

Recognition of road signs is necessary because of safety on roads. When using an automated recognition system, it is extremely important to accurately and timely identify traffic signs when the vehicle is moving in a city or on a highway. Currently, commercial closed systems are being developed and used to solve the recognition problem, which are delivered "complete" with the car. Such systems include the Opel Eye from Opel, Speed limit assist from Mercedes, Road sign information from Volvo.

Architecture of TSR.

TSR system in general consists of the following hardware and software modules:

– camera;
– image capture card;
– detection module;
– classification module;
– database.

The image from the camera is input to the system. Then, a certain algorithm determines the position of the road sign. After that, the character is recognized by the recognition program.

Opel Eye. The Opel Eye system works in conjunction with the front camera, provides high speed sign recognition and has a number of additional features. The camera uses a high-power processor, providing simultaneous execution of numerous operations. Works only at speeds above 60 km/h. System starts by focusing on circular patterns after this identifies the numbers inside them via contour comparison. When a picture matches with an image of a road, the sign is displayed in the instrument pane of car l. The system begins to recognise and repeatedly read signs at 100 metres.

Active Speed limit assist (Mercedes). In conjunction with command navigation system work. The camcorder in the windshield continuously captures the surroundings in front of the car. Then, on the basis of algorithms, the computer filters out all the unnecessary data very quickly. The image of these signs is transmitted in almost real time for indication to the instrument cluster.

Road Sign Information (Volvo). The system helps the driver remember the road signs that he drove. Shows speed limit signs and overtaking is prohibited at the same time. May also show the sign "Road for cars" and "Motorway". When a speed limit sign is detected, a red triangle with a limit value is placed on the speed scale. Signs are reset when a "End of restriction" sign is detected.

Table shows the comparative characteristics of existing software products that identify road signs.

Comparative characteristics

	OpelEye	Speed limit assist	Road sign information
Claimed accuracy	0 %	5 %	96 %
Illumination of the sign, not less then	0	0	0
Recognition of other prohibitory signs	+	–	+
Accuracy in the case of tilted, overlapped or dirty image	5%	0%	75%
Neural network algorithm	–	–	+
Image type detection	circular	circular	all

Based on this analysis, a number of conclusions were made:

1. Currently, there are no methods that fully satisfy the required characteristics when recognizing road signs, in the presence of noise, affine and projection transformations of images.

2. From the analysis of existing software systems it follows that all of them are limited by a rather narrow range of distortion of road signs, which necessitates the development of recognition methods that are more resistant to such distortions.

3.The most effective methods for solving this problem are those based on the use of convolutional neural networks in connection with their increased degree of invariance to various kinds of distortions.

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THE PROBLEM OF FRICTION IN MECHATRONIC MODULES AND THE METHOD OF REDUCING ITS INFLUENCE ON THE PARTS BY APPLYING THE NO-WEAR EFFECT

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This paper is devoted to the study of methods of reducing the effect of friction on the parts of mechatronic modules using the No-wear effect. The advantages of using this method in robotics were considered, the conditions of its use were analyzed.

Keywords: friction, mechatronic module, selective transfer, No-wear effect, effect of Garkunov.

ПРОБЛЕМА ТРЕНИЯ В МЕХАТРОННЫХ МОДУЛЯХ И МЕТОДИКА УМЕНЬШЕНИЯ ЕГО ВЛИЯНИЯ НА ДЕТАЛИ ПУТЕМ ПРИМЕНЕНИЯ ЭФФЕКТА БЕЗЫЗНОСНОСТИ

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Данная статья посвящена изучению методики уменьшения влияния трения на детали мехатронных модулей применяя эффект безызносности. Были рассмотрены преимущества использования данного метода в робототехнике, проанализированы условия его использования.

Ключевые слова: трение, мехатронный модуль, избирательный перенос, эффект безызносности, эффект Гаркунова.

The purpose of our research is to analyze the problem of friction in mechatronic modules and the possibility of solving it with the help of the No-wear effect. We set the following tasks: 1) to describe the concept of the No-wear effect; 2) to show the advantages of this effect in robotics; 3) to analyze the conditions of use of the No-wear effect in robotics. The level of our research is theoretical. The relevance of our study is to increase the efficiency and reliability of production.

The No-wear effect (the phenomenon of selective transfer under friction) was discovered by Soviet scientists D. N. Garkunov and I. V. Kragelsky when studying the wear of the IL aircraft components. The No-wear effect (Effect of Garkunov) is a very low friction and wear, and in some cases there is lack of wear, so a friction effect without wear is observed.

Copper is separated from a solid solution in a steel–copper, steel–bronze or steel–brass friction pair. This is possible due to the destruction of interatomic bonds. The separated pure copper is brought to the surface of the steel in the form of a layer about a thousandth of a millimeter thick.

The formed film is not carried away from the contact zone, but it passes to another friction surface, this gives the friction units high wear resistance. It is known that under certain conditions small particles are separated from one surface and transferred to another in friction units.

If each particle separated from the surface is not carried away from the friction zone, but is held by the opposite surface, covering it with a thin layer and giving it a high smoothness, then when the opposite surfaces are covered with a thin layer of copper, wear will stop [2, p. 336].

In robotics, this effect can be very useful both in terms of reliability and in terms of economics. In the first case, it will be possible to increase the life of the mechanism by several times, as well as reduce the probability of breaking. This is undoubtedly important in industries with aggressive conditions (nuclear industry, space technology, explosive production, etc.).

In the second case, it will save huge resources, such as time, man-hours, natural and economic, which are spent on repairing or replacing parts that have undergone wear. To achieve this effect, it is necessary to use lubricants containing surfactants with reducing properties for a bronze-steel pair. It is possible to use lubricants containing fine copper powder for other cases [1, p. 328].

It is also necessary to ensure dust protection of the mechanism, as the ingress of dust or particles of any materials negates the use of this type of lubricant, as there is abrasive friction. In addition, it is necessary to maintain the temperature so that it does not exceed the resistance temperature of the used lubricant, due to which selective transfer is realized [2, p. 347].

In this case, it is desirable to add a device for automatic lubrication to the module, but this will either require the use of sensors of the part surface condition, or calculate or verify experimentally the length of time through which it is necessary to resume the lubrication layer.

Thus, in order to reduce friction in the mechatronic module, it is necessary to place several sensors: temperature sensor, dust sensor, surface layer condition sensor.

This approach has both advantages and disadvantages. The advantages are increased uptime, reduced wear and increased reliability. The disadvantages are the increased cost and complexity of production, as well as the need for repair only by replacing the entire module.

But with all these disadvantages, the economic benefit significantly exceeds all costs, increased reliability plays an important role in hazardous industries, where the reliability of systems comes first.

Thus, the application of this effect can be used either in the simplest mechanisms that can be replaced as quickly and easily as possible (guide ways and rails, which are enclosed in a sealed housing), or in the most important mechanisms that must properly perform their functions under any conditions (safety devices, safety systems, auxiliary motors and backup systems).

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THE CHOICE OF PROGRAMMING LANGUAGES:
SEVERAL ASPECTS OF THE PROBLEM

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The article deals with the choice of programming languages based on the rating of programming languages and labor market analysis.

Keywords: programming, programming language, labor market, IT-sphere, apps, languages rating, job statistics.

ВЫБОР ЯЗЫКОВ ПРОГРАММИРОВАНИЯ:
НЕКОТОРЫЕ АСПЕКТЫ ПРОБЛЕМЫ

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Статья посвящена выбору языков программирования на основе рейтинга языков программирования и анализа рынка труда.

Ключевые слова: программирование, язык программирования, рынок труда, IT-сфера, приложения, рейтинг языков, статистика вакансий.

Today, in all spheres of society, programming is used in many ways and every year computer technologies are increasing their potential, while programming languages are becoming obsolete. In this regard, there is such a problem as the need to consider the most popular programming languages and their applicability in various technological fields. The purpose of the study is to identify relevant programming languages for learning.

A programming language is a formal language designed to write computer programs. Since the creation of the first programmable machines, mankind has come up with more than eight thousand programming languages, so when writing a program, it is necessary to take into account its potential, and therefore the relevance of the programming language.

Today, according to the world ranking, the three most popular languages are:

1. Java.
2. C.
3. Python.

It is worth considering that each programming language performs certain tasks, and therefore it is necessary to consider these programming languages and their applications.

1. **Java** is a strongly typed object-oriented programming language[2].

Projects developed with using Java technology are: RuneScape, eBay, LinkedIn, Amazon, Yahoo!

The main spheres of Java applications are: desktop applications with a graphical interface, mobile applications, embedded systems, web applications, corporate (enterprise) systems [2].

Sep 2019	Sep 2018	Programming Language	Ratings	Sep 2019	Sep 2018	Programming Language	Ratings
1	1	Java	16.661%	6	5	Visual Basic .NET	3.291%
2	2	C	15.205%	7	8	JavaScript	2.128%
3	3	Python	9.874%	8	9	SQL	1.944%
4	4	C++	5.635%	9	7	PHP	1.863%
5	6	C#	3.399%	10	10	Objective-C	1.840%

A ranking of programming languages compiled by Tiobe Software [1]

2. **C** is a compiled statically typed general-purpose programming language.

The syntax of this language is the basis for the following programming languages: C#, Java, C++, Objective-C [3].

The main applications of the C language are: web development, desktop applications, computer games, mobile applications.

3. **Python** is a high-level general-purpose programming language that focuses on improving developer's productivity and code readability.

The main areas of application of the Python language are: web development, analysis and data manipulation: scripting, machine learning, data analysis and visualization [4].

At the moment many sites are created in Python, among them are: pinterest.com, instagram.com and rdio.com.

4. **C++** is a compiled, statically typed general-purpose programming language

The main areas of application of the C++ language are: applications for embedded systems, high-performance servers, operating systems, application programs [5].

5. **C#** is an object-oriented programming language developed by a group of Microsoft engineers [6].

C# language allows you to develop almost any application that is associated with the Visual Studio IDE.

The relevance of programming languages is determined by the demand of programmers in the labor market. Let's look at the number of requests for different programming languages in large cities of our country, because they have a high level of development of the IT sphere.

After doing some research, I found that:

Languagerating	Moscow		St. Petersburg	
	Language	Number of requests	Language	Number of requests
1	Java	860	Java	394
2	C/C++	705	PHP	207
3	PHP	477	C#	137
4	Python	343	Python	132
5	C#	330	C/C++	130

Approaches to programming in particular and information technology are constantly changing, so the relevance of programming languages can be considered for the next 10 years. At the same time, based on my research, we can conclude that it is worth studying basic programming languages: C++, Python, Java.

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DATA STORAGE. RESTORE DELETED INFORMATION

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The article describes how to recover deleted or lost information from solid state drives.

Keywords: recovery, system structure, data.

ХРАНЕНИЕ ДАННЫХ. ВОССТАНОВЛЕНИЕ УДАЛЕННОЙ ИНФОРМАЦИИ

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Описываются способы восстановления удаленной или утраченной информации с твердотельных накопителей.

Ключевые слова: восстановление, структура файловой системы, файл.

Data stored on information storage is an integral part of our life. They can store data on the distribution of which the fate of many people and companies depends.

Therefore, it is so important to monitor the storage of data and the state of the hardware. We need to know the features and privileges of devices, and to identify the border between personal data and data from the Internet, production secrets.

Do we have confidence in moving the data to the trash that they remain on our computer? And how to restore them if necessary.

There are currently two main ways to recover data. The method is selected depending on the malfunction of the drive. The hardware-software method is used in cases where the software method does not give a result.

The software method is data recovery without physical interference in the drive device, as well as in the functioning of the micropragram and the structure of the service information modules. This method is used in cases when the drive itself is preserved, but for one reason or another, access to the data stored on it is lost. The reason for this may be the formatting of logical disks, an unsuccessful change in the logical geometry of the drive, deletion of information, partial or complete destruction of the file system, as information about the structure of data placement on the drive. Often in these cases, it is possible to recover most of the data, however, there are cases when it is impossible to recover lost data (overwriting data can be considered a special case). To automate the recovery process, many programs have been written, including free ones.

In the case of formatting a logical drive or partition, the structure and attributes of the data are not violated, but information on the location of data on this drive is changed or inventoried (initialized).

With fast formatting, a small part of the file table is updated, part of the service records remains, you only need to interpret it and read the data in the correct order.

Full formatting can update the entire file table, so restoring the structure of files and folders is not always possible. To restore data without information about the structure, you can use file recovery by signature.

If a file system has been damaged as a result of a software or media failure, data recovery programs can recover some of the information that depends on the amount of damage.

When deleting data, in fact, the data physically remains on the drive, however, it is no longer displayed in the file system, and the place on the media where it is located is marked as free and ready to record new information. In this case, the file attributes are changed. If you write to this partition or logical drive, partial or complete replacement of data marked as deleted may occur.

Such files can be easily read and restored with all attributes and location information by reading the file system overhead. There are programs only for recovering deleted data, and complex solutions where recovering deleted data is only one of the functions.

There are also special programs – "shredders" designed to destroy data. After proper use of such programs, recovery is not possible.

In the event that reconstruction of the file system is not possible for any reason, some files can still be restored using signature recovery. With this type of recovery, a sector-by-sector scan of the drive for known file signatures occurs.

The basic principle of signature search algorithms is the same as the very first antiviruses. As an antivirus scans a file in search of data sections matching the known fragments of the virus code, the signature search algorithms used in data recovery programs read information from the disk surface in the hope of meeting familiar data sections. The headers of many file types contain character sequences. For example, JPEG files contain a sequence of "JFIF" characters, ZIP archives begin with "PK" characters, and PDF documents start with "% PDF-" characters. Some files (for example, text and HTML files) do not have characteristic signatures, but can be determined by indirect signs, because contain only characters from the ASCII table (see Table).

Signatures

File	Starts with a signature
avi	5249
bmp	424D
tif	4949
doc	D0CF
docx	504B
jpeg	FFD8
png	8950

According to the results of scanning, most often a list of files is sorted by type. File location information is not restored. It is good to use this type of recovery for recovering photos from memory cards, since the data on the card are of the same type and are recorded, in the general case, strictly sequentially, without fragmentation.

Most programs allow you to apply several recovery methods at the same time in one scan. As a result, the maximum possible result is obtained when using this program. The most reliable, easiest and cheapest way to recover information is to restore information from previously made backups. To create backups, specialized software is used, which can also perform data recovery.

A hardware-software method is required for physical damage to the drive. Here it is necessary to focus on the type of drive: whether it is a flexible magnetic disk (HDD), hard magnetic disk (HDD), flash (NAND-Flash drive) or CD / DVD / BD. Consider the main types of media and their malfunctions.

Conclusion: we can conclude that the problem is relevant to this day. People lose data every day and we looked at various ways of data recovery, such as: software method, signature recovery, mixed recovery, hardware and software method.

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УДК 519.8

COMPARISON OF OPEN-SOURCE LINEAR PROGRAMMING SOLVERS FOR INTEGRATING INTO POSTGRESQL

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Today Method DEA is widely used, but integration of this method into Database Management System is not still done. The embedding is advisable for more effective using. This method can be integrated into PostgreSQL. Programmers can enable Open-Source Linear Programming Solvers into object-relational database management system, as first step for achieving the goal.

Keywords: Method DEA, Open-Source Linear Programming Solvers, Comparison, PostgreSQL.

СРАВНЕНИЕ СВОБОДНЫХ ПРОГРАММНЫХ ПАКЕТОВ, РЕШАЮЩИХ ЗАДАЧИ ЛИНЕЙНОГО ПРОГРАММИРОВАНИЯ С ЦЕЛЬЮ ИНТЕГРИРОВАНИЯ В СУБД POSTGRESQL

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В настоящее время Метод DEA широко используется, но до сих пор не выполнена его интеграция в СУБД. Встраивание метода целесообразно для его более эффективного использования. Данный метод может быть интегрирован в PostgreSQL. В качестве первого шага для достижения данной цели программисты могут объединить программные пакеты, решающие задачи линейного программирования, имеющие открытый исходный код, с объектно-реляционной системой управления базами данных.

Ключевые слова: метод DEA, бесплатные программные пакеты, решающие задачи линейного программирования с открытым исходным кодом сравнение, PostgreSQL.

Today many systems need optimization for more effective work. Thus, programmer needs in a simple, but effective tool that allows them to present information compactly, without missing important details. Data Envelopment Analysis is fit to be this tool [1].

Method DEA is an effective tool that can be used in the field of information technology. Data envelopment analysis (DEA) is a methodology to measure the efficiency of multiple decision-making units (DMUs) [2]. Method DEA is using on the computer, because the level of calculation is so high. It can use many input parameters in application of method DEA and many mistakes can be made in manual calculation. This method is already implemented and programmers can use method DEA for optimization their systems on the computer. But also, they can try to integrate it in database management system. Today Method DEA is widely used, but integration of this method into Database Management System is not still done.

PostgreSQL is free for commercial using and the complete source code is available, released under the terms of the PostgreSQL License, a permissive software license. There are also commercial distributions of PostgreSQL. It adds value for enterprise customers. PostgreSQL is an open source object-relational database management system (ORDBMS) with an emphasis on extensibility and standards compliance.

In that way, programmers can integrate DEA into PostgreSQL, but the function's programming is difficult and long process. On the first step, Open-Source Linear Programming Solvers can be added to the object-relational database management system, such is PostgreSQL.

So, solvers can be tried to insert into PostgreSQL. The programmer should choose which Solver will be integrated.

A programmer should answer some questions, before choosing the Solver:

– Is the product free or low-cost?

– Is the product an LP solver?

– Does the product use an exact method such as the Simplex algorithm or an Interior Point algorithm?

– Is the product mature? (as demonstrated through software development practices, documentation, and active commercial or academic user communities)?

– Is the product a stand-alone product (e. g. not an add-in to MATLAB, Excel)?

In total, about 100 LP tools were identified. But, there are identified ten potential LP solvers. These solvers are listed in Table 1 [3].

Table 1

LP solvers

Solver name	Website
lp_solve	http://lpsolve.sourceforge.net/5.5/
MINOS	http://www.sbsi-soloptimize.com/asp/sol_product_minos.htm
CLP	https://projects.coin-or.org/Clp
GLPK	http://www.gnu.org/software/glpk/
PCx	http://pages.cs.wisc.edu/~swright/PCx/
PPL	http://bugseng.com/products/ppl/
JOptimizer	http://www.joptimizer.com/
LiPS	http://lipside.sourceforge.net/
CVXOPT	http://abel.ee.ucla.edu/cvxopt/
QSOPT	http://www2.isye.gatech.edu/~wcook/qsopt/

Then, identified lp_solve, MINOS, CLP, and GLPK as the test candidates, because they have the best parameters and they are more popular, then other. They do have common desirable traits. First, all of the tested solvers have a mature code base and are extensively documented. MINOS is a commercial solver. It can be purchased with AMPL and GAMS. MINOS is not free for programmers. The other three solvers, such as lp_solve, CLP, GLPK are open-source applications. In a survey of websites, presentations, and papers discussing open-source solvers, these three solvers were referenced the most often. Also, all of the major open-source development environments provide an interface to some combination of these three tools [3].

It important to know that PostgreSQL has built-in support for three procedural languages:

– Plain SQL. Simpler SQL functions can get expanded inline into the calling (SQL) query, which saves function call overhead and allows the query optimizer to "see inside" the function.

– PL/pgSQL. It resembles Oracle's procedural language and SQL/PSM.

– C. It allows loading custom shared libraries into the database. Functions written in C offer the best performance. Most built-in functions are written in this language.

In addition, PostgreSQL allows procedural languages to be loaded into the database through extensions. Three language extensions are included with PostgreSQL to support Perl, Python, and Tcl.

The solvers and their Application Programming Interface (API) are listed in Table 2 [3].

Table 2

API of solvers

LP Solver	Application Programming Interface (API)
CLP	C++
GLPK	C, Java
lp_solve	Java, .NET, C, C++, C#
MINOS	Fortran, C, MATLAB

MINOS is written in the Fortran 77 programming language and distributed as source code. This solver cannot integrate into PostgreSQL. CLP is written in the C++ programming language, GLPK is written in the C programming language and lp_solve is written in the C. It means that these three solvers can be added to object-relational database management system.

To draw the conclusion, one can say that programmers can try to add open-source linear programming solvers for system optimization and analysis into object-relational database management system, such as PostgreSQL. But it is important to consider the application programming interface of solvers, because it influences on compatibility and direct operation of solvers in efficiency`s evaluation and optimization of systems.

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METHODS OF IMPROVING THE ACCURACY
OF MEASURING INSTRUMENTS

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The accuracy of measuring instruments directly affects the quality of objects in the rocket and space industry. The paper discusses and describes the most common and relevant ways and methods to improve the accuracy of measuring instruments.

Keywords: metrology, measuring instruments, accuracy improvement, measurement efficiency, methods, methods.

СПОСОБЫ И МЕТОДЫ ПОВЫШЕНИЯ ТОЧНОСТИ
СРЕДСТВ ИЗМЕРЕНИЙ

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Точность средств измерений напрямую влияет на качество объектов ракетно-космической отрасли. Рассматриваются и описываются наиболее распространенные и актуальные методы и способы повышения точности средств измерений.

Ключевые слова: метрология, средства измерения, повышение точности, эффективность измерений, методы, способы.

During the production of rocket and space technology, many diagnostics from control and laboratory to flight are carried out. As the requirements for flight characteristics of objects increase, the role of tests becomes more and more important, which explains the relevance of methods and methods for improving the accuracy of measurements. Based on the results of tests, important decisions are made about the quality of the object of rocket and space technology. The purpose of this work is to analyze the most used methods for improving the accuracy of measurements.

The accuracy of measurements determines their quality. In practice, the following 9 ways to improve measurement accuracy are most often used:

1. Replacement of measuring instruments with more accurate ones (acquisition or development of special ones means of measurement).

This method is appropriate for dominating instrumental components of measurement error. Improving the accuracy of measurements is not always available. The choice of more accurate measuring instruments is often very limited. Most often, these restrictions are related to the operating conditions of measuring instruments. In addition, it should be borne in mind that the cost of measuring instruments, as a rule, increases rapidly with increasing accuracy.

2. Reducing the relative error.

You can achieve this by selecting the upper limit of measurements for which the given basic and additional errors are normal, so that the expected values of the measured value (reading) are in the last third of the measurement range.

3. Limiting the conditions for using measuring instruments.

This method of increasing the accuracy of measurements is appropriate if additional errors of measuring instruments are dominant, which are caused by significant deviations of external influencing quantities from their normal values temperature, vibration, voltage, humidity, etc.

4. Individual calibration of measuring instruments.

This method of increasing the accuracy of measurements is used in the case of a predominance of systematic components of the error of measuring instruments. The systematic error components of measuring instruments (for example, for resistance thermometers and thermocouples) can be significantly reduced by adjusting the measurement results obtained by individual calibration.

5. The use of information redundancy.

Information redundancy is a state of measurement information in which it is more necessary for the implementation of object management functions.

An example of using information redundancy to improve the accuracy of measurements is the inclusion in the measurement system of additional measuring instruments that measure the same value and averaging their readings [1].

6. Monitoring of the operational state of measuring instruments during their operation.

This method is very promising and relevant, but requires development in order to identify, exclude or reduce metrological failures in measuring instruments.

7. Improvement of measurement methods.

This method of increasing the accuracy of measurements is effective if the methodological components of measurement error dominate. Improvement of measurement methods can be carried out by changing the algorithm for processing measurement results.

8. The use of test signals.

This method of increasing the accuracy of measurements is used in measuring systems for measuring electrical and non-electrical quantities. The essence of the method is to determine the parameters of the static conversion function (SFP) using additional test transformations, each of which is functionally related to the measured value. Test methods allow you to improve the accuracy of measurements by reducing systematic and so-called systematic errors.

9. Automation of measurement procedures [2].

Such an event, in addition to reducing the complexity of measurements, helps to eliminate subjective errors that occur when processing diagrams, calculating intermediate and final measurement results, preparing samples for chemical analyses, etc. Operations performed by a person.

There are also 4 methods for improving the accuracy of measuring instruments:

1. Comparison with a measure.

The method of comparison with a measure based on the fact that the size of the measured |values is compared using a comparator with a size of size, reproducible measure, and the desired experimental value calculated according to the obtained values of the readings of the comparator and the nominal value of the measures. This method is one of the most effective ways to eliminate the systematic component of measurement error.it is widely used in the measurement of linear quantities.

2. Inverse transformation.

This method is used for automatic error correction of measuring instruments. To implement this method, a reverse Converter is used, whose static real conversion function must match the function. This method is effective when the reverse Converter is significantly more accurate than the forward Converter.

3. The reference signals.

It consists in the fact that the input of measuring instruments is periodically supplied with reference signals of the same kind as the measured value instead of the measured value. The difference

between the actual calibration characteristic is used for sensitivity correction or for automatic correction of the measurement result. In this case, as with the substitution method, all systematic errors are eliminated, but only at those points in the measurement range that correspond to the reference signals.

4. Modulation.

A method that periodically inverts the input signal and suppresses interference that has a unidirectional effect [3].

Thus, we can conclude that among the methods of improving the accuracy of measurements, there is no universal one, since each of them plays an important role in determining the quality of objects to which they are applied.

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MOBILE ROBOTS IN MODERN LIFE

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This paper is devoted to the study of the achievement of modern mobile robotics. The definitions of the basic terms "robotics" and "mobile robot" are given. The main stages of creating mobile robots were shown. Examples of the use of mobile robots in various spheres of modern life are considered.

Keywords: robotics, mobile robot, stages of creation, design.

МОБИЛЬНЫЕ РОБОТЫ В СОВРЕМЕННОЙ ЖИЗНИ

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Данная статья посвящена изучению достижений современной мобильной робототехники. Даны определения основных терминов «робототехника» и «мобильный робот». Были показаны основные этапы создания мобильных роботов. Рассмотрены примеры использования мобильных роботов в различных сферах современной жизни.

Ключевые слова: робототехника, мобильный робот, этапы создания, проект.

The purpose of the article is to analyze the achievements of modern mobile robots. The level of our research is theoretical. We have completed the following tasks:
1) to define robotics by Russian and foreign sources;
2) to define mobile robots;
3) to consider the main stages of creating mobile robots;
4) to show the applications of mobile robots.

Modern robotics appeared in the second half of the 20th century. The industry needed universal manipulation machines. The first manipulators appeared in the 40–50s for atomic research. The first fully automated robot appeared in the USA in 1960. The "Golden Age" of Robotics came in the 90s.

We like the definition of Yu. V. Poduraev, that "Robotics is a field of science and technology related to the creation, research and use of robots, it covers the design, software, robot sensing, control, and robotization of industry and non-industrial sphere" [1; 8].

The Merriam-Webster Dictionary defines "Robotics is the technology dealing with the design, construction, and operation of robots in automation" [2].

O. D. Egorov, Yu. V. Poduraev, M. A. Buinov give the following definition of mobile robots: "A mobile robot is a robot that can move in a manufacturing environment in accordance with the control program. It can be equipped with a manipulator" [1; 8].

Mobile robots do not include mobile manipulation robots, which can be quickly moved in the manufacturing environment manually or by means of vehicles with manual control.

A modern person understands a mobile robot as a children's toy robot that can perform elementary tasks. The application of mobile robots is much more. The stages of creating these robots are as follows:

1) to set the goal that the designed robot must fulfill;

2) to carry out calculations of the main design features of assembly units and mechanisms;

3) to study issues related to the placement and arrangement of actuators, elements of remote or autonomous control, main and supplementary mechanisms of the internal structure of the robot;

4) to create its 3D-models in any engineering design environment (Compass 3D, SolidWorks, AutoCAD and others);

5) to create a mathematical model of the behavior of a mobile robot in a virtual environment using computer programming;

6) to find out and eliminate the defects of the half-finished design;

7) to assemble a mobile robot prototype;

8) to test its work and behavior in real conditions.

Today, there is a wide variety of types of mobile robots. Each has its specific purpose. For example, most modern aircraft use an autopilot that can control all stages of flight. Any quadcopter is a flying mobile robot that can be controlled remotely. Drones with a manipulating arm are also created that can provide assistance in various situations. Floating mobile robots are used to explore the bottom, search for sunken ships, study the behavior of underwater inhabitants and repair ships in motion. Mobile robots can be used for military purposes to find mines and mine bombs [3, 3].

Thus, mobile robots are important for the life of modern society, as they can simplify human activities.

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CREATING A CONSTRUCTION TOY FOR CHILDREN ON THE BASIS OF RUBE GOLDBERG MACHINE

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This paper is devoted to the study of the principle of the Rube Goldberg machine, and the process of its assembly. Our project considers the prospect of creating a construction toy for children. The paper describes the main stages of creating this construction toy and shows its benefits for children. The technical details of the construction toy are given.

Keywords: Rube Goldberg machine, mechanism, construction toy, child.

СОЗДАНИЕ КОНСТРУКТОРА ДЛЯ ДЕТЕЙ НА БАЗЕ МАШИНЫ РУБА ГОЛДБЕРГА

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Данная статья посвящена изучению принципа работы машины Руба Голдберга, и процессу её сборки. Проект рассматривает перспективу создания конструктора для детей. Даны основные этапы создания конструктора и польза его для детей. Описаны технические характеристики конструктора.

Ключевые слова: машина Руба Голдберга, механизм, конструктор, ребенок.

The purpose of the study is to analyze the technical capabilities of the project to create a construction toy for children. The following tasks are considered:
1) give a theoretical explanation of the principle of Rube Goldberg machine;
2) describe the stages of creating a construction toy;
3) show the benefit for the child when using this construction toy.

The relevance of our research is to create the construction toy, which identifies children's interest and a penchant for technology, allowing in-depth study of the mechanisms in the assembly process of the machine. The level of our research is theoretical

Reuben Lucius Goldberg is an American animator, sculptor, writer, engineer and inventor.

The Goldberg machine is a device that performs a very simple task in an extremely complex way, usually through a long sequence of "Domino principle" interactions. Sometimes this expression is used to ironically refer to any unnecessarily complex system [1, p. 137].

Designing Rube Goldberg Machine to create a construction toy for children of school/preschool age, can be divided into several stages:
1. Design of the mechanism itself, as a whole, and its components.

2. Search for the material to be used to create the mechanism.

3. Creation of the components of the mechanism.

4. Combination of the components into a single mechanism.

5. Fitting the mechanism, and bringing it to working condition [2, p. 387].

We will consider this machine as a kind of educational toy for children. It is similar to LEGO, bolt, joint or labyrinth construction sets.

This toy will work in several directions:

1. Designing the mechanism develops the child's spatial thinking and creativity, allows him to think broadly and independently.

2. The Assembly of such a machine allows the child to develop fine motor skills, and this develops the speech apparatus, imagination, perception of shapes of objects and improves handwriting.

3. Bringing the mechanism to the working state teaches the child to see what does not work and why, it develops formal logical thinking or a causal relationship.

4. Such a toy will develop the intelligence of the child as a whole, makes the child more assiduous and patient, it will prepare him for school if the child is a preschooler. And it will improve performance in school, if the child is a schoolboy.

The construction toy on the basis of Rube Goldberg machine increases children's interest in different mechanisms. It develops variable thinking in younger students and contributes to the solution of certain engineering problems.

The toy itself is a panel tilted at a certain angle. The key in the design is the principle of moving the panels-nodes of the mechanism on the board, as in the game of 15 puzzle.

The child will be able to choose which nodes to install. It can be: contact closure, lever mechanisms, spring mechanisms, mechanisms working on the principle of "Domino". The child himself decides how to build his own mechanism, displays various kinematic connections in different directions on the game panel.

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METHODS OF ANALYSIS OF THE EMOTIONAL COLORING OF THE TEXT BASED ON NEURAL NETWORKS

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The article describes the concept of sentiment analysis, its basic methods and RNTN model for analysis of the emotional coloring of the text.

Keywords: sentiment analysis, CNN, word embedding, word clustering, RNTN.

МЕТОДЫ АНАЛИЗА ЭМОЦИОНАЛЬНОЙ ОКРАСКИ ТЕКСТА НА ОСНОВЕ НЕЙРОННЫХ СЕТЕЙ

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Описывается понятие анализа настроений, его базовые методы и модель RNTN для анализа эмоциональной окраски текста.

Ключевые слова: анализ настроений, CNN, встраивание слов, кластеризация слов, RNTN.

Sentiment analysis or opinion mining is the computational study of people's opinions, sentiments, emotions, appraisals, and attitudes towards entities such as products, services, organizations, individuals, issues, events, topics, and their attributes [1]. The field has been developing with those of the social media in the internet, for example, reviews, forum discussions, blogs, micro-blogs and social networks, because these are suitable places for expressing personal opinion. Since early 2000s, sentiment analysis has grown to be one of the most active research areas in natural language processing (NLP). In fact, it has spread from computer science to management sciences and social sciences such as marketing, finance, political science, communications, health science, and even history, due to its importance to business and society as a whole. Opinions are central to almost all human activities and are key influencers of our behavior. Our beliefs and perceptions of reality, and the choices we make, are, to a considerable degree, conditioned upon how others see and evaluate the world. For this reason, whenever we need to make a decision we often seek out the opinions of others. This is true for separate people as well as for organizations.

In recent years, CNNs have been applied to natural language processing, as a model for classifying sentences. At first, word embeddings were used as input to the CNNs. Then there were used both word embeddings and their semantically expanded matrix. However, the additional expanded matrix comes, in principle, from the word embedding space.

Word embedding in NLP is a function that maps words or phrases from the vocabulary to vectors of real numbers. Word2vec takes a large corpus of text as its input and produces a vector

space where each word is positioned. If some words have common contexts in the corpus, they are expected to be located in close proximity to one another [2]. But, it's disadvantage is not being able to reflect the information of the whole corpus because learning is performed with limited window size. GloVe tackles this problem by defining an objective function so that the inner product of two word vectors becomes the logarithm of the probability of simultaneous appearance in the corpus [3]. As a result, GloVe is better at reflecting the statistical information of corpus and measuring the similarity between word vectors. Recently, FastText was developed by Facebook in 2016. While Word2vec has problems in representing words not in the training dataset, FastText can learn a new word vector value by expressing words from vectors of subwords (or partial words) [4].

Word clustering is a technique for grouping semantically similar words into clusters. It has been utilized variously in natural language processing: semantic features based on word clustering can be added to the POS tagging, the POS characteristics revealed by the word clusteringbased semantic features, can be reflected in dependency parsing, the class-based features, extracted from word clustering, can be applied to the implementation of natural language understanding.

These are methods which can be used for semantic analysis for different purposes and in different combinations. For analysis of the emotional coloring of the text there is a new model called the Recursive Neural Tensor Network (RNTN). Recursive Neural Tensor Networks take as input phrases of any length. They represent a phrase through word vectors and a parse tree and then compute vectors for higher nodes in the tree using the same tensor-based composition function. The RNTN obtains high results with 80.7 % accuracy in predicting sentiment for all

An example of RNTN

nodes. Unlike bag of words models, the RNTN accurately captures the sentiment change and scope of negation. RNTNs also learn that sentiment of phrases following the contrastive conjunction 'but' dominates [5]. At Picture 1 there is an example of the Recursive Neural Tensor Network accurately predicting 5 sentiment classes, very negative to very positive ($--$, $-$, 0, $+$, $++$), at every node of a parse tree and capturing the negation and its scope in this sentence.

Nowadays organizations don't have to conduct surveys and focus groups to gather public opinions. Finding and monitoring opinion sites in the Internet and summarizing opinions from them is not always easily, so the field of analysis of emotional color of texts has a huge potential for development.

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MODIFICATION OF SELECTIVE PRESSURE IN GENETIC ALGORITHMS FOR SOLVING THE PROBLEMS OF UNCONDITIONAL MONOCRITERIAL OPTIMIZATION

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The paper develops and investigates a new method for implementing selective pressure in genetic algorithms. A comparison was made of this development with the classic options for implementing selective pressure.

Keywords: genetic algorithms, selective pressure, development, research.

МОДИФИКАЦИЯ СЕЛЕКТИВНОГО ДАВЛЕНИЯ В ГЕНЕТИЧЕСКИХ АЛГОРИТМАХ ДЛЯ РЕШЕНИЯ ЗАДАЧ БЕЗУСЛОВНОЙ ОДНОКРИТЕРИАЛЬНОЙ ОПТИМИЗАЦИИ

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Разработан и исследован новый способ реализации селективного давления в генетических алгоритмах. Было проведено сравнение данной разработки с классическими вариантами реализации селективного давления.

Ключевые слова: генетические алгоритмы, селективное давление, разработка, исследование.

A serious problem in the work of classical genetic algorithms is the premature convergence to a local optimum. This paper presents some attempt to solve this problem by changing the selective pressure during the operation of the algorithm.

A new variant of selective pressure (selection operator) was based on classical rank selection. In the classic version, individuals are ordered by the value of the fitness function, and then they are assigned a certain rank value. The best individual receives a rank (the number of individuals in a population), and the worst – rank 1. Next, the probabilities of individuals to be selected as parents are calculated, this probabilities are directly proportional to the ranks of individuals, that is, they are expressed by the following formula: $P(rang_i) = \dfrac{i}{1 + 2 + \ldots + n}$,

A more general formula is considered: $P(rang_i) = \dfrac{i^k}{1^k + 2^k + \ldots + n^k}$. Obviously, rank selection is a special case of the new formula for $k = 1$. We consider a particular case of this formula

for $i = n$: $P(rang_n) = \dfrac{n^k}{1^k + 2^k + ... + n^k}$. Since $\underset{n->\infty}{Lim} \dfrac{(1^k + 2^k + ... + n^k)}{n^{k+1}} = \dfrac{1}{k+1}$, we can assume that

for sufficiently large probability is expressed as follows: $P(n) = \dfrac{n^{k+1}}{n(1^k + 2^k + ... + n^k)} \approx \dfrac{k+1}{n}$, that is, the probability that the best individual will be chosen as a parent is almost directly proportional to the coefficient, it is assumed that with increasing this coefficient the selective pressure also increases.

Let us similarly consider the probability of an arbitrary individual: $P(rang_i) = \dfrac{i^k}{1^k + 2^k + ... + n^k} \approx \dfrac{(k+1)i^k}{n^{k+1}}$, take the partial derivative with respect to k ,

$$P'_k = \dfrac{((k+1)i^k)' n^{k+1} - (n^{k+1})'(k+1)i^k}{n^{2(k+1)}} = \dfrac{n^{k+1}(i^k + (k+1)i^k \ln i) - (k+1)i^k n^{k+1} \ln(n)}{n^{2(k+1)}},$$

$P'_k = \dfrac{i^k (1 + (k+1)\ln(i/n))}{n^{k+1}}$, since $1 \le i \le n$ it is obvious that $P''_{ik} > 0$. In other words, the greater the rank of an individual is, the more its probability will increase with increasing coefficient k (for the worst individuals it decreases, while for the best it increases). From this we can conclude that selective pressure is lower with lower values of the coefficient.

The main idea of the work is a gradual increase in this ratio. It is assumed that at the initial stages of the algorithm, the selective pressure is very low, and the algorithm practically does not converge, however, the operator of elitism operates, which copies the best individuals found in the next generation. The fewer resources the algorithm has, the stronger the selective pressure is (the faster it begins to converge), that is, the algorithm begins to search for at least some worthy result. To implement this idea, the coefficient is calculated by the formula:

$$k = \dfrac{Current\_generation\_number}{Number\_of\_generations}.$$

To test and compare the algorithms, 15 test functions were selected, among which there are well-known ones, such as the functions of De Jong, Katkovnik, Griewank, Rosenbrock, Rastrigin, Shekel and others.

To evaluate the effectiveness of the new selection operator on the same functions, classical genetic algorithms with the following parameters were tested:

1) Selection Operators: a) Fitness proportional selection; b) Rank-based selection; c) Tournament selection with tournament size 3; d) Tournament selection with tournament size 5; e) Tournament selection with tournament size 7;

2) Crossover operators: a) One-point crossingover; b) Two-point crossingover; c) Uniform crossingover;

3) The probability of mutation: a) Low mutation; b) Average mutation; c) High mutation;

4) The probability of crossing: a) 0,75; b) 0,99;

5) The percentage of elitism: a) 0 per cent; b) 5 per cent; c) 10 per cent; d) 20 per cent;

6) The percentage of apartheid: a) 0 per cent; b) 5 per cent; c) 10 per cent; d) 20 per cent.

Total: 288 settings for each selection operator.

Table 1 shows the average changes in the efficiency of solving test problems in comparison with each classical selection operator. In the mean values, only algorithms were taken into account with the presence of the elitism operator (as discussed above) and low (low or medium) mutation probabilities (because algorithms with a high mutation do very poorly).

As it can be seen from the table, in comparison with classical algorithms, a new version of selective pressure showed very good results. It is assumed that such success is due to the fact that we took into account only those algorithms in which the operator of elitism was present, without it, the

effectiveness of the new selection operator greatly decreases, as well as the fact that most of the test problems are multi-extreme and their local optima do not differ much from the global one.

Table 1

The average change in the efficiency of algorithms on tasks

Type of selection	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Sum
Propor-tional	–1 %	1 %	0 %	25 %	8 %	12 %	18 %	–1 %	0 %	0 %	0 %	0 %	1 %	0 %	25 %	88 %
Rank	6 %	7 %	0 %	12 %	10 %	5 %	7 %	8 %	0 %	1 %	0 %	0 %	0 %	0 %	2 %	57 %
Tour-nament 3	10 %	13 %	0 %	18 %	15 %	10 %	12 %	13 %	1 %	3 %	0 %	1 %	0 %	0 %	5 %	102 %
Tour-nament 5	17 %	19 %	0 %	25 %	23 %	14 %	16 %	15 %	3 %	5 %	0 %	1 %	0 %	0 %	10 %	149 %
Tour-nament 7	21 %	21 %	0 %	30 %	26 %	18 %	17 %	16 %	4 %	7 %	0 %	2 %	0 %	0 %	13 %	177 %

It might seem that success was due to the fact that many resources were allocated for the tasks (initially there were 100 individuals and 100 generations per task), so all the algorithms were tested on the same tasks, but with fewer resources. The results are shown in table 2.

Table 2

Efficiency of the new selection operator for various resources

Number of individuals x number of generations	100×100	90×90	80×80	70×70	60×60
Percentage of algorithms with new selection in the TOP 100	71 %	72 %	68 %	68 %	66 %

As it can be seen from the table, despite the decrease in resources, most of the algorithms in the TOP 100 in terms of efficiency (of totally for all tasks) are representatives of the new selection operator. This indicates that this algorithm can be effective on tasks with a small amount of resources.

Conclusion. A new version of the implementation of selective pressure in genetic algorithms was developed and investigated. On test problems, this option proved to be very good, surpassing classical algorithms, both on standard test functions and on functions with a reduced number of specified resources. However, it is worth noting that it turned out to be effective in test problems, we do not know how the algorithm will prove to behave on a real problem.

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Yak-9 THE MOST MASS PRODUCED SOVIET FIGHTER SINCE THE GREAT PATRIOTIC WAR

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The article deals with the history of the modification of the "Yak-9" fighter during the Great Patriotic War.

Keywords: aircraft, Great Patriotic War, Yak-9 fighter.

Як-9 – САМЫЙ МАССОВЫЙ СОВЕТСКИЙ ИСТРЕБИТЕЛЬ ВЕЛИКОЙ ОТЕЧЕСТВЕННОЙ ВОЙНЫ

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Рассматривается история модификации истребителя «Як-9» во время Великой отечественной войны.

Ключевые слова: Великая Отечественная война, истребитель Як-9, авиатехника.

The Yak-9 plane was the most massive Soviet fighter of the Great Patriotic War, for which it was nicknamed the air soldier in army newspapers, because in 1944 there were more different versions of the Yak-9 at the front than any other fighters combined, and in total over the years of the war 16 769 Yak-9s (including modifications) were produced. The victory over the forces of the Luftwaffe in World War II was achieved largely thanks to this aircraft. The purpose of this report is to highlight the main stages in the modification of the Yak-9 during the war, taking into account changing historical conditions.

The history of the appearance of the Yak-9 fighter began with the rearmament of the fighter aircraft of the Red Army. To train pilots in the latest aircraft technology, they needed a special double-seat aircraft with dual control, and it was such a plane that was developed in the design office of Alexander Sergeyevich Yakovlev based on the Yak-1. In May 1941, mass production of a new aircraft was launched, which received the designation "Yak-7UTI", which stands for training fighter. Later, at the plant in Novosibirsk, where the Yak-7UTI was produced, the idea arose to make a combat aircraft based on this machine. In the shortest possible time, the training aircraft was redesigned into a single-seat combat aircraft and adjusted its production, and the resulting machine was called "Yak-7".

In the second half of December 1942, a new Yak-9 fighter appeared and its serial production was immediately launched at the Aviation Plant No. 153 (Novosibirsk), which collected up to 20 aircraft per day. Later, Factory No. 166 in the city of Omsk also began production of this aircraft.

The creation of aircraft factories beyond the Urals was part of a program to create backup plants in regions remote from the European border. Yak-9 was developed on the basis of the Yak-7B modification, which was the reason for their external similarity. However, despite this, the new aircraft was better than its predecessor in every respect: the wing spars became metal, which reduced the weight of the aircraft structure by almost 150 kg. and allowed to increase the fuel supply, as well as to establish more powerful weapons. The aircraft could reach speeds from 500 to 600 km/h, the maximum flight altitude reached from 9 to 11 km., And the flight range could reach from 900 to 2000 km., Depending on version. The combatant pilots appreciated the new machine very well, it showed itself to be very maneuverable, was light and convenient to drive.

The outcome of the air war for the Soviet troops depended on competition with the design bureau of the famous German aircraft designer Willy Messerschmitt. One of his significant developments was the fighter Messerschmitt Bf.109, the work on which was completed back in 1934.This aircraft became the main force of the Luftwaffe during the Second World War.

Consider the comparative characteristics of the German fighter and the Yak-9. In terms of maximum speed at small and medium altitudes, the Yak-9 was superior to the Messerschmitt 109F, but inferior to its new modification "G". This German aircraft first appeared in the sky over Stalingrad, a powerful engine was installed on the machine and at that time the Messerschmitt 109G became the fastest fighter on the eastern front, however, in terms of maneuverability it was inferior to the Soviet Yak. In addition, the Messerschmitt 109G in 1943 acquired missile launchers, but throughout the war had smaller-caliber weapons compared to the Soviet Yak-9, although it was made from better materials.

During the war, all of the country's production resources were directed to the production of the maximum number of products, due to the advantage of German aviation in numbers (approximately equal to 9 to one). Soviet designers were aimed at improving their products through modernization, rather than creating new designs, which would require much more time and re-equipment of production processes. The Yak-9 aircraft was an excellent option for the development of new modifications of fighter jets.

So, for example, one of the modifications was the Yak-9T fighter, where the "T" index meant tank. The aircraft was armed with 37 mm. a gun, which was located in the collapse of the engine blocks, i.e. inside the hollow sleeve of the screw. From a distance of half a kilometer, the shells of this gun pierced tank armor up to 30 mm thick., And just one well-aimed hit in an enemy aircraft was enough for it to fall apart in the air. The appearance of this modification was caused not so much by the need to deal with tanks as with German aircraft, whose strong armor had almost complete protection against the weapons of old Yakov modifications. The problem for this modification was that it was possible to shoot only in short bursts, because from strong recoil, the direction of the aiming line went astray, which caused high demands on the pilots operating this model.

The battle for military power between the forces of the Wehrmacht and the Soviet army went on continuously, the Yak-9K modification soon appeared, the main feature of which was a 45 mm caliber cannon. The plane was equipped with such a powerful weapon to deal with bombers. A total of 53 units of this model were produced, they were never used for their intended purpose, but were able to show themselves on the good side, shooting down 12 aircraft on average, with a loss of only one.

Another variant of the Nine was the Yak-9B fighter-bomber, in the fuselage of which it was possible to carry up to 400 kg.bombs, the fuselage was located behind the cockpit, which did not violate the aerodynamics of the aircraft. The statistics of bomber sorties are just fine. Over 2494 sorties, 53 air battles, 29 tanks, 11 armored personnel carriers, 1014 vehicles, 7 field guns, 18 steam locomotives, 161 railway wagons, 20 field headquarters, 4 fuel depots and 25 aircraft were destroyed, and all this with only 4 aircraft losses. The successes of the 3 Belorussian Front are in no small part related to the successful work of the 1st Air Army, which includes the famous Yak-9B.

In November 1942, there was a turning point in the war and situations when Soviet troops began to move from defense to offensive became more frequent. A radical turning point in the war was also manifested in the actions of aviation: the pace of advancement of Soviet troops to the west

increased, but in the returned territories the Soviet services did not have time to prepare airfields, so a fighter with a longer flight range was needed. So the Yak-9D modification was born, which was characterized by an increased capacity of fuel tanks. The maximum flight range of such a machine reached 1360 km. and on the basis of this modification the Yak-9DD was built, the flight range of which reached about 2000 km. This aircraft was intended for long-range escort of bombers.

The Yak-9U is considered the most radical modification of the aircraft, it appeared at the front in the second half of 1944. The letter U meant an improved version, and the new modification did have a more powerful engine and perfect aerodynamics, which allowed the fighter to reach speeds of up to 670 km/hours

Yak-9 became one of the best aircraft in the first place because of the ease of production and flexibility for subsequent modifications. This allowed us to simultaneously improve the technical characteristics of aircraft and increase production. By the end of the war, about 74 thousand fighters were in service, and this was almost twice as much as the enemy. With such an advantage, the Soviet pilots began to gain an advantage in the air, and by 1944 the German bombers had virtually paralyzed.

The contribution of Soviet scientists and engineers brought a tremendous influence on the outcome of the war, but one should not forget that one of the main reasons for our victory is not only beautifully designed and assembled equipment, but also the strength of spirit of our people.

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FULL TEXT SEARCHING

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The article describes the basic concepts of full-text search, its meaning and some methods of application. The method of information search by inverted index method is described.

Keywords: inverted index, file search, document, request.

ПОЛНОТЕКСТОВЫЙ ПОИСК

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Описываются основные понятия полнотекстового поиска, его значение и некоторые способы применения. Описывается способ поиска информации методом инвертированного индекса.

Ключевые слова: инвертированный индекс, файловый поиск, документ, запрос.

Currently, web-development uses various technologies and programming languages, including: HTML Hypertext Markup Language – to create HTML documents and describe their contents, Cascading Style Sheets CSS (Cascading Style Sheets) – to describe how HTML elements should look. Using CSS allows you to remove styling from an HTML document and render this design in a separate file, as well as apply a single style to a group of documents, JavaScript programming language – to create interactive, dynamically changeable elements of HTML-pages, PHP programming language – to create dynamic and interactive HTML-pages, as well as to organize their interaction with the database.

It should be noted that the PHP language is used, as they say, on the server side, and JavaScript – on the client side, that is, in the browser. There is also a server-side implementation of the JavaScript language – Node.js, but we will limit ourselves only to working in the browser.

Today, several technologies are most often use to implement various web services: TCP/IP, HTML, XML and UDDI.

The universality of the presented technologies is the basis for understanding web services. They work on standard technologies that are independent of application providers and other network resources. They can be used in any operating systems, application servers, programming languages, etc.

Currently, text processing technologies are actively developing, but there are still many unresolved problems. At the present time, one of the most important problems is the search for the necessary information in the text, namely the implementation of full-text search.

The most common text processing technology systems are text search systems. The task of text search systems is to find in certain collections of natural language documents that meet the information needs of users. Text search technologies deal with different types of information. These can be journals, reports, statutes, and other types of text documents.

As a unit of information in text search systems is considered to be a document-the amount of information that has a full content and some kind of unique identifier.

Text search systems have the ability to process electronic documents stored in computer memory and available for automated processing. Computer processing and analysis of text documents are possible only if the individual elements of the text document are available in software. Therefore, it is not enough to scan a paper text document and store it in the computer's memory as a graphic file. You must have the document in digitized form-a format where every component of the text is programmatically available.

Full-text search-searches the entire contents of the document.to Any Internet search engine can be attributed to the full-text search such as Yandex, google and others. In order to speed up the work in the implementation of full-text search, it is customary to use pre-assigned indexes. The most common, at the moment, full-text search technology using indexes are inverted indexes.

An inverted index is a data structure designed to record in a separate list all the words and documents contained in a collection in which each of these words occurs. This index is used for text search.

The inverted index can be used not only to find files that contain a search query, but also to account for the position of the query in each document. The search query can be single-layered or multi-layered. When searching for a single-word query, the result is in the inverted index list. When you search for a verbose query, you must use the intersection of the list results.

To implement a full-text search with an inverted index, the TF-IDF measure is often used. This measure is proportional to the frequency of the request in one document and inversely proportional to the frequency of the request in all documents. In General, the TF-IDF − formula looks like Formula (1):

$$tf - idf(t, d, D) = tf(t, d) \cdot idf(t, D), \tag{1}$$

TF − the ratio of the number of query words to the total number of words in the document. Formula (2):

$$tf(t, d) = \frac{n_t}{\Sigma n_k}, \tag{2}$$

IDF reduces the weight of commonly used words. For each unique word within a particular document collection, there is only one IDF value. Formula (3):

$$idf(t, D) = \log \frac{|D|}{\left|\left\{d_i \in D \,\middle|\, t \in d_i\right\}\right|}, \tag{3}$$

One of the subspecies of full − text search is quote search. This type of search is based on automatic text processing. When you search for documents where a specific word occurs, the search automatically searches the entire array of documents and selects all the documents where the word occurs. This search can be used as a means of checking texts for uniqueness. It analyzes the imported text or text fragment and finds matching texts in other files by searching.

The system of full-text search can be called necessary in modern life, but its creation, maintenance and adaptation to new conditions set by the consumer is a very laborious process, the result of which is very important. Despite the fact that the field of full-text search is evolving, some problems remain unresolved. None of the search methods can be called universal because of the variety of technical requirements of the user, so this area is a wide field for scientific work.

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CONSIDERATIONS OF DEVELOPMENT AND FUNCTIONING OF THE "STATE PROCUREMENTS" MODULE OF UNIVERSITY ACS "PALLADA"

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This article reviews a state procurement module developed for university ACS "Pallada". It defines environments and means of development. It describes the functionality of the module. The module itself is incorporated into the system and is being tested.

Keywords: ERP- and CRM-system, university ACS, state procurements module.

ОСОБЕННОСТИ РАЗРАБОТКИ И РАБОТЫ МОДУЛЯ «ГОСЗАКУПКИ» ДЛЯ АСУ ВУЗОМ «ПАЛЛАДА»

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Рассматривается разработанный модуль госзакупки для АСУ вузом «Паллада». Определены среды и средства разработки. Описан функционал работы модуля. Модуль внедрен в систему и проходит тестирование.

Ключевые слова: ERP- и CRM-система, АСУ вузом, модуль госзакупки.

Digitalization of the economy is happening all over the world today, including Russia. Many companies in various business areas are either in the process of or have already adopted the e-governance system. Siberian state university of science and technology named after academician M. F. Reshetnev as well as other universities of Russia has its own control system required for the functioning of various departments. In Siberian state university this system is based on a ERP and CRM system Odoo and is named university Automated Control System "Pallada" [1]. It is worth noting that the advantages of the system include its modularity, built in DBMS and simplified interface design which allows to focus on solving tasks at hand. Moreover, thanks to a built in DBMS creating a class will automatically create corresponding entities in the database. "Pallada" consists of modules, each of which is meant to be used to solve specific tasks. For example – electronic document management system simplifies the document management process. Currently not all tasks are performed using the "Pallada" system – not all modules have been created while some of them need further work and modernization.

In order to augment the functionality of the automated control system "Pallada" a module which allows to transfer state procurement process to electronic format. The classes of this module are written in Python, interface – in XML, and DBMS – PostgreSQL. Documents are created using Aeroo Reports module [2].

Main work stages of the developed module:
1. Creating a service note.
2. Creating a state procurement card.
3. Creating a terms of reference.
4. Making contract changes.
5. Printing documents.

User interacts with the module via user interface. Work with the module begins in the "Service note" section. In order to make a procurement of a certain product, the initiator of the procurement should create and fill in the service note. After that, service note goes through a sequence of approvals: Initiator – his/ her supervisor – Prorector curating the initiator – EFD (EFD AEFA – Economy and Finance Department of the Administration of Economy, Finances and Accounting) – SPD (State Procurement Department). Starting with the second level a digital signature is required as means of confirmation. Moreover, from the second level and up (supervisor) it is possible to send a service note back to the initiator for corrective action. From the third level and up (prorector) the service note may be rejected. After the approval of prorector – EFD fill in the data in their table (financial provision code, expenses type code, classification of transactions of the general government sector, financial responsibility center). After approval of EFD – SPD fill in their fields in the service note (sole supplier, PROCUREMENT (BIDDING)) and make a decision on accepting or declining the service note. Also, starting with the second stage, employees can leave comments (if necessary). Attachments can be added into the service note on every stage of the process. After SPD has accepted the service note – initiator of the procurement can create a state procurement card. From now on initiator keeps working in the "State procurement card" section. Initiator must fill in the terms of reference for the procurement and send the state procurement card for approval at the LD (Logistic Department). After the card is sent for approval LD verifies the information provided by the initiator of the procurement and fills in the contract information. After that LD sends the procurement card for approval by the Administration of Economy and Finances, then by SPD, then by the LT (Legal Team). LT checks the contract and if there are any issues, the state procurement card is sent to the LD (from the LT), if there are no issues – to SPD (from LT). After that SPD either accepts the state procurement (or sends it for further development). Furthermore, files can be attached to the state procurement card using an "Attachment" button. Starting with the second stage comments can be added. After the procurement is accepted it's published. After that documents are printed. Algorithm is developed in accordance with existing law and regulations [3].

Currently the developed module is incorporated into the ACS "Pallada" and is being tested.

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VIGENERE ENCIPHERING METHOD

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The article describes the encryption by the Vigenere method, the history and application of the method, the formula of encryption and decryption, the relevance of the topic, as well as the conclusion on the article.

Keywords: Vigenere cipher, Encryption, decryption, cryptography.

ШИФРОВАНИЕ МЕТОДОМ ВИЖЕНЕРА

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Приведено описание шифрования методом Виженера, история и применение метода, формулы шифрования и дешифрования, актуальность темы, а также заключение по статье.

Ключевые слова: шифр Виженера, шифрование, дешифрование, криптография.

The problem of encryption and decryption of text messages is now particularly pressing. Today there are a huge number of encrypted documents, files and other information belonging to different countries of the world, different epochs and written for different reasons.

Without cryptography, privacy and integrity-related information security challenges are unthinkable today. If by 1990 Cryptography ensured the closure of state communication lines, nowadays the use of cryptographic methods became widespread thanks to the development of computer networks and electronic data interchange in various fields.

Encryption – is a way of concealing the original meaning of a message or other document, ensuring that its original content is distorted. Often, in more complex ciphers, a key to the cipher is required to decrypt an already encrypted message in addition to knowing the encryption rules. The key here refers to the specific secret state of the encryption and decryption algorithm parameters.

Humanity has been using encryption since the first classified information came into being that access should not be public.

Chiffre de Vigenere – is a method of polyalfavit encryption of letter text using a keyword. It is a simple form of multialfavit substitution.

The first accurate documented description of the multialfavit cipher was formulated by Leon Battista Alberti in 1467, and a metal cipher disk was used to switch between alphabets. The Alberti system switches alphabets after several encrypted words. Later, in 1518, Johann Trisemus in his work "Polygraphy" invented tabularecta, a central component of the Vigenere cipher. What is now

known under Vigenere's cipher was first described by Giovanni Batista Bellazo in his book Laci-fradel. Sig. Giovan Battista Bellaso. He used Trisemus's idea of tabularecta, but added a key to switch cipher alphabets through each letter.

The encryption rule, consists of a sequence of several Caesar ciphers with different shift values. An alphabet table called tabularecta or a Vigenere square (table) can be used for encryption. For the Latin alphabet, the Vigenere table is composed of rows of 26 characters, with each next row shifted by several positions. Thus, 26 different Caesar ciphers are obtained in the table. At different stages of encoding, the Vigenere cipher uses different alphabets from this table. Each encryption step uses different alphabets, selected depending on the keyword character.

Vigenere Table (tabularecta)

The person sending the message writes the keyword ("LEMON") cyclically until its length matches the length of the source text: LEMONLEMONLE

The first character of the source text A is encrypted by the sequence L, which is the first character of the key. The first character L of the encrypted text is at the intersection of row L and column A in the Vigenere table.

Similarly, a second key character is used for the second character of the original text; That is, the second character of the encrypted text X is obtained at the intersection of row E and column T. The rest of the original text is encrypted in a similar manner.

Source text: ATTACKATDAWN Ciphertext: LXFOPVEFRNHR/

Key: LEMONLEMONLE/

Decryption is performed as the following: by finding in the Vigenere table a string corresponding to the first character of the keyword; Find the first ciphertext character in this line. The column containing this character corresponds to the first character of the source text. The following ciphertext characters are decrypted in a similar manner. If the letters A–Z correspond to the numbers 0–25, the Vigenere encryption can be written as a formula:

$$C_i \equiv (P_i + K_i) \mod 26.$$

Formula for Vigenure Encryption

$$P_i \equiv (C_i - K_i + 26) \mod 26.$$

Formula for Vigenure decryption

The advent of the first electronic computers in the middle of the twentieth century dramatically changed the situation in the field of encryption (cryptography). With the penetration of computers into various spheres of life, a fundamentally new industry – the information industry – has emerged. The problem of ensuring necessary level of information security appeared very difficult, demanding for the decision not just implementation some set of scientific, scientific and technical

and organizational actions and application of specific means and methods, and creation of a complete system of organizational actions and application of specific means and methods on information security.

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AUTOMATION OF THE TEMPERATURE MEASURING AND FIXING PROCESS BASED ON THE NI CDAQ-9181 CONTROLLER AND THE NI USB-6008

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This article discusses the possibility of creating an automatic temperature measurement and fixation system based on the NI cDAQ-9181 controller and NI USB-6008. Such a system will allow real-time temperature measurements, as well as record the result for further processing.

Keywords: automation, temperature measuring, thermocouple.

АВТОМАТИЗАЦИЯ ПРОЦЕССА ИЗМЕРЕНИЯ И ФИКСАЦИИ ТЕМПЕРАТУРЫ НА ОСНОВЕ КОНТРОЛЛЕРА NI CDAQ 9181 И NI USB-6008

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Рассмотрена возможность создания автоматической системы измерения и фиксации температуры на основе контроллера NI cDAQ-9181 и NI USB-6008. Данная система позволит в реальном времени производить измерения температуры, а также фиксировать полученный результат для дальнейшей обработки.

Ключевые слова: автоматизация, измерение температуры, термопара.

One of the main trends in modern production is an automation. The concept of an automation implies a process in the development of production, in which part of the control and monitoring functions that were previously performed by humans transfers to industrial devices and automatic devices.

Due to the automation of various production processes, the speed of performing tasks may be significantly increased. In addition, automation makes it possible to exclude the human factor. The number of common errors is significantly reduced, which makes it possible to improve the quality of the process. Due to the development of new technologies, production automation contributes to the storage and processing of more data than with the manual method. This method of organization allows to perform several tasks in parallel without loss in quality and accuracy.

Now consider a temperature measuring device as an example of an automatic system. The main elements of the device are (see Figure 1):

1) wifi antenna (for model cDAQ-9191);
2) power connector;
3) 10/100 Mbps. network port with indicator;
4) reset button;

5) work/ power status indicator;

6) wi-fi signal strength indicator (for cDAQ-9191 model);

7) grounding connection; 8. slot for connecting external modules.

Let's study the device and the principle of its operation.

The cDAQ-9181 is a CompactDAQ Ethernet chassis designed for small, distributed sensor measurement systems [1]. The chassis controls the timing, synchronization, and data transfer between C Series I/O modules and an external host. You can use this chassis with a combination of C Series I/O modules to create a mix of analog I/O, digital I/O, and counter/timer measurements. The chassis also has four 32-bit general-purpose counters/timers. You can access these counters through an installed, hardware-timed digital C Series module for applications that involve quadrature encoders, PWM, event counting, pulse train generation, and period or frequency measurement.

Fig. 1. The main elements of the device

The cDAQ module interface manages data transfers between the STC3 and the C Series modules. The interface also handles autodetection, signal routing, and synchronization.

The National Instruments USB-6008/6009 devices provide eight single-ended analog input(AI) channels, two analog output (AO) channels, 12 DIO channels, and a 32-bit counter with a full-speed USB interface [2]. The USB-6008 provides basic functionality for applications such as simple data logging, portable measurements, and academic lab experiments. The device features a lightweight mechanical enclosure and is bus powered for easy portability. You can easily connect sensors and signals to the USB-6008 with screw-terminal connectivity. The included NI-DAQmx driver and configuration utility simplify configuration and measurements.

Taking Differential Measurements

For differential signals, connect the positive lead of the signal to the AI+ terminal, and the negative lead to the AI-terminal.

Fig. 2. Connecting a Differential Voltage Signal

The differential input mode can measure ±20 V signals in the ±20 V range. However, the maximum voltage on any one pin is ±10 V with respect to GND. For example, if AI 1 is +10 V and AI 5 is -10 V, then the measurement returned from the device is +20 V

Fig. 3. Example of a Differential 20 V Measurement

Connecting a signal greater than ±10 V on either pin results in a clipped output.

Fig. 4. Exceeding ±10 V on AI Returns Clipped Output

Fig. 5. Connecting a Referenced Single-Ended Voltage Signal

Taking Referenced Single-Ended Measurements. To connect referenced single-ended (RSE) voltage signals to the NI USB-6008/6009, connect the positive voltage signal to an AI terminal, and the ground signal to a GND terminal, as shown in the following Figure.

When no signals are connected to the analog input terminal, the internal resistor divider maycause the terminal to float to approximately 1.4 V when the analog input terminal isconfigured as RSE. This behavior is normal and does not affect the measurement when asignal is connected.

Analog Output

The NI USB-6008/6009 has two independent analog output channels that can generate outputsfrom 0 V to 5 V. All updates of analog output channels are software-timed. GND is theground-reference signal for the analog output channels.The following Figure shows the circuitry of one analog output channel on theNI USB-6008/6009.

The main block featured in the NI USB-6008/6009 analog output circuitry is the digital-to-analog converter (DAC), which converts digital codes to analog voltages. There is one DAC for each analog output line [2].

A thermocouple is a temperature-sensitive closed-circuit thermoelectric device that consists of two conductors made of dissimilar metals that are connected at both ends. An electric current is

created when the temperature at one end or junction differs from the temperature at the other end. This phenomenon is called the Seebeck effect, which is the basis for measuring temperature using thermocouples.

Fig. 6. Circuitry of One Analog Output Channel

One end of the thermocouple is called hot junction, and the other end is called cold. The hot junction measuring element is placed inside the primary transducer shell and is affected by process temperature. A cold junction or reference junction is a connection point outside the process where the temperature is known and where the voltage is measured, for example, in the transmitter, on the input board of the control system or in the signal conditioning device.

In accordance with the Seebeck effect, the voltage measured on a cold junction is proportional to the temperature difference between the hot and cold junctions. This voltage can be called Seebeck voltage, thermoelectric voltage or thermoelectric EMF. As the temperature of the hot junction increases, the voltage observed on the cold junction also increases nonlinearly depending on the temperature increase. The linearity of the temperature-voltage curve depends on the combination of metals forming the thermocouple.

Fig. 7. Cold Junction Compensation

The voltage measured on a cold junction depends on the temperature difference between the hot and cold junctions; therefore, it is necessary to know the temperature of the cold junction in order to calculate the temperature of the hot junction. This process is called Cold Junction Compensation (CJC). The CJC is controlled by an emergency shutdown device or other signal conditioning device. Ideally, the CJC measurement is performed as close as possible to the measurement point, because the long wires of the thermocouple are very sensitive to electrical noise, and the signal in them is degraded.

Accurate CJC is critical to the accuracy of temperature measurements. The accuracy of the CJC depends on two factors: the accuracy of the measurement of the reference temperature and the proximity of the point of the reference measurement to the cold junction. Many transmitters use an isothermal terminal block (often made of copper) with a built-in precision thermistor or transistor to measure the temperature of the block.

Fig. 8. Wiring diagram of automatic temperature measuring system

In this way was developed an automatic system for measuring temperature in real time based on the NI cDAQ 9181 controller and NI USB-6008, which also allows to record the result for further processing.

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Bachelors and Specialists' Research (Economists & Humanitarian students)

THE ESSENCE AND DYNAMICS OF GLOBAL ECONOMIC PROBLEMS OF OUR TIME

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The article is devoted to the determining the essence of global economic problems in dynamics, as well as analyzing forecasts for their solution. The article provides information about the trends of modern problems from an economic point of view.

Keywords: economy, global problems.

СУЩНОСТЬ И ДИНАМИКА ГЛОБАЛЬНЫХ ЭКОНОМИЧЕСКИХ ПРОБЛЕМ СОВРЕМЕННОСТИ

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Статья посвящена определению сущности глобальных экономических проблем в динамике, а также анализу прогнозов их решения. Статья даёт информацию о тенденциях современных проблем с экономической точки зрения.

Ключевые слова: экономика, глобальные проблемы.

With the development of the economy, there are more and more global economic problems. Thus, global economic problems are already at the forefront of research and require the attention of world communities to implement their solutions.

Despite the fact that this problem has frequent research, it still remains relevant in the modern world. Over the past century the world and the civilizations in particular have made great progress in the development of various spheres of social life and especially in economic activities, and thus

they faced with many almost insoluble global problems that require the greatest assistance and cooperation of all the mankind. These are, for example, resource-economic and world-economic problems, which are manifested, in particular, through crises. Global problems significantly affect the pace and the level of economic development, the scale and the structure of the world economy.

Global problems are a set of vital problems that affect all humanity and are insoluble within individual regions or even countries; the reasons for their occurrence, such as increasing and concentrating production capacities, active production implementations, the impact of scientific and technological progress [1] and over-accumulation of funds (capital) [2] are identified. The classification of these global economic issues which includes problems of the "society-nature" system and intra-social (social) global problems is highlighted.

In turn, the second group of issues is considered from various aspects, such as: the problem of overcoming poverty, the food problem, the problem of nuclear war, the demographic problem, the problem of human development.

Global economic problems of our time in dynamics are divided into three groups:

1. International ones com ibinessues related to security on Earth.

2. Environmental ones include risks arising from the interaction of "Society and nature".

3. Social ones include complex social problems that exist in the "Person and society" system.

The analysis of problems highlights the main reasons that pose a threat to human development:

– Uneven population growth in different countries of the world;
– Careless attitude to nature;
– Excessive use of natural resources;
– The creation of weapons of mass destruction;
– International terrorism;
– The spread of diseases.

According to assessments of global environmental issues, one of the most important problems is the pollution and depletion of water resources. Thus, examining the statistics for 2018, we can conclude that the water reserves are more concentrated in Iceland; it is 47 % of the total water reserve. Other countries are clearly experiencing some shortage of water resources, because the share for each of the subjects does not exceed even 10 % [3]. This suggests that the global environmental problem of water scarcity in the world is very important at this point in time, as it has an adverse impact on the majority of the world's states [4].

Comparing the problems related to the security of the individual and the world as a whole, terrorism is the most acute at this time. For example, for the past 5 years, Iraq, Afghanistan, Nigeria, Syria, Pakistan and Yemen have remained the most vulnerable to terrorist attacks.

According to the Global Terrorism Index for 2017, the Russian Federation improved its performance in the overall ranking and ranked 33rd place, so it was among the countries with an average level of terrorist threat.

And, finally, a study of socio-economic problems from the side of issues related to poverty alleviation [5] shows that poverty is prevalent in developing countries, where approximately 2/3 of the population live [6]. So, analysing the statistics for the Russian Federation, it can be noted that in 2015 the poverty level in Russia increased from 11.2 % to 13.3 % while the number of poor people increased by 3.1 million people, reaching a total of 19.2 million people. High inflation also reduced real wages by 9.5 % in 2015. In 2017, in Russia, according to the Federal State Statistics Service, the poverty level was 13.2 % of the total population. These parameters are comparable and similar to the poverty level since 2015 [7].

In conclusion, we note that today's forecasts of the development of economic problems are already presented. Specialists note that by 2050 half of the world's population will not have access to supplies of sanitation-safe water [8].

Another acute global socio-economic problem, which is currently in the top ratings of the solution, is the problem of increasing poverty in all countries.

In 17 years, according to the promise of the head of the World Bank, the number of people living below the poverty line will be reduced to 3 percent of the total population of the planet [9].

In addition to all the above forecasts, the issue of ensuring public safety is another not the last problem of importance at the moment. Experts say in future armed conflicts the most numerous new forms of warfare will appear. In the upcoming wars in Asia, for example, Russia with China or India with Pakistan, it is quite possible to use a nuclear arsenal in addition to traditional military means. Potential conflicts in the Middle East may also include nuclear aspects if the proliferation of nuclear weapons continues [10].

Summing up my reasoning, I would like to say that global problems are closely related to phenomena and processes. To solve them, new approaches and practical measures coming from a holistic world, the need for cooperation on a planetary scale are needed.

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INVESTMENT AS A FACTOR OF ECONOMIC GROWTH

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The article raises the problem of sustainable economic growth. It shows that investment plays a main role in providing sustainable economic growth. Also considers ways to improve the investment policy of the Russian state in order to promote economic growth.

Keywords: of economic growth, investment, investment policy, investment process, socio-economic development.

ИНВЕСТИЦИИ КАК ФАКТОР ЭКОНОМИЧЕСКОГО РОСТА

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Поднимается проблема устойчивого роста экономики. Показано, что в обеспечении устойчивого экономического роста главную роль играют инвестиции. Рассмотрены направления совершенствования инвестиционной политики российского государства в целях содействия экономическому росту.

Ключевые слова: экономический рост, инвестиции, инвестиционная политика, инвестиционный процесс, социально-экономическое развитие.

Investment affects the deepest foundations of economic activity, determining the process of economic growth as a whole [1]. In modern conditions, they are the most important means of ensuring conditions for overcoming the current economic crisis, structural changes in the national economy, ensuring technical progress, and improving the quality of economic performance at the micro and macro levels. Activation of the investment process is one of the most effective mechanisms for socio-economic transformation.

Without investment, it is impossible to create modern capital and ensure the competitiveness of producers in foreign and domestic markets. The processes of structural and qualitative renewal of world commodity production and market infrastructure are carried out exclusively through investment. The more intensive it is, the faster the reproduction process takes place, and the more active the effective market transformations take place.

The current state of our country, which is in the midst of an ongoing crisis, makes us think about the need to change the structural policy of the state, as one of the conditions for Russia's exit from the crisis.

It is not possible to implement such large-scale changes without significant investment, both from the state and from the private sector [2].

In times of crisis, for Russia, investment is the most important means of structural transformation of social and productive potential. To attract investment, it is necessary to create a favourable investment climate in the country. The state should play a primary role in this process.

To accelerate economic growth, it is necessary to achieve [3]:

1. Increase of economic activity of the population and increase of the labour force.

2. Improving the quality of fixed capital investment and increasing its volume to 25 % of GDP.

To increase economic growth also necessary [3]:

1) improvement of the investment climate (removal of normative restrictions when conducting business, reform of control and Supervisory activities, promotion of competition, improvement of corporate legislation, improving the efficiency of the public sector);

2) development of infrastructure (transport and energy);

3) formation of a trust environment and development of competition in the financial market,

4) maintaining financial stability, etc.;

5) increasing labour productivity and efficiency of the labour market;

6) creating conditions for the development of small and medium- sized businesses;

7) improving the competitiveness of domestic products on world markets, actively developing the export of services.

To achieve an economic breakthrough: growth in fixed capital investment: gradually, starting in 2020, when investment growth should be 7.6 %, and then at least 6 % annually. Economic growth should contribute to the growth of wages, which will solve the problem of poverty of the population. The government intends to increase the share of fixed capital investment in GDP to 25 % by introducing [5]:

1) stable tax conditions;

2) predictable tariff regulation;

3) reduction of conditional procedural risks of business activity;

4) completion of control and supervision reform;

5) competition development;

6) reduction of the state's share in the economy.

Priority investment areas include firstly the development of transport and energy infrastructure, the introduction of critical technologies, as well as technologies in the field of artificial intelligence and blockchain, the digitalization of the economy, and the promotion of import substitution. According to the draft Federal law "on protection and promotion of investments", investors who will make large investments will be able to be protected from changes in taxes, tariffs, payments and fees for a certain period (6 or 12 years , depending on the amount of investment and reinvestment of profits), if they worsen the investment climate [3].

At the end of September 2018, lists of socially significant projects were compiled, which businesses will be offered to invest in on favourable terms. The list includes 394 projects with a total cost of 11.5 trillion roubles-from forestry to nuclear medicine; most of the investments are expected to be from private enterprises.

The largest part of investments is provided for infrastructure – more than 10 trillion roubles, in metallurgy and coal industry (mainly in the aluminium industry) – 467.4 billion roubles, for the fuel and energy sector -60 billion roubles [4].

The benefits include: subsidizing the interest rate on loans, subsidies, reduction of customs payments, land and property tax benefits, preferential financing under government programs, and others.

At the end of September 2018, the Government approved a Comprehensive plan for the development of the main infrastructure for the next 6 years. It includes about 200 projects for the construction of high- speed main roads, airports, roads and Railways worth more than 6 trillion roubles, of which about 2.3 trillion will be contributed from the Federal budget, and about 3 trillion – private investment [4].

An important role in the Russian economy can be played by foreign investment, which brings with it modern technologies (which means increasing labour productivity, creating new socially

attractive jobs with a high level of pay, management experience, etc.). Therefore, the state's efforts should also be directed at attracting foreign investment.

Thus, investment policy is one of the most important tools used by the state to establish sustainable economic growth and, consequently, the country's recovery from the crisis. Therefore, it is necessary to apply the above-mentioned directions for improving the investment policy of the Russian state in order to promote economic growth.

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RESPOND OF SOCIAL MEDIA PLATFORMS TO "INFODEMIC"

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The authors view the coronavirus epidemic not only as an infectious epidemic, but also as an informational one. The virus has gained wide publicity not only in the traditional media, but also on many Internet resources. Special attention is paid to the specifics of coverage of the epidemic in social networks. The article also reviews the problems of new media and ways to deal with fake-news.

Keywords: coronavirusasan information occasion, infodemic, fake news, social networks, media.

РЕАКЦИЯ СОЦИАЛЬНЫХ СЕТЕЙ НА «ИНФОДЕМИЮ»

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Авторы рассматривают эпидемию коронавируса не только как инфекционную эпидемию, но и как комплексный повод для интенсивной информационной деятельности. Заболевание получило широкую информационную огласку не только в традиционных СМИ, но и на Интернет-ресурсах. Весьма интересна специфика освещения эпидемии в социальных сетях. Также рассматриваются проблематика новых медиа и способы борьбы с fakenews.

Ключевые слова: коронавирус как информационный повод, инфодемия, fakenews, социальные сети, СМИ.

The coronavirus, its spread and lethal consequences became the main informational reason for the end of winter and beginning of spring 2020. Outbreak of infection CoVID 19, mutations of the coronavirus family, mainly affecting animals, and in some cases, which could infect humans, caused panic in the world. As part of the fight against the spread of the disease are carried over mass events, two days earlier ends the Venetian Carnival, Fashion Week in Milan is held in a closed show, and models of the French brand Marine Serre walked on the podium wearing protective masks-respirators. Today it is almost impossible to buy medical masks in Russian cities in pharmacies. March 11, 2020 WHO officially declared coronavirus a pandemic.

The coronavirus epidemic as a whole has reached an entirely new level of information coverage. For example, the swine influenza pandemic in 2009–2010 received significantly less media coverage, although the infection itself posed a much greater threat. At the same time, COVID-19 surpassed all the epidemics of the 21st century in terms of its impact on the global economy [1]; however, this is due not to the danger of the virus itself, but rather to the source of the disease spread – China – and the methods of combating the disease spread.

In his YouTube show "Redakciya" in "Coronavirus: How to protect against it and not to panic". Alexey Pivovarov called the Coronavirus epidemic the first virus in human history that can be monitored online – as a currency rate [2]. Indeed, the spread of infection around the globe can be watched on maps.arcgis.com, which provides a statistical summary of the infected, dead and recovered, displays all the data on a map of the world.

In the same issue of the show, Victor Maleyev, an expert, microbiologist from the Central Research Institute of Epidemiology, Doctor of Medical Sciences, called the coronavirus epidemic infodemy (infection-information epidemic). He associates panic with fear of unknown new infection. Thus, in the case of swine flu pandemic, the infection itself was originally familiar to scientists, and the population was at least familiar with the word "influenza".

The widespread use of social media, an alternative to the official media, played a significant role in this information epidemic. Social media became a completely different platform for covering the problem. Thanks to their accessibility and openness, they have repeatedly become sources of information leaks. One of the precedents was the publication of a video shot in an infectious disease hospital in Moscow by patients diagnosed with coronavirus. The case was widely publicized thanks to the Baza project. Textual publications of people under quarantine after foreign trips are also not taken into account.

Instagram is one of the leading social networks for information dissemination. This happens not only because of the wide audience, but also because of the simplicity and already formed habit of users to share publications in their stories.

Messengers (mainly WhatsApp and Viber) become a source of fake news distribution, a source of panic. Fake news is being spread by injecting it into group chats. Throws are designed for the most receptive audience – parent groups and forums. The common fake news is the "news" that more than 20 thousand people are infected in Moscow, and the authorities are hiding the data in order not to disrupt the vote on amendments to the Constitution [3]. The "news" that the Pope had been infected was also spread. People can believe in this fake not only because of its thoughtfulness, but also because of the already formed information field – Iranian Deputy Minister of Health IrajKharirchi got coronavirus infection.

VKontakte's social network stands out from the rest due to its use of humor – memes and obvious skepticism about news and official statistics. Thus, for example, one of the most popular news publications "Lentach" every day publishes statistics on the infected, accompanying the posts with humorous headlines – "Dense nihao to all coronavirus", "Last time I ask, where is the diademavirus?", "Imagine that you are attacked by a gang of Wuhan, and one of them shouts: "对他打喷嚏," "sneeze on it".

It is noteworthy that a selection of memes about the coronavirus is made by the media itself (Meduza, KP.RU). Separately, one of the vectors of meme development – the game Plague Inc, a simulator of the virus, whose main task is to destroy the world. Since the beginning of the spread of the epidemic, the Internet community is drawing a parallel with this game.

The Plague Inc logo even became the logo of the most popular TV channel and installation account dedicated to coronavirus.

Humor about the infection appears even on federal channels – on Channel One in the show "VecherniyUrgant" the host, together with Elena Malysheva, performed a "memory song to prevent coronavirus" – a parody of W. Leontief's song "Dear Friend". In the parody version the text sounded like "...Dear Friend, do not sneeze, take vitamins; let the coronavirus know that we do not have China here..." The video was complemented by the dance of the show's co-host, Dmitry Khrustalev, wearing a virus hat.

YouTube became a social network – explainer. To date, there are a number of video-explainers on the site. The demand for such content is also due to the Internet users' distrust of traditional mass media (according to a survey by the IOM, only 28 % of Russian young people trust the media [4]). Alexei Pivovarov (Redakciya), Russia Today, Yan Lapotkov (Topless channel), Anton Lyadov (The People channel) and others have released their videos. By their message, the

clips are aimed at reducing panic and calming the population. The authors of the video invite experts who communicate all the necessary information in accessible language and in an informal setting (which affects the receptivity of the audience). The above-mentioned issue of the show "Redakciya" not only tells about the nature of coronavirus, but also debunks myths about the effectiveness of masks, the appropriateness of taking antiviral drugs and other things.

Messenger Telegram, unlike its competitors, has become a kind of analytical platform. This is partly due to the specifics of the messenger users – there is practically no "parent" audience. Telegram is mostly used by "advanced" users, the male audience dominates, while it is less suggestible and less subject to panic [5]. Telegram as a whole has a high level of criticality and interaction of channel authors among themselves. Publication of unconfirmed information is fraught with condemnation of colleagues, fake authors are strongly criticized. As a result, the messenger has become a source of quality and relevant information.

Thus, the "profile" popular PR channel "Besposhadniy PR" was one of the first to publish the text in the format of an interview with A. Vasilkov, candidate of medical sciences, explaining the coronavirus phenomenon. Later, the interview was published in the modified form on the Internet portal The Bell, for which it was criticized by the authors of the telegram channel. The channel was also criticized by the untimely actions of the Ministry of Health and WHO and official media (e. g., Kommersant) for publishing materials by order of the Moscow City Hall.

Social networks also counteracted info-demia. For example, Facebook and VKontakte news feeds contain articles on the infection epidemic. In Instagram and TikTok, when trying to move to a publication with a hashtag "coronavirus" social networks offer to familiarize themselves with the official account of the WHO, encourage the creation of content on the subject of the epidemic to carefully check the information.

The diversity of social media corresponds to the diversity of audiences represented on them. Social networks are beginning to have a tangible impact in shaping the information field for users, and for young people they are even becoming the main source of media consumption. In the conditions of panic in the society, social networks allow 'defusing' the situation with higher efficiency than traditional media.

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VERTICAL VIDEOS. HOW TABOO BECOMES A TREND

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The author examines the trend of creating vertical videos on the Internet. Earlier shooting in this format was perceived negatively. The article considers the main stages of format development on the Russian market, examples of successful cases of Russian video production. Attention is paid to the emergence of vertical video offline. The author analyses the problems and gives the forecasts of video production development.

Keywords: vertical video, YouTube, video production, digital technologies.

ВЕРТИКАЛЬНЫЕ ВИДЕО. КАК ТАБУ СТАЛО ТРЕНДОМ

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Автор рассматривает тенденцию создания вертикальных видео в Интернете. Ранее съемка в таком формате воспринималась негативно. Рассматриваются основные этапы развития формата на российском рынке, примеры удачных кейсов российского видеопроизводства. Уделяется внимание появлению вертикальных видео в оффлайне. Автор анализирует проблематику и дает прогнозы развития видеопроизводства.

Ключевые слова: вертикальные видео, YouTube, производство видео, диджитал технологии.

In 2019 the average person spent 84 minutes daily watching online video, and this figure is growing rapidly around the world. Back in 2017, daily viewing time was 29 minutes on average[1], and Zenith Media predicts that in 2021 the average viewing time will be up to 100 minutes per day [2]. The increasing ofvideo viewing time is facilitated by the improvement of mobile devices, increased display sizes and mobile data connection speed. At the same time, according to a study by Mediascope, 29 % of Russian Internet users watch video exclusively from mobile devices, while the desktop chooseonly 27 %. The rest use several devices to watch online video. In combination with the predominant interaction with smartphones in vertical (portrait) mode (98 % of the time, according to a study by Mobile Marketer), a global trend to create vertical videos is forming.

This format began to quickly gain popularity after the launch and distribution of Instagram stories. Stories initially represent vertical video clips and the functionality allows them to be formatted without any third-party software inside the application itself [3]. The development of vertical videos was also supported by the success of the social network TikTok. Even YouTube eventually made concessions and in 2018 adapted its application for viewing videos with different

proportions, including 9:16, and later offered advertisers to launch vertical advertising. Even TV producers recognized the vertical format – at the end of April 2019 Samsung announced The Sero, a TV set where the image can take a vertical position. If previously vertical videos were a bad tone, now it is one of the leading trends in content-making.

Today, the content market is represented by a large number of examples of successful use of vertical shooting format. One of the popular types is music videos. A pioneer in 2015 was Harrison, who shot a vertical clip for the song "How Can It Be?" and now one of the most popular works is a clip of Camila Cabello and Young Tag on the track Havana. In Russian YouTube segment Elena Temnikova, Basta, OQJAV clips were released in this format. Apple, Sberbank, Audi, Jeep, Mercedes Benz, Adidas, Samsung and many others launched their "vertical" advertising campaigns.

The 1968.Digital project of Mikhail Zygar, the first Russian series for mobile phones, should be highlighted separately. The series consists of 40 episodes, each of which tells the real story of the hero from 1968. The story is told through a smartphone screen, which could have this hero. So, Beatles has a chat at WhatsApp, Andy Warhol exhibits his works at Instagram and Gabriel Garcia Marquez writes his novel in notes on his phone. The project was launched in April 2018 in three languages at once, six series of the series were purchased by Apple News. 1968.Digital was the first ever content that Apple News paid for. A total of 35 million users watched the series, and in 2018 the project became the most popular Russian-made series on Amediateka, and after the English version was released, the British broadcaster Viasat ordered a series about World War II from the Russian studio [4].

Vertical video clips show high performance compared to horizontal ones. Video platform Wibbitz notes that they bring 130 % more views and 4 times more interaction with the video on Facebook. And according to MediaBrix, vertical videos have up to 90 % "viewability" when the horizontal ones have only 14 %. This figure is primarily due to the fact that the horizontal video on the screen of a mobile phone, which is in the vertical position in the hands of the user, seems small, the details of the video sequences and text are poorly visible, which causes irritation to the viewer.

The author of the work, as a person working in the video production environment, would like to note that most often the user is "hooked" to the very concept of vertical video, especially when it is presented not in Instagram stories, but on more traditional video hostings – YouTube, Vimeo, etc. Such videos are still not usual, and therefore stand out among other content and are of interest. Today, in an effort to follow the trends, some companies adjust their originally horizontal content to the placement sites, making it vertical. As a result of this adaptation, the quality of work decreases, and the level of interest and involvement of the user still remains lower compared to video, which was purposefully created vertical.

It should be noted that vertical videos also take place offline – in a venue not yet quite standard for such content. For example, the Reshetnev Siberian State Universityin Krasnoyarsk has vertical screens everywhere, where dynamic posters and adapted commercials are played.

As for the reverse side of the video production the situation is ambiguous. On the one hand, shooting vertical video is available and understandable to everyone, because most often the video on your smartphone is shot vertically. On the other hand, it is difficult to fit a lot of information into vertical video. Even though the content with a vertical aspect ratio of 9:16 takes the same place on the screen as the standard 16:9, the number of objects that can be placed in the frame, still significantly reduced.

According to the survey conducted by the author, only 18.9 % of respondents are ready to watch vertical videos on a regular basis on video hostings, all others prefer a horizontal location. This is explained by the fact that the ratio of sides 9:16 does not allow you to cover enough space in the video and the viewer becomes crowded, want to "expand" the video to the usual resolution. Traditionally, since the advent of cinematography, all video footage was broadcast in a horizontal format, the most popular and still familiar is the 16:9 aspect ratio. Thus, we can conclude that vertical videos are relevant and in demand as a unit of content (a commercial, clip, etc.), but not as regular content.

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УДК 811

THE PROBLEMS OF SPECIAL SCIENTIFIC TEXTS TRANSLATION AND EDITING IN IT FIELD

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More and more technical literature is being published in the world. Mostly it is published in English. This article discusses the problems encountered when publishing books translated from English into Russian.

Keywords: translation problems, foreign languages, technical literature.

ПРОБЛЕМЫ ПЕРЕВОДА И РЕДАКТИРОВАНИЯ СПЕЦИАЛИЗИРОВАННЫХ НАУЧНЫХ ТЕКСТОВ В ОБЛАСТИ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ

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В мире выпускается все больше технической литературы, при этом большая ее часть издается на английском языке. Рассмотрены проблемы, возникающие при издательстве и переводе специализированных книг в области IT с английского языка на русский.

Ключевые слова: проблемы перевода, иностранные языки, техническая литература.

In the process of learning specialized literature in the field of IT many experts are faced with the problem of inadequate translation from English into Russian. The purpose of the article is to study the experience of translating specialized literature in the field of IT analyze typical errors and identify ways of preventing them. We have studied translation errors, analyzed consequences, and defined how to prevent them.

Many experts addressed the problem of inadequate translation of specialized literature. Here are some of them: Kherina A. A. [1] Klyushina A. M., Zdor A. I. [2].

The relevance of the problem under consideration is confirmed by our survey among programmers. It turned out that one in four prefers to read specialized literature in the original. More than a half often faces poor translations. And only one in nine has never met a poorly translated literature in the field of IT. You can find more detailed results of the survey in Figure.

In the process of teaching programming, it becomes necessary to independently study a large number of specialized sources of information. Becoming more competent, future specialists begin to work with the translated specialized literature and notice a large number of errors in the translation.

Being engaged in such disciplines as: programming, programming technologies, object-oriented programming, Internet technologies, computer science, introduction to a specialty,

electrical engineering and independently studying specialized literature in the field of IT, we came to the conclusion that all translation errors can be divided into three groups: marketing , translation, technical ones.

Result of survey 1

The first group of errors are marketing ones. Programming is a very specialized field, and there are not many potential buyers for books. To increase sales translators sometimes intentionally distort the name of the book and its content in order to expand the target audience and increase sales revenue.

For example, in the book Refactoring to Patterns [3], authored by Joshua Kerievsky. The title was translated as "Рефакторинг с использованием шаблонов", while an adequate translation of the book's title is "От рефакторинга к шаблонам". The name used by the translator implies refactoring using templates. This translation option informs the buyer about new opportunities in the processing of the code. However, in the book, the author teaches how to stop doing independent refactoring and switch to using design patterns when writing programs.

A second example of a marketing error is the "Легкий способ выучить Python", authored by Шоу Зед. In the Russian version, the 3rd edition is indicated on the book, while the content is a translation of the 2nd edition with a change in date. The difference between these publications is large. They talk about different versions of the programming language. The information on the cover does not match the content. It becomes clear immediately, but only after reading the first two chapters.

The second group of is the errors: lack of professional knowledge of the translator or refusal to consult with a professional in the translated field. Inadequate translation leads to distortion of information. A danger is the translation of terminology. Examples of such errors can be found in Learning Java [4], authored by P. Niemeyer and D. Leuck. The phrase "*Their storage requirements (or lack thereof)*" has been translated as "*Требования к их хранению (или нехватка thereof)*". Thereof is not a keyword of the Java programming language, because of this the phrase has no meaning in the Russian translation. In the same book, the phrase "With the introduction of variable-length arguments lists" was translated as "*С введением списка аргументов длины переменной*". In the Java programming language, variable lengths are missing; variable lists are missing. The authors of the book meant a variable length for a list of arguments.

Third group of errors is technical ones. These errors occur when the publisher edits the text. Technical errors are especially dangerous for beginner programmers. Because of them, examples

of program code do not work, the logic of complex calculations is lost. Typical examples of technical errors are books on the Python programming language. In this programming language, tabs are part of the language syntax. Publishers, having no idea about this feature, align the text of the programs to the left. In this regard, such examples do not pass the compiler check. If in simple programs the reader himself can guess how to put tabs, then in complex programs, this may not be obvious. Examples of technical errors are presented in the book "Python Programming for Beginners" [5], authored by McGrath Mike. In the book, all scripts were left aligned. Because of this, none of the examples presented in the book work.

As a result of the study, we can offer the following ways to avoid mistakes when translating specialized literature in the field of IT:

– during the translation process, you need to consult with people who are IT specialists;

– at the end of your work, you must give the final translation to a professional for verification;

– before you start translating a book, you need to study the basic rules adopted in the translated field;

You do not need to deceive a customer to increase your sales. Most people who want to buy a book watch reviews before buying a book.

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УДК 338.2

RISK REDUCTION METHODS IN INNOVATIVE ACTIVITY

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This article is devoted to the problem of risks in innovation. The types of risks typical for innovative projects as well as methods of their reduction are presented.

Keywords: innovation, risks, diversification, insurance.

МЕТОДЫ СНИЖЕНИЯ РИСКОВ ИННОВАЦИОННОЙ ДЕЯТЕЛЬНОСТИ

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Данная статья посвящена проблеме рисков в инновационной деятельности. Представлены виды рисков, характерные для инновационных проектов, а также методы их снижения.

Ключевые слова: инновации, риски, диверсификация, страхование.

In the conditions of a competitive market, innovation is one of the most effective ways for companies to fight for consumers. It is known that innovative activity is characterized by high risk, and the results of an innovative activity depend on the accuracy of the risk assessment and the methods used to manage it.

Risk is the probability of loss of invested funds that may not bring a positive result in the manufacturing and sale of new goods and services. In investing a significant amount of money in innovation, risk in unstable economic conditions is becoming more prevalent. More than half of venture capital firms incur significant losses, without achieving success. That is why good risk management determines the ability of innovative companies to withstand adverse situations.

There are several types of risks:

1. A mistake in assessing the potential of innovation. Often, the head of an innovation project overestimates the importance of a product or service to a consumer, resulting in significant losses.

2. Risks may arise in connection with insufficient levels of financing, which may lead to the decrease in the effectiveness of a project, and, possibly, to its premature closure.

3. There are risks of unreliability of partners, which consist in non-compliance with the terms of the contract. These types of risk include: partner's refusal to conclude an agreement after negotiations; contracts with insolvent partners; contracts on conditions unfavorable to the manager.

4. The next type of risk is associated with a low level of professionalism in marketing services.

The risks of securing ownership of the results of intellectual activity are of great importance. The basis of their occurrence is the imperfection of the existing legislation in the field of patent law, namely the acquisition of a patent or license with delay, as well as the short term of a patent [1].

In order to achieve efficiency in innovation, it is imperative to use various methods to reduce risks.

One of the ways is the diversification of innovation, which consists in expanding the range of goods and searching for new technologies. This will allow an innovative company to enter new markets [2].

Another option to reduce the risk of innovation is to transfer it to another person. This method consists in transferring risk from one party to another. The transfer is beneficial to both parties in the transaction. If a company transfers risks that are considered significant, then the party accepting these risks can assess them as insignificant, as it has better opportunities to reduce losses.

One of the most important methods of risk reduction is insurance. It protects the interests of individuals and legal entities in the case of certain insured events at the expense of cash funds formed by insurers from paid insurance premiums, as well as at the expense of other funds of insurers [3]. Insurance is the safest and fastest way to get reimbursement, because the resources for covering the losses of an innovative company from insurance institutions come faster than from any other source.

To avoid the risks associated with the choice of partners, a thorough study and analysis of information about potential partners is necessary. An integral element of risk aversion is planning and forecasting innovative activities of the company. This will allow you to adapt to economic instability and reduce risks.

Another way to counter external negative influences and, thus, reduce risk, is the use of innovative methods of personnel management and carefully selecting employees who are competent in their fields.

The protection of trade secrets in the enterprise plays a significant role in risk reduction as well. In some cases, the leakage of commercial and technical information on innovative developments can lead to the following: rival companies start developing the same products as you. In order to eliminate this problem, when concluding a contract between the employee and the head of an enterprise, it is necessary to make obligations for non-disclosure of trade secrets. The presence of these obligations in the contract will allow the manager to apply various sanctions to employees liable of leaking of confidential information. Another effective direction of protecting the company's trade secrets is the stability of the staff of innovative projects.

Thus, in order to achieve high results and maximize profits, an innovative company needs to apply a whole range of methods to reduce the risks of innovation.

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УДК 659.4

MODERN TOOLS TO PROMOTE THE BRAND
OF KRASNOYARSK WINTER UNIVERSIADE – 2019

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The author considers modern tools and methods of promotion, corporate identity and brand building of the XXIX World Winter Universiade 2019 in Krasnoyarsk. Several stages of the communication campaign which resulted in the improvement of the image are highlighted. The corporate style, concept and brand positioning have been developed to build the image of the Universiade. Modern technologies of PR-communication were used: videoconferences, work with influencers, presentation of the Universiade using modern augmented reality technologies. Volunteer uniforms as 'live' advertising media are widely used.

Keywords: promotion tools, corporate identity, brand of the Universiade-2019 in Krasnoyarsk, advertising medium.

СОВРЕМЕННЫЕ ИНСТРУМЕНТЫ ПРОДВИЖЕНИЯ БРЕНДА
КРАСНОЯРСКОЙ ЗИМНЕЙ УНИВЕРСИАДЫ – 2019

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Автор рассматривает современные инструменты и методы продвижения, фирменный стиль и построение идентичности бренда XXIX Всемирной Зимней Универсиады – 2019 года в г. Красноярске. Выделяется несколько этапов реализации коммуникационной кампании, которая привела к улучшению имиджа. Для формирования имиджа Универсиады разработаны фирменный стиль, концепция и позиционирование бренда. Использованы современные технологии PR-коммуникации: видеоконференции, работа с инфлюенсерами, представление Универсиады при помощи современных технологий дополненной реальности. Широко используется униформа волонтеров как «живой» рекламный носитель.

Ключевые слова: инструменты продвижения, фирменный стиль, бренд Универсиады-2019 в Красноярске, рекламные носители

The organization of international sporting events is one of the effective ways to promote territories. Holding of Olympiads, Universiades and championships gives an opportunity to show widely the individuality and progressiveness of the region and the country, contributes to the improvement of economic and infrastructure component of the territory. For information and communication support of such events, a variety of promotion tools are used, which work to improve the reputation of the host territory. The venue falls not only into the international

information field, but also into the local one at the stage of event preparation, that is why the communication strategy is important, which shows a clear system of brand interaction with the public. Such a system should provide basic meanings, advertising strategies and constant interaction with the target audience.

The XXIX World Winter Universiade 2019 is a world university sports competitions held from March 2 to 12, 2019 in Krasnoyarsk under the auspices of the International University Sports Federation (FISU).

In the first stage of the communication campaign the corporate identity and brand positioning have been developed [1]. The logo of the Winter Universiade 2019 is based on the Latin letter "U" – the capital letter of the word "Universiade". It includes an indication of the city and year of the Games in English – Krasnoyarsk 2019, the serial number and name of the event in English – 29th Winter Universiade, as well as 5 stars of blue, yellow, black, green and red – elements of the FISU logo. The image of the letter "U" in the logo of the Universiade in Krasnoyarsk symbolises an ice block whose edges show the severity of Siberian nature, rock tops and snow-covered slopes. The colours of the image of the Winter Universiade-2019 are based on the combination of strict, "cold" shades of blue and bright, "hot" purple colour. It symbolizes the union of the two beginnings – the harsh Siberian nature and the warmth of human hearts.

The mascot of the competition was U-Laika – a Siberian dog of the likeness breed, a symbol of loyalty, friendliness, joy and indomitable energy. As slogans are approved: "Real Winter", "Welcome to Winter", "100 % Winter", "Krasnoyarsk the soul and energy of Siberia", as well as the name "World Winter Universiade 2019 in Krasnoyarsk".

The key messages of the event have been developed: sport as a world uniting guests and participants of the Universiade; sport as a world demonstrating openness and friendliness of Russia; sport as a world uniting different cultures and values; sport as a world standing over time; sport as a world opening infinite possibilities for a person [2].

The second stage was to establish and build a promotion strategy. Such methods were used as videoconferences between Krasnoyarsk higher education institutions and major universities of foreign countries where the issues of university sports and volunteerism development were discussed [3]; participation in special exhibitions and forums where the Executive Directorate presented the Universiade Village and the Universiade Park using VR-technologies; working with influencers (Universiade ambassadors), including winners and medalists of international sporting events, famous actors and bloggers, which allows to influence certain segments of the target audience; through the creation of the Universiade Village and Park. The Universiade headquarters in Krasnoyarsk attract the student community, which is the target audience of the event; volunteer recruitment programs have been developed.

The third stage of the communication campaign was held directly during the Universiade. Volunteers of the Krasnoyarsk Winter Universiade-2019 played a big role in promoting the brand. The Krasnoyarsk 2019 volunteers are strictly selected participants of the volunteer programme who live in the Krasnoyarsk region, as well as in other regions of the country and worldwide. They are ready to spend their energy, time and skills on a pro bono basis. There are many areas of volunteer work. Four categories of volunteers are involved in major sports competitions:

– volunteers who do not require any special training, for them a small briefing is enough, for example, such volunteers send streams of people, meet delegations;

– professionals with basic knowledge: medics, press centre staff, interpreters, accompanying delegations, these people know the necessary foreign languages at a fairly high level;

– sports volunteers who work directly at sports venues are usually people who know the specifics of a particular sport and are themselves often athletes;

– city volunteers who work in the city, outside the sports venues, and their task is to help guests, tourists, journalists orientate themselves in the city [4].

The uniform of volunteers of the Krasnoyarsk Winter Universiade played a significant role in promoting the event's brand during the event thanks to its memorable uniform corporate identity, which contains certain colour codings. According to the Krasnoyarsk 2019 Corporate Style Guide,

blue and white colours are dominant, bright and noticeable in the dark, indicating cold Siberian winter with real snow where the Universiade held (Krasnoyarsk and Siberia).

The inserts of purple color on the sleeves convey the key message of the event: warmth and hospitality of Siberians, Siberian territory – with all its "severity". The uniform also features the logos of the 29th Winter Universiade 2019 in Krasnoyarsk, the FISU logo, the logo of the general partner – NORNICKEL, mining and metallurgical company. On the elements of the clothes there is an inscription 'volunteer', which allows to easily and quickly identify volunteer assistants. Gathering in one place, the volunteers create a certain visual field, attract attention in a bright form, appear in video and photo media, which increases brand recognition and its identification in the minds of the target audience.

A novelty of the Krasnoyarsk Winter Universiade was the cultural programme that took place from February 20 to March 11, 2019. The Universiade Park was specially created for this purpose. It hosted cultural events, concerts of art groups from Russia (Godenko Krasnoyarsk National Dance Company of Siberia), France (REMUE MENAGE theatre), and venues of the Universiade's partners. The highlight of the Park was the national sites of the peoples of the Siberian region – visitors could get acquainted with the culture of the peoples of the North.

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ADAPTATION OF RUSSIAN-SPEAKING STUDENTS WHILE STUDYING IN CHINA

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The adaptation of students to educational activities at university is a topical issue which plays an essential role in the development and formation of the student's personality. This article discusses the problems that Russian-speaking students face when studying at a Chinese university. The features of adaptation to the educational process, academic environment, Chinese culture, and economic and everyday aspects are considered, and measures are proposed to prepare students for studying in a different environment.

Keywords: adaptation, intercultural communication, university, Russian students.

АДАПТАЦИЯ РУССКОЯЗЫЧНЫХ СТУДЕНТОВ ПРИ ОБУЧЕНИИ В КИТАЕ

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Адаптации студентов к учебной деятельности в вузе является одной из актуальных проблем, которая играет очень важную роль в развитии и становлении личности студента. Рассматриваются проблемы, с которыми сталкиваются русскоговорящие студенты при обучении в китайском университете. Рассмотрены особенности адаптации к учебному процессу, академической среде, китайской культуре, экономические и бытовые аспекты и предлагаются меры для подготовки студентов к обучению в иной среде.

Ключевые слова: адаптация, межкультурное общение, университет, российские студенты.

In the modern stage of human development, education in conditions of cultural exchange, for example by means of studying abroad, is becoming ever more common. This is a study of the peculiarities of Russian-speaking students' adaptation to intercultural communication, and how this impacts on their success during the educational process. Nowadays, this is highly topical. International education generates positive attitudes to cross-cultural communication and foreign languages, and develops stability, competence and tolerance. I. Kant believed that every person should communicate with his neighbours, regardless of their origin or skin colour, and act and behave according to what he expects from them towards himself [1]. The culture of a person is manifested in his actions and through his attitudes to others.

Currently, China is the most populated country in the world and also one of the fastest growing. It offers a lot of different educational opportunities for international students such as universities, local and government grants, student exchange programmes and many others. In order to consider the peculiarities of Russian-speaking students' adaptation in China, a survey was

conducted among 15 students of the Reshetnev Siberian State University of Science and Technology who have studied at a Chinese university. The majority of Russian-speaking students were amazed by the culture of this country.

National cuisine is an essential part of any culture, which is why people usually pay significant attention to it. Many students noted that Chinese food is very specific and strange in taste, and the majority do not like it since the content of pepper and oil in it is high. Often it transpires to be hot, sweet or spicy. The same points of view were expressed by the authors of the article 'Intercultural adaptation of Russian students in the context of the internationalization strategy of higher education in China' by Yarulin I. F. and Zadorozhin V. A. This research study examined the problems faced by Russian students when studying at Chinese universities. Their study is also based on a survey of Russian-speaking students and the results were the same [2].

In the university canteen, hardly any employees know even a few words in English, and therefore, Russian-speaking students were trying to say in Chinese what they would like to acquire. On the other hand, it helps and motivates to learn Chinese as soon as possible and try to understand more. 67 % of students reported this in the survey. The huge flow of students and the long queues in the dining hall as well as the noise are also surprising. The level of hygiene is much worse than in Russian dining halls. There are fixed hours when they are open, and at all other times they are closed. One of the best habits that 73 % of respondents noted was lunchtime from 12 pm to 2 pm. At this time, you have enough time to do almost everything: eat without haste, sleep and even do your homework. It is also extremely difficult to find European food near the university. Fast-food services such as MacDonald's and KFS are adapted to the tastes and preferences of the Chinese people, and therefore, it is difficult to adapt to such food in China. There are many varieties of sweet foods in Chinese stores. However, it is tricky to find delicious sweets or biscuits. Dairy products are quite expensive and differ greatly in taste from Russian ones.

Discipline in China is at the highest level. Students strictly follow the rules of the university, and the teacher's instructions must be executed, which is radically different from Russian universities. Chinese students, unlike Russian ones, are afraid of being punished for infringing regulations, and therefore, they clearly follow what is permitted and what is prohibited. The university strictly controls the participation of students in social events. There is also tight control over class attendance and student performance, which is very surprising for Russian students. 67 % of respondents noted that such control helps in the learning process and disciplines them. Classes are held in small groups; every student receives attention, so the effectiveness of such studying is much higher than at a Russian university. Unfortunately, on the other hand, only basic disciplines are studied, and there are no additional subjects that could be useful. Teachers are really amiable to foreign students. They are ready to help with studies or adaptation to culture, and offer various exciting places to relax and organize excursions. However, 80 % of respondents consider the level of most teachers' English proficiency low and not sufficient for teaching. This makes it impossible to accurately convey information and answer students' questions. A significant accent interferes with the perception of speech, and many words are difficult to understand.

The university's infrastructure is closest to the European style, as 83 % of respondents stated. There are various sports grounds, stadiums, a student's park, grocery and hardware stores, a coffee shop, canteens, parking spaces, and places to rent scooters. They are located quite close to each other, which allows students to develop comprehensively. Classrooms are comfortable, spacious and well-furnished with modern equipment, which contributes to the better development of a particular discipline. Classes are always open, with any student able to go and study there [3]. International students' halls of residence are very comfortable, spacious and equipped with all the necessary things. However, low-speed Internet is one of the greatest problems for 87 % of Russian students. Many applications and social networks are banned by the state.

All residents of China are really interested in foreigners. They are quite keen on taking pictures, making advertisements, eating together, making friends and being sure to show you off to all their friends and acquaintances. Perhaps this is due to the fact that the level of knowledge of foreign languages in China is very low, as 84 % of respondents stated. Only a small proportion of

the population know basic English. We can assume that this phenomenon is due to the fact that only in 1978 was the policy of openness in China adopted. Until that time, the country was closed, and therefore, there were few specialists who could teach foreign languages. In addition, the Chinese language does not have many sounds familiar to English. For example, in Chinese there is no sound /r/, but in English it is expressed clearly. There are a lot of difficulties in learning foreign languages for Chinese people because of this phenomenon. As a result of these differences in tongues, and considering their complexity, the Chinese often do not want to learn English. We need to understand the Chinese language is quite direct. There are no complex sentences, and the meaning depends on the order of words or characters. For this reason, Russian complex sentences translated into another language are too difficult to understand.

Communication with Chinese students was difficult, as the level of Chinese language proficiency among Russian students was at a low level, and the Chinese themselves rarely speak English and hardly ever Russian. Part-time work is prohibited, and nobody does it. Currency exchange is very fast with an ATM that accepts any card and issues cash in yuan. It is also not difficult to get a Chinese card to attach to WeChat and then use it and pay using a QR code. This phenomenon was praised by about 90 % of respondents. In addition, a lot of support is provided by volunteer students who speak good English and show all the main places to new arrivals, and help to solve almost any issues.

This study of Russian-speaking students` adaptation in China was conducted on the basis of a survey of 15 students who studied at the Chinese University as well as personal experience. The main problems of intercultural communication between Chinese students, teachers and Russian-speaking students, and the peculiarities of Russian-speaking students` adaptation while studying at a Chinese University were considered. Based on the survey results, it was discovered that the Chinese side helps Russian-speaking students to get used to China, meets them at the airport and provides good halls of residence, while volunteer students show them the area and conduct various events to help get acquainted with the culture. One of the main opportunities is the full immersion in Chinese and the possibility of daily practice with native speakers, which allows this language to be learnt effectively and quickly. Strict discipline also has a positive effect on progress. However, the Chinese university provides only some general subjects. There is such a problem as a low level of English-language proficiency, which makes it much more difficult for intercultural communication. The speed of adaptation is much lower than it would be if Chinese students and teachers had a higher level of English. There is less opportunity to earn money, do additional things, hobbies, sports, or help parents or relatives. The level of infrastructure is definitely good, and the campus has everything necessary for academic and extracurricular activities of students.

The author of the dissertation 'Adaptation of Chinese students to intercultural communication in the educational process of a Russian University', candidate of pedagogical Sciences Wei Xing says that 'Educational dialogue as a form of organization of interaction of participants in the educational process ensures the development of personal qualities that contribute to successful adaptation to intercultural communication.'[4] Chinese and Russian Universities can use this method when helping students adapt to life in China. Perhaps they should organize co-operative lectures, events such as an evening of national cultures, cooking classes with Chinese students, or group or project work. This process would facilitate cross-cultural communication, the development of communication skills, and the rapid adaptation of Russian students in China.

Based on the research, we can suggest organizing the preliminary training of Russian-speaking students in Russia before the trip to China. The first option would be to organize several meetings of students who have travelled to China with those who are planning to go to study. They can share their experience, describe their impressions and give valuable tips. The second option is to create an express Chinese course on which all the key everyday phrases would be mastered and language skills improved. In addition, we also propose that Chinese students could join this course to provide speaking practice. Thus, if you conduct all the necessary training for Russian students in advance of their trip to China, it would be easier for them to adapt to a different learning environment.

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ART AND CULTURAL VALUES IN THE INTERNATIONAL TRADE

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The article considers the movement of art objects and cultural values as part of the process of modern world trade. Special attention is paid to state regulation when solving problems related to the art market. The perspective of development of the market of art and cultural values through the use of modern technologies is considered.

Keywords: art commercialization, art market, art objects, cultural values, international trade, auction houses.

ИСКУССТВО И КУЛЬТУРНЫЕ ЦЕННОСТИ В МЕЖДУНАРОДНОЙ ТОРГОВЛЕ

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Рассматривается движение предметов искусства и культурных ценностей как часть процесса современной мировой торговли. Особое значение при решении проблем связанных с арт-рынком уделяется государственному регулированию. Рассматривается перспектива развития рынка искусства и культурных ценностей через применение современных технологий.

Ключевые слова: коммерциализация искусства, арт-рынок, предметы искусства, культурные ценности, международная торговля, аукционные дома

The market economy dictates its own laws in all spheres of human life. This also applies to the sphere of art and cultural values, which have always had a special value for countries and their culture and in the modern market have acquired a commercial character, there has been a commercialization of art. Such trends in the world market as internationalization combined with globalization, strengthening of inter-state cultural, social and economic ties, Informatization and technologization of trade have also affected the trade in art objects and cultural values. Cultural values are movable objects of the material world, regardless of the time of their creation, having historical, artistic, scientific or cultural significance [1].

The turnover of art and culture items is hundreds of millions of dollars, and their number is 1.5–1.8 million pieces. Such large turnover and the value of the items themselves require special attention from the state. However, in Russia there are difficulties in this issue – there are no reliable statistics on the number of imported and exported art objects, since it is estimated that up to 80 % of cultural heritage items are imported and exported illegally. One of the features of the modern art market is the lack of transparency when making transactions. Sellers, even the most reputable auc-

tion houses and galleries often hide information about their transactions (prices, names of sellers and buyers). Also, modern trade of this kind is characterized by the legalization of illegal income – the development of money laundering schemes, and tax evasion, as well as the leakage of cultural values from the countries that own them. In connection with the existing problems of the country, that are developing and applying different measures to reduce these problems.

Export of art and Antiques abroad as a gift or in the process of commercial sale of art paintings by authors is associated with difficulties in obtaining permits. Administrative and criminal liability is provided for violations of the law on the transport of cultural property across the border. In accordance with the laws of the Russian Federation, the Supervisory authority may issue a fine or confiscate the object of the offense, or if the illegal export is classified as smuggling of cultural property with a declared value of 100 thousand rubles. and more than that, it is possible to apply imprisonment for up to 12 years, depending on the severity of the crime [3].

In Russia, the law of the Russian Federation "on the export and import of cultural property" of 15.04.1993 No. 4804-1 regulates relations on the movement of cultural property from the Russian Federation to foreign States that are not members of the Eurasian economic Union, as well as to the Russian Federation from foreign States that are not members of the Eurasian economic Union. [1] the Procedure for the movement of cultural property between the member States of the Eurasian economic Union and the list of cultural property in respect of which a permit for export is established is regulated by the rules and regulations of the Eurasian economic Union.

The provisions of this Law apply to individuals and legal entities engaged in the export, temporary export, import or temporary import of cultural property; to state authorities, state bodies performing functions to ensure security, law and order, to fight crime, to protect human and civil rights and freedoms; to persons who have diplomatic and other privileges and immunities provided for by international treaties of the Russian Federation.

This Law regulates the circulation of cultural property located on the territory of the Russian Federation, as well as movable items declared for import or temporary import into the Russian Federation as cultural property, regardless of the form of ownership.

Features of export-import of weapons that are cultural values, including weapons; cultural values containing precious metals and precious stones; cultural values by state and municipal museums, archives, libraries, and other state and municipal repositories of cultural values; cultural values sent by post are regulated by the legislation on weapons, on precious metals and precious stones, on the Museum Fund of the Russian Federation and museums in the Russian Federation, on archives, on libraries, and in the field of postal communications, respectively [1].

All works must be declared. The export of national property is strictly controlled by the state and supervised by the customs service with the assistance of the police.

In PP. 34 article 333.33 "Amounts of the state fee for state registration, as well as for performing other legally significant actions" of the Tax code of the Russian Federation established fees for issuing an opinion (authorization document) for the export of cultural property: individuals – 5 % of the value of exported cultural property, but not more than 1,000,000 rubles; individuals registered as individual entrepreneurs and legal entities – 10 % of the value of exported cultural property; for issuing a notification confirming that the law of the Eurasian economic Union does not establish a permit for export of cultural property – 3,000 rubles for issuing a passport for a stringed musical instrument or bow – 1,500 rubles for issuing a certificate of an expert on cultural property – 4,000 rubles; for issuing a conclusion (permit) for temporary export of cultural property, including when extending the term of temporary export of cultural property – 0.01 % of the insurance value of temporarily exported cultural property, but no more than 5,000 rubles [2].

Other countries are also actively involved in international trade in art and culture. There is a correlation between the level of development of the country and the extent of its participation in the art trade. Thus, the main world leaders in this area are the United States, China and the United Kingdom. Also significant are France, Germany, Switzerland, Italy, and Spain. Russia's share is about 4 %. Analysis of auction sales revealed the most popular works of art by period of creation (modernism – 47 % and military art – 25 %) and type (paintings – 42 %, drawings – 29 %, graphics

– 18 %). The world is particularly popular works of classical Russian painting. The share of sales accounted for 72 %. [4] The largest art markets are located in New York and London-auction houses Sotheby's and Christie's. in the auction houses rotate huge sums: Christie's (4,999 billion dollars.), Sotheby's ($3.932 billion), Poly Group International 0.654 billion dollars.), Phillips ($0.654 billion), China Guardian ($0.606 billion) [6]. The Russian market is represented by a small number of auction houses and private art galleries.

The modern digital economy dictates new conditions for the development of trade in art objects and cultural values. This is why online trade in this area is actively developing through the creation of online auctions. The global development of the Internet is currently a key factor in the marketing strategies of auction houses around the world. Today, 97 % of auction houses in the world operate on the Internet (compared to 3 % in 2005). Online trading has become a tool for the survival and growth of art trade. Despite a drop in overall sales of art and Antiques, online auction turnover reached $ 6 billion in 2018., an increase of 11 % over the previous year and accounting for almost 9 % of the global art and Antiques market by value [5].

Thus, while auction sales are declining, online trading is growing. Various websites that specialize in the sale of art and related items appear and become popular [6]. Thus, the trade in art and cultural values received a new breath.

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THE ROLE OF ESP IN THE PROGRAMMING PROFESSION

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The article considers the importance of ESP in the programming profession. Various reasons for studying English by programmers, formulated by specialists in this profession, are given. The results of a survey of specialists and students, based on which conclusions were drawn, are analyzed.

Keywords: English for special purposes (ESP), general English (GE).

РОЛЬ ПРОФЕССИОНАЛЬНО-ОРИЕНТИРОВАННОГО АНГЛИЙСКОГО ЯЗЫКА В ПРОФЕССИИ ПРОГРАММИСТА

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Рассмотрена важность профессионально-ориентированного английского языка в профессии программиста. Приведены различные причины для изучения английского языка программистами, сформулированные специалистами этой профессии. Проанализированы результаты опроса специалистов и студентов, на основании которых были сделаны выводы.

Ключевые слова: профессионально-ориентированный английский язык, общий английский язык.

Nowadays English is used in all spheres of life: political, economic, social and even spiritual. In many aspects of each area, English has become very important. For example, in India, employees who speak English can earn up to 34 % more than their non-English speaking counterparts; in Brazil, it's an even more remarkable 51 % more, which can be even higher depending on the job level [1]. Speaking English is not only a matter of earning money, but a question of promotion, too. If you are skilled in GE (General English) it gives you a lot of opportunities both social and professional. But for successful professional advancement and development, ESP (English for special purposes) is used. What is more, ESP is widely used in scientific, educational, tourism, diplomatic, financial and business spheres. The purpose of this research is to study and reveal the importance of ESP in the profession of programmer.

The Tproger portal published an article that provides the views of experts working in the field of programming or IT [2]. Experts note that "knowledge of the English language is absolutely critical", because all the documentation and books are written on it, which are often obsolete by the time they are translated (or the translated text may not be accurate); without knowledge of English, the speed of work decreases, because you have to constantly access the Internet to translate something; without knowledge of the language, the circle of communication and opportunities is limited;

the code becomes clearer (for example, variable names written in English are perceived better than those written by transcription).

ACE (American Club of Education) provide article on how important it is for programmers to learn English [3]. For example, it is very important to know ESP, since the details in programming are very important.

Below are often mentioned arguments why programmers should learn English:

− the international community communicates in English;

− it is important to know not only GE, but ESP (levels from B2 to C2);

− most IT-companies are based in English-speaking countries, so 75 % of orders go abroad, because customers prefer to communicate in English;

− specialized literature is written in English;

− most programming languages and development environments are based on English.

In order to study different opinions about necessity of the English language skills in the programming profession, we compiled a survey and analyzed it.

The first group of respondents included 8 specialists working in areas related to programming. A 100 % result was obtained. English language was useful to everyone and still is, not only in learning a programming language, but also in the process of work, and they also consider knowledge of English important for a programmer.

Another group of respondents included 28 students at Reshetnev Siberian State University of Science and Technology. We asked a few questions to them: if the English language helped them in learning any programming language, has knowledge of English important for a programmer, and what level of English should a programmer have.

The results of the research a presented in the diagrams.

In general, the statistics is rather contradictory, but still the majority of respondents understands the importance of the English language and its benefits in life. GE allows a person to get a job, communicate with colleagues, socialize in any environment. If a person knows ESP, he has access to more resources providing professional knowledge, as well as the opportunity to communicate with representatives of the same profession from other countries. Such opportunities help a person to develop and advance in the profession. Knowledge of ESP is important not only for a programmer, but for any specialist.

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THE FEATURES AND ROLE OF APHORISMS IN THE PROCESS OF MODERN COMMUNICATION

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The status of aphorisms and some of their key features are explored in this article. It includes Russian, British English and American English examples of aphorisms. There is information about their role in the modern process of communication, and also some advice about their translation.

Keywords: aphorism, phrase, translation, quote.

ХАРАКТЕРНЫЕ ОСОБЕННОСТИ И РОЛЬ АФОРИЗМОВ В СОВРЕМЕННОМ ПРОЦЕССЕ КОММУНИКАЦИИ

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Исследуются положение и ключевые признаки афоризмов. Она включает русские, английские и американские примеры афоризмов. Также предоставлена информация об их роли в современном процессе коммуникации. Даются некоторые советы по переводу афоризмов.

Ключевые слова: афоризм, фраза, перевод, цитата.

The main goal of this article is to study the position of aphorisms and their features in different languages of the world. It seems to me that people nowadays read less classic literature and are less interested in the environment around them. These factors can cause not only a lack of knowledge, but also poor vocabulary.

An aphorism is an original finished thought, recorded in a concise, memorable form, and subsequently repeatedly reproduced by other people.

To study the status of aphorisms in the modern world, I have conducted a survey. The results show that everyone knows what an aphorism is. However, only 36 % of respondents believe that aphorisms appear in our speech from spheres outside the world of cinema and literature. Unfortunately, only 13.6 % of people believe that they hear aphorisms in the speech of other people every day, and 45.5 % responded that they hear them once or twice a week. 40.9 % of respondents believe that they hear them once a month or less often. Most of the respondents think that they know a few aphorisms, but it seems to me that we often use different set expressions and do not even realize that they are actually aphorisms.

There are many aphorisms in the Russian language, with most of them taken from literature. For example, everyone knows the phrase 'luch sveta v temnom tsarstve', or in translation 'a ray of light in the dark kingdom', from the work of N. Ostrovsky. This phrase is used to describe a good event or a cheerful or pleasant person. Some authors work only in the genre of aphorisms. Modern Russian writer-aphorists include A. Davidovich, V. Borisov and G. Malkin. Another source of aphorisms is cinema [1]. Phrases from L. Gaidai's film 'The Diamond Arm' are popular in Russian culture. For

instance there is such a phrase as 'Nashi ludi v bulochnuyu na taxi ne ezdyat', or 'Our people do not take taxis to get to the bakery'. Two of the most popular aphorisms in the Russian language are the phrases 'Rebyata, davaite zhit' druzhno!', or 'Kids, let's all get along', and 'Vyhodi, podlyi trus!', or 'Come out, you foul coward!', from the animated series 'Leopold the Cat' by A. Reznicov. In Russian language, aphorisms are used not only in everyday speech, but also in the process of learning at schools or universities, in sport, at cultural events or even at work, when they are appropriate.

There are also many aphorisms on various topics in British English. Motivational aphorisms such as 'Leisure is sweet when it follows work well done' or 'Work is the best well-known cure for worry' are very popular. Moreover, there are even aphorisms about business, such as 'Cooperation, not competition, is the life of business' or 'To be really successful, a company must have branches as well as roots'. The most popular American English aphorisms are quotes from movies. For instance, the phrase 'Houston, we have a problem' is used almost all over the world. Also, everyone knows the phrase 'I'll be back' from 'Terminator'. 'I've got a feeling we're not in Kansas any more' from 'The Wizard of Oz' is used when a person comes to an unfamiliar and strange place.

In the translation of aphorisms, you should use different translation transformations.

1. Replacing parts of speech. In the Russian translation of the phrase 'I have Van Gogh's ear for music' into Russian, the noun 'music' is replaced with the adjective 'musikalnyi'.

2. Additive. Conjunctions and pronouns are often added in the process of translating, for instance, 'You want it all and you want it now, and you get nothing and you get it gradually.' translated from the Russian 'Hochesh vsego i srazu, a poluchaesh nichego i postepenno'.

3. Modulation. This is a situation when one word is replaced by another more appropriate one to make an aphorism closer to the cultural values of the language [2].

For example, the word 'face' can be replaced with the word for 'head', instead of 'crave' can be used the word for 'write' and also the word 'offensive' can sometimes be replaced with a word for 'irritating', as in the aphorism 'It's annoying when your dreams come true for others.' Often an aphorism is determined not only by the meaning of the words which it includes. That is why the translation may sometimes be difficult. First of all, the translation loses the humour as well as the emotive power of words. Of course, we can find some examples of similar aphorisms in several languages: 'as cool as cucumber' and 'spokoyen kak udav', literally 'as calm as a boa', or 'buy a pig in a poke' and 'kupit' kota v meshke', literally 'buy a cat in a sack'.

In conclusion, I share the opinion that we meet aphorisms in the process of communication every day. They can show some cultural and national features of different languages of the world. As I said in the beginning, these bright and memorable phrases appear in our speech not only from literature and cinema. Quotes are often translated into other languages and sometimes can be more popular than in the original language. For instance, there are such famous phrases as 'Elementary, my dear Watson!', 'To be or not to be: that is the question' or 'And now here is my secret, a very simple secret: it is only in the heart that one can see rightly, what is essential is invisible to the eye.' It seems to me that aphorisms make our speech more diverse and concise. They are also part and parcel of our daily communication process.

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THE SIGNIFICANCE OF TRANSLATION AND INTERPRETING AS PROFESSIONS AND THEIR FUTURE

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The role of machine translation and its drawbacks are explored in this article. Possible threats to the future of the translation and interpreting professions are investigated.

Keywords: translation profession, interpreting, translation, machine translation.

ЗНАЧИМОСТЬ ПРОФЕССИИ ПЕРЕВОДЧИКА И ЕЕ БУДУЩЕЕ

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Рассматривается роль машинного перевода и его отрицательные стороны. Исследуются возможные угрозы для будущего профессии переводчика.

Ключевые слова: профессия переводчика, устный перевод, письменный перевод, машинный перевод.

The main goal of my article is to analyse the need for human translators and interpreters in the future. Nowadays, international relations are very developed around the world. Knowledge of English is one of the most crucial aspects of getting a prestigious job. Therefore, the profession of an interpreter is one commonly chosen by students. However, it is important to understand the demand for this profession on the labour market.

Translation and interpreting appeared in ancient times when it became necessary to communicate with different peoples, tribes and other ethnic groups that spoke different languages. For instance, in Russia translators worked under the name of *tolmachi*, who were engaged in the interpretation and study of texts. In the XIV century, the first case of a translation of a scientific book into a national language (from Latin to Icelandic) was performed. After many centuries, this profession is still important.

We live in the age of high technology. As with many activities, translation can also be performed by machines. There are high-quality machine translation systems which have been developing every year [1]. Employers do not always need to recruit translators to communicate with overseas guests. Sometimes machine translation is enough to solve some problems and understand each other. Despite this, it is not always a great decision to use machines in business. There are significant disadvantages of such a kind of translation.

Nowadays, absolutely all people connected with languages use online translation. Machine translation systems are divided into two groups: machine-aided human translation and human-aided machine translation.[1] They differ only in the roles of the computer and the human. However, the human is directly involved in both types. I have conducted a survey among translators, interpreters

and students in this sphere. The results show that respondents are confident that all machine translation needs to be corrected by a person. Sometimes it is necessary to change the word order, choose more appropriate words and translate set expressions. It is the first reason explaining why the vast majority answered that machine translation will not be able to replace human interpreters and translators. Moreover, in spite of the high capabilities of existing technologies, none of them can transmit the range of emotions and feelings that a human can. We know this can play an important role in successful negotiations.

It is possible that machine translation can replace human translators. However, it is impossible for interpreting and especially simultaneous interpreting. The interaction of three people in real-time is the main characteristic which makes this type of translation a special activity [2]. Therefore, nobody from this chain can be removed. Moreover, there are some unpredictable situations during interpreting which can be solved only by a person, for instance, a speaker's slurred speech. This shows one more disadvantage of machine translation.

The next drawback is the ambiguity of language which machines cannot distinguish. For example, such a Russian statement as 'ya tri tarelki s'el' has a figurative meaning, but a machine performs a "raw" translation such as 'I ate three plates' that can cause misunderstanding and confusion. Due to these reasons, most respondents consider that these professions will always be in demand.

However, there were identified threats to these professions. The main ones concern the appearance of high technologies and improvement of automated translation algorithms in machine translation. Furthermore, scientists reveal a tendency that falling incomes and prestige of translators and interpreters can play a major role in the future of these professions [3]. My survey has proved it because there were people who consider that the translation and interpreting professions are not appreciated by other people and employers. Further reasons were also identified. The first one is a surplus of specialists in this sphere. The second one is that in a few years it will be common for everyone to know foreign languages.

In conclusion, I can say that translators and interpreters are essential professions at the moment. Unfortunately, there are some threats that can endanger this job because of certain factors. The main reason for this profession disappearing is the automation of the translation process. However, we cannot say with certainty that machine translation systems will be an effective substitute for a human. This will only happen if all the factors above occur simultaneously. There is a chance that interpreters and translators will continue to be an integral part of the communication process as is the case now.

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SWOT ANALYSIS AS A WAY TO MAKE AN EFFECTIVE MANAGEMENT DECISION

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The main idea of the article is to analyze the influence on development of the enterprise, also it is role in making rational and timely decisions.

Keywords: management, management decisions, strategic management, external and internal environment, applying of SWOT-analysis.

SWOT-АНАЛИЗ КАК СРЕДСТВО ДЛЯ ПРИНЯТИЯ ЭФФЕКТИВНОГО УПРАВЛЕНЧЕСКОГО РЕШЕНИЯ

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Рассмотрено влияние анализа на развитие производственного предприятия, а также его роль в принятии рационального и своевременного управленческого решения.

Ключевые слова: менеджмент, управленческие решения, стратегическое управление, внешняя и внутренняя среда, применение SWOT-анализа.

In the modern world there are many organizations with different scope of activities. Each organization is interested in top managers able to take viable decisions. Managers are required to be competent and to regulate their practice towards existing economic laws.

In this case managers are helped by methods of planning, organizing activities and control. One of such methods is the SWOT-analysis. It was developed by professor Kenneth Andrews at Harvard University in 1963.

SWOT-analysis is one of the popular methods, that studies internal and external factors influencing the company development. This is analysis of the strengths and weaknesses in an organization and also opportunities and threats from the external environment. It's a universal technique of strategic management, which is popular among the managers nowadays. Then we consider the elements of the method and their role on the market of goods and services [1].

Elements of the SWOT-analysis: S – Strengths, W – Weaknesses, O – Opportunities of the company, T – Threats.

The strengths of goods or services hold a vantage on the market competition, it means that the product of a company is more stable, qualitive and unique. An organization can increase profits and sales on the basis of its strengths.

The strengths must be always improved. Company's weaknesses cut business growth and often reduce profits and sales. It is really important to monitor areas where the company is not strong enough and to develop programs and strategies to minimize losses and to prevent mistakes.

The opportunities of a company are one of the elements of the analysis that shows the favorable factors of environment. Managers should constantly evaluate all these opportunities, because it is very important for the development of manufacturing [2].

The threats of the company may decrease competitiveness on the market in the future and reduce profits, increase the loss of the market share. Each threat must be eliminated. SWOT-analysis matrix is presented in the table (see table).

General matrix of SWOT-analysis

	Positive side	Negative side
Internal environment	Strengths	Weaknesses
External environment	Opportunities	Threats

However, the company must have a balance of internal and external environment. The correct interaction of planning, organization, motivation and control ensures sustainability and uniqueness of the organization's projects in strategic management [3]. A lot of managers face the challenge of minimizing the costs. Their task is to point the finance at ideas that will make the company more profitable. Legislative, political, technological or economical threats could lead the expenses or the bankruptcy of enterprise. The use of SWOT-analysis makes it possible to indicate the direction of production and marketing [4].

Manager must understand all the market trends to avoid any mistakes in the strategic decision despite the visual simplicity of this method. We consider the vantages of this method: it can be used in various sectors of the economy; it can be adapted to any object. The method takes into account the requirements of objective economic laws.

The analysis of opportunities and threats allows to choose future decisions. When the situation changes, the decision will be developed regarding capabilities and potential of a company [5]. Management decisions must conform to rules: timeliness, specificity, modernity and mobility. SWOT-analysis contributes to the retention of requirements, that helps us to take an optimal and effective management decision [6].

In conclusion, applying of SWOT-analysis helps managers to make a rational decision, also make a choice that is based on the analytical process. It is difficult to work at a complex information processing, making an effective decision, correct and timely forecasting without a special "tool". SWOT-analysis helps to improve the quality of decisions in the management process.

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DEVELOPMENT OF THE RUSSIAN MODEL OF SOCIAL PROTECTION OF THE POPULATION

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The development of the Russian model of social protection of the population, the stages of development of social population and the activities of social services are considered in the article.

Keywords: social protection, stages of development, activities of social services.

РАЗВИТИЕ РОССИЙСКОЙ МОДЕЛИ СОЦИАЛЬНОЙ ЗАЩИТЫ НАСЕЛЕНИЯ

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Рассматривается развитие российской модели социальной защиты населения, этапы развития модели социальной защиты населения, а также деятельность социальных служб.

Ключевые слова: социальная защита, этапы развития, деятельность социальных служб.

Social protection of the population is a system of legal, socio-economic and organizational measures, guaranteed and implemented by the state to ensure a decent life, that is, material security at the level of standards of modern development of society and free human development. Four stages can be distinguished of the formation and development of a system of social protection of the population, corresponding to the main stages of social policy in the era of market reforms in Russia [1].

The first stage covers the end of the perestroika era (1989–1991). It corresponded to the non-radical phase of reform. Social protection was a reaction to the deterioration of the social well-being of the population caused by inflation, the first signs of unemployment, the decline in the standard of living of pensioners and other economically inactive groups of the population. It was carried out within the framework of traditional state social security by indexing pensions, scholarships and allowances, implementing social programs using the economic opportunities of labor collectives, branches of the Soviet Charity Fund, and charitable associations. The main way of social support was the indexation of pensions [2].

The second stage (1992–1995) is associated with the radical phase of economic reform. In these years, the transition began from socialist and social insurance of a socialist type to social protection, the basic principles of which were formed in the "Concept of Social Protection of Disabled Citizens and Families with Children", developed in May 1992. The concept provided for the creation of a system of urgent social assistance to low-income and disabled citizens, a promising model of a social protection system designed for market social relations, and a program of specific measures to implement the basics s their positions. At this stage, the formation of the regulatory framework for social work at the federal level was basically completed.At the third stage (1996

2004), the social protection system functioned on a new legislative basis, the main element of which was the federal law On the Basics of Social Services for the Population of the Russian Federation, as well as the federal laws On Social Services for Senior Citizens and the Disabled in the Russian Federation, On state benefits to citizens with children", "On the social protection of disabled people in the Russian Federation", "On veterans", "On state social assistance". A number of long-term programs have been developed to help children, people with disabilities, refugees and internally displaced persons and other socially vulnerable groups of the population, and regular development of targeted programs for social support of these social groups has begun. At this time, the activities of social services become more systematic and professional. Model provisions for social service institutions are being developed, regulatory documents of the regional level are appearing. At moments of relative economic stabilization, the effectiveness of social programs is enhanced. On the whole, the adaptation of both the population and the social services themselves to new conditions was completed. The emphasis in activities is shifted from pension provision to the payment of benefits. The main institution of social protection during this period was the territorial center of social assistance. At the same time, the economic and financial crisis of the late 1990s sharply increased the number of citizens living below the poverty line and significantly complicated the financing of social institutions [3].

At the fourth stage (since 2005), the process of redistributing powers in the field of social protection of the population between the levels of government – federal, regional, municipal. Since January 2005, the 122nd Federal Law, known as the "Law on the Monetization of Benefits", came into force, which, on the one hand, significantly reduced the volume and number of beneficiaries, and on the other, divided the beneficiaries into federal and regional ones. Moreover, the overwhelming majority of them was assigned to the subjects of the Russian Federation. At this stage, the targeting of social support was further strengthened. One such targeted measure has been housing subsidies. The issues of organizing the provision of subsidies for housing and utilities began to be resolved in close coordination with federal legislation and the ongoing housing and communal services reform. The second most important area of targeted social assistance was the payment of low-monthly families a monthly child allowance. Since 2005, the responsibility for this measure of social support has completely shifted to the regions [4; 5].

On the way to further improving the regional system of social protection, as in previous periods, serious obstacles remain, associated primarily with insufficient financing of the industry. The material and technical base of social institutions remains weak, the standards of social services and methods for the provision of social services are not well developed, the activities of federal, regional and local authorities, public organizations, foundations and associations in the field of social services are not coordinated, and public opinion on the importance of and the need for social work in society.

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УДК 165.6

DEVELOPMENT OF DIALECTICAL METHODOLOGY OF COGNITION IN MODERN SOCIETY

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This scientific article deals with the philosophical and methodological foundations of Russian philosophy and their relevance. It is proved that the interaction of denominations in relations should be formed by dialectical interactions and it is necessary to get to know the society and on this basis to find solutions to its development.

Keywords: dialectics, methodology, Russian philosophy, epistemology, globalization.

РАЗВИТИЕ ДИАЛЕКТИЧЕСКОЙ МЕТОДОЛОГИИ ПОЗНАНИЯ В СОВРЕМЕННОМ ОБЩЕСТВЕ

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Раскрываются философско-методологические основы русской философии и их актуальность, доказывается, что взаимодействие конфессий в отношениях должно складываться по диалектическим взаимодействиям и необходимо познать общество и исходя из этого находить решения его развития.

Ключевые слова: диалектика, методология, русская философия, гносеология, глобализация.

Over the years, various methods of cognition and transformation of reality have been developed within the framework of philosophy. Among them, first of all, the dialectical and metaphysical methods are distinguished. According to dialectical methodology, based on the principle of the universal interconnection of objects and processes, there are no absolutely isolated things in the world around us and to get to know a particular object we should determine its place in the system of interacting things, its relationship with the surrounding phenomena.

The origins of dialectics were laid in the philosophy of Socrates. Since ancient times he has become a model of wisdom, the ideal of a sage who put truth above human life in the minds of people. The image of Socrates as a thinker was the basis for many pieces of literature and art. The dialectics of Socrates, understood by him as the art of a creative dialogue, is of a particular interest. This method is the basis of his teachings.

The dialectics of Socrates contradicted the sophistic teachings which proclaimed the priority of the personal self over the society. These teachings were very popular, developed and supported by the Greek philosophers, who claimed that an individual is not limited by any norms, all actions

are based on personal desires and abilities. While the sophists tried to bring man closer to God, competing in eloquence, discussing the creation of the world, Socrates first addressed the philosophical problem of the existence of a human. Socrates believed that the secrets of the universe belong to the sphere of divine interests, and a man should learn the world through himself. This knowledge makes him a virtuous member of society, since only knowledge will help to distinguish good from evil and lies from truth. The dialectics of Socrates directed people to introspect and fill their lives with meaning (a person's focus on something more than himself).

In the modern world, dialectics has been formed as the science of the most General laws of the nature, society, and thinking development. At the same time, dialectics acts as a method of cognition of the surrounding reality, the main principles of which are the principles of the unity of the world and the universal connection of phenomena. In the works of Russian researchers, dialectical methodology is reflected by Prokopovich, Lomonosov, Kozelsky, Radishchev, Bryantsev, etc. Thus, according to the concept of Andrey Bryantsev, all things are not only "linked" in time and space by a "physical connection", where the present is determined by the past and contains the cause of the future, but are also connected by means of goals ("final causes") prescribed by the Creator. As you can see, the concept of "linking" acts as a system, the elements of which are interconnected. Next, Bryantsev reveals the principles of dialectics as follows: "the Universe in the thing itself is an immeasurable body, mechanically arranged, and composed of innumerable parts of various sizes and hardness, which are mutually connected by means of the universal law". At the same time, on the basis of dialectical knowledge, the philosopher developed a theory of many interconnected worlds and an infinite variety of forms of organic life [1].

The dialectical foundations of the society cognition remain relevant in modern conditions of its development. For example, in epistemology the application of the dialectics laws to thinking determines the corresponding theory of knowledge. Dialectical logics reveals the dialectics of cognition, i. e. the laws of its development, including the development of forms of thinking. Thus, it is a comprehensive and profound teaching about the development of human knowledge as a reflection of the material world development.

In the political sphere of public life, dialectics with a return to the citizens collective security is the development of civil society organizations that strive to participate in the management of public processes. These include the church, political parties, corporations, etc. With the development of writing and later with multiple processes of social labor division, the complexity of the social structure, the development of states, some special knowledge becomes a commodity. They are acquired in the course of training for a fee, i.e. there appeared a kind of exchange relationship. The emergence of philosophical schools headed by spiritual authorities, the struggle of ideological currents indicates a clear private-property claim to certain knowledge. Currently, there are two opposite trends in the development of relations in the spiritual sphere of society. On the one hand, the needs of humanization and democratization of public relations dictate the need for tolerance of ideological pluralism (plurality) [2].

On the other hand, the processes of globalization in all spheres of society lead to the promotion of common spiritual values. The further development of society depends on the persistent spiritual and practical activity of people. The possibility of choosing certain solutions creates a condition for alternative social development, the presence of options for evolution that exclude each other. The history of mankind is a chain of unique events, since there is no single nation or state with the same historical fate. The stages of human history are characterized by a variety of ways and forms of social development.

In the economic sphere dialectics is a qualitative leap in the transition to the production of material goods. The formation of labor activity led to the appearance of people's relationships about people and about things. The corresponding system of social relations developed on the basis of dialectical thinking. Dialectical foundations of Russian philosophy were formed on the basis of objective conditions for the development of society. And further effective development of social relations is possible if the dialectics of the nature development, society and thinking is taken into account.

Thus, we note that society develops under the influence of objective conditions and subjective factors. Objective conditions operate independently of people's consciousness. These conditions include the laws of nature and natural dependencies between social subjects. They are implemented in accordance with the laws of dialectics, as shown above. Subjective factors are conscious activity and strong-willed efforts of people: the creativity of outstanding personalities, the presence or absence of organizational abilities and initiative among the leaders of the society, social institutions, the use of technical objects, etc. It is necessary to get to know the society and, based on this, find effective solutions to its development.

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УДК 334

MANAGING STRATEGIC ALLIANCES IN THE HI-TECH FIELD

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The role of the strategic alliance in the field of high technologies and the formation of sustainable partnerships in a dynamic environment is described. The significance of this phenomenon in the process of making management decisions and creating joint ventures is determined. The conclusion is made about recommendations for establishing mutually beneficial and trusting long-term relationships in the science-intensive sphere.

Keywords: strategic alliance, joint ventures, high technologies, science-intensive sphere, strategy.

УПРАВЛЕНИЕ СТРАТЕГИЧЕСКИМИ АЛЬЯНСАМИ В НАУКОЕМКОЙ СФЕРЕ

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Описана роль стратегического альянса в сфере высоких технологий и формировании устойчивых партнёрских отношений в условиях динамичной внешней среды. Определена значимость данного явления в процессе принятия управленческих решений и создания совместных предприятий. Сформулирован вывод о рекомендациях по установлению взаимовыгодных и доверительных долгосрочных отношений в наукоёмкой сфере.

Ключевые слова: стратегический альянс, совместные предприятия, высокие технологии, наукоёмкая сфера, стратегия.

Strategic alliances are the response of modern organizations to the constantly changing structure of the external conditions for doing business, which predetermines the unification of single individuals and the search for partners to achieve competitiveness in the market [1]. More and more companies every year become partners in mutually beneficial and trusting relationships, this significantly affects the knowledge-intensive sphere. The current situation in the field of high technology, both domestic and foreign, obliges all participants in this business to play by the rules. In order to survive, you need to join forces. Strategic alliances are designed to solve this problem and turn possible obstacles into mutual profit for many companies that have not yet experienced all the possible positive aspects of cooperation in various business fields, especially knowledge-intensive. Such partnerships take various forms, for example, a takeover or a more confidential method that is the exchange of technology. Over the time, when all players move to a new type of cooperation, the structure of competition also changes, firms compete not with individual rivals, but

with entire groups and coalitions according to the principle of their common strategic aspirations [1]. The problems of the transition to a new type of relationship affect our country very much, we need to learn from the experience of colleagues from Japan, the USA and Europe so that domestic companies can transfer the front of decision-making from internal to external, because the modern world requires this at the stage of globalization, which should be fixed on the agenda [2].

The author of many scientific works, Sumina Ekaterina Vladimirovna, in her article on the urgent problems of aviation and astronautics, writes: "Changing legislation, globalization, the increasing needs of customers, the search for new, most effective ways to increase the competitiveness of companies put pressure on the growth and profitability of the organization, forcing to seek new partners with additional capabilities, resources and knowledge, form exceptional strategies and tactics for achieving goals and objectives" [3].

Indeed, modern overstated requirements force managers to make special tactical decisions to maintain their position on the world stage, especially in the high-tech sphere, where administrative decisions are made and sometimes with high risk contracts are made with international partners, which are aimed only at ensuring that the company survives and brought a little more profit, although this is one of the forms of strategic partnership, such a phenomenon has long passed.

An example of successful associations in the European and American arena is the collaboration of the auto giants Daimler and Chrysler, oil companies British Petroleum and Amoco, as well as Unilever [2]. There is an increase in the emergence of strategic alliances throughout the world, especially in Asia and Europe. At a time when economic reforms were only taking place in Russia, starting from the 1970s, a business oriented toward the organization's external relations was developing actively, that is, strategic associations arose [1]. In general, the tendency to increase strategic alliances only so, since the 1980s there has been an annual increase of at least 25 % [2]. Sometimes it is very difficult to track the exact number of occurrences of strategic associations, because far from all such relationships are registered in a legal form, much more often partnerships arise privately and unofficially between individual participants [1]. However, in the figure in Figure, you can see the growth dynamics of international strategic alliances in the high-tech sphere in 1970–1993.

Raising trends of international alliances
and co-ventures in the hi-tech field in 1970–1993 [1]

The number of joint ventures in the high technology sector has always been high, because this requires a reduction in the high costs typical of industries such as computer manufacturing, information technology, the automotive industry and the aerospace industry. High technology requires high costs for research and development, and the principle of strategic alliances is based on the fact that the result of joint ventures will be much better than their work separately at the same cost of resources. In general, when there is a persistent trend throughout the world for an increase in strategic alliances, joint ventures, multinational companies, a number of favorable recommendations can be formulated for firms in the high-tech field who want to join forces in partnerships with the aim of strengthening market positions and expanding global influence and

improving competitiveness. Recommendations should also take into account a particularly important characteristic of modern business, like globalization, and be of the following form:

– Companies should share resources so as to achieve greater efficiency through technology sharing.

– The main strategic goal of two or more enterprises united in the field of high technologies should be to achieve synergy of these enterprises.

– The total cost of research should be smoothed out due to the joint efforts of partners.

Finally, strategic alliances are playing role in knowledge-intensive sphere as uncompromising condition to achieving development goals of organization. Complicated rules of competition in the international environment and technological challenges of digitalization and upcoming period of crises conditions in the economy also make it the most promising strategic solution.

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DEVELOPMENT OF CROSS-CULTURAL TOLERANCE OF UNIVERSITY STUDENTS AT FOREIGN LANGUAGE CLASSES

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The article presents the main approaches to determining intercultural tolerance, the formation of which is considered one of the key trends in the development of modern education. Possible means of creating intercultural tolerance of universities students are examined by the example of foreign language classes.

Keywords: cross-cultural tolerance, culture, empathy, activity approach.

ФОРМИРОВАНИЕ МЕЖКУЛЬТУРНОЙ ТОЛЕРАНТНОСТИ СТУДЕНТОВ УНИВЕРСИТЕТА НА ПРИМЕРЕ ЗАНЯТИЙ ПО ИНОСТРАННОМУ ЯЗЫКУ

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Представлены основные подходы к определению межкультурной толерантности, воспитание которой считается одной из ключевых тенденций развития современного образования. Рассматриваются возможные пути и средства формирования межкультурной толерантности у студентов высших учебных заведений на примере занятий по иностранному языку.

Keywords: межкультурная толерантность, культура, эмпатия, деятельностный подход.

The current socio-political situation in the world and in Russia requires urgent formation of new conceptional priorities, which would make it possible to prevent the situation of a civilizational conflict which can lead to such negative consequences as the growth of xenophobia, hostility, racism, and national discrimination. The reflection of the current situation was the inclusion of the requirements of tolerance formation as one of the modern fundamental priorities in the content of education.

The need for tolerance formation arises from the very first days of education, since students who have entered the university come from different social groups and cultures, with different life experiences and abilities.

Intercultural tolerance is defined as the ability to tolerate the perception of a foreign culture, a different value system, a different way of life, unfamiliar behavior and appearance, strange traditions, opinions and beliefs. As the main functions of intercultural tolerance, most researchers identify preserving culture function, peace-supporting function, regulating, and communicative functions [1].

The formation of intercultural tolerance among students is considered as a process of creating favorable conditions for acquiring a positive and overcoming negative experience of interaction with representatives of other cultures.

Tolerance of the individual as a whole, as well as intercultural tolerance in particular, is characterized by such indicators as: humanity; reflexivity (knowledge and acceptance of individual strengths and weaknesses); love of freedom, equality; responsibility; self-esteem, global self-esteem confidence; self-control; variability (the ability to perceive and evaluate reality from different angles); susceptibility; self-irony and a sense of humor; flexibility; empathy (accompanied by qualitative changes in the personality in the process of its intellectual and emotional participation in the experience of another person) [2; 3].

The process of formation of intercultural tolerance of students is connected with the development of empathic skills of the individual, which has at least six levels and each is an obligatory step of the subsequent one [3].

1. The conscious acceptance of differences objective reality in different personal views.
2. Identification of oneself with a certain nation.
3. The presence of the boundaries of one's own identity with the possibility of their expansion.
4. The development of a motivated interest in cultural differences.
5. Transformation of the empathy situation into a personal, individual experience.
6. Regeneration of one's own identity after "controlled immersion" in another sociocultural environment.

One of the most important and promising means of promoting intercultural tolerance is the appeal to the technology of dialogue of cultures. The use of activity approach is also essential. Within the framework of this approach, it seems possible to conduct educational and gaming classes involving the use of interactive methods – role-playing games, discussions, and trainings. Such classes are aimed at developing critical thinking of students, group work, and discussion skills.

Universities foreign language course books contain cross-cultural material, which allows to implement the sociocultural component, offering information about different countries, developing students' skills to represent their country in comparison with other countries. Students learn to build verbal and non-verbal behavior, taking into account the characteristics of the culture of the language being studied, with an understanding of the unified system of ethnic values of peoples.

The quality of training largely depends on the teacher's ability to choose linguistic and cross-cultural material. Knowledge of a foreign culture consists of the search for differences between your own and another's cultures. Cross-cultural texts take a large place in the process of teaching a foreign language.

Various forms of organization of educational activities are very important: group, pair and individual work. When organizing communication activities, an optimal psychological climate is created to achieve a cognitive goal. To form a student's tolerant personality, it is important to master the behavior during a conversation. It includes the specifics of greetings, promises, approval, disapproval, regret, apology, requests, etc.

During the collective cognitive activity of students, especially if students are of different nationalities, different cultures the following aspects are achieved:
− awareness of the purpose of the activity, which requires the joint efforts of all members of the students group;
− establishment of mutual responsibility relations among members of the group;
− students control over the performance of work, that is reflection – analysis of activity;
− communication, during which students acquire the ability to ask questions, listen to their opponents;
− interaction, thanks to which students begin to realize that the success of their educational activities depends on the success of each member of the group.

The organization of reflection plays a special role in the teacher's activities. Reflexive skills help students understand their uniqueness and purpose, which are manifested through the analysis of its subject activity. The physical sensory organs are a source of person's external experience, and reflection is a source of internal experience, a way of self-knowledge, a necessary tool of thinking [4].

The result of the formation of intercultural tolerance of a university student as a factor of productive cross-cultural interaction can also be expressed in its international academic mobility, for the development of which such interactive teaching technologies as case study, brainstorming, design techniques, business games, as well as the latest developments in the field of the electronic educational environment are used (Moodle, Web 2.0, MOOCs).

To come to the conclusion, the formation of intercultural tolerance in the context of globalization and multiculturalism of Russian society at the present stage is becoming one of the dominant trends in the formation of the 21st century. The task of modern educational institutions is to create conditions for students to develop orientation on the values of non-violence, tolerance, justice, legality as the moral basis for behavior in social and intercultural conflicts. Starting from the first year of studying, it is important to teach students to be critical of their views, accept others as significant and valuable, and be tolerant. This contributes to the development of cooperation and harmonization of relations in the students group, which ultimately makes the education process more effective.

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ESTABLISHING THE FACTS IN THE ADMINISTRATIVE PROCESS

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The article discusses the issues of the circumstances subject to clarification of the case on administrative offence, provides suggestions for improving the provisions of the administrative procedure Code of the Russian Federation.

Keywords: administrative offence, the actual fact that article.

УСТАНОВЛЕНИЕ ФАКТИЧЕСКИХ ОБСТОЯТЕЛЬСТВ В АДМИНИСТРАТИВНОМ ПРОЦЕССЕ

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Рассматриваются проблемные вопросы обстоятельств, подлежащих выяснению по делу об административном правонарушении, дискуссионные аспекты понятий доказательства и доказанности в административном процессе, содержатся предложения по совершенствованию норм Кодекса административного судопроизводства Российской Федерации.

Ключевые слова: административное правонарушение, фактическое обстоятельство, статья.

The establishment of the actual facts or proof is one of the urgent problems, which is debatable and not fully investigated by science in the administrative process.

In accordance with paragraph 1-6 of article 26.1 Cao RF, in the case of an administrative offense, subject to clarification of the following circumstances: event offense; a person who commits illegal actions (inaction); the guilty person; the circumstances mitigating and aggravating administrative responsibility; the nature and extent of the damage caused by the offense; the circumstances precluding the proceedings [1].

Paragraph 7 of part 1 of article 26.1 of the administrative code expressly stipulates that the condition that turns out court and other circumstances that matter for proper resolution of the case, as well as the causes and conditions of committing an administrative offense.

According to part 3, article 62 of the APC, the circumstances relevant to the proper resolution of the case, determined by the court on the basis of the substantive law subject to application to disputable public relations, on the basis of requirements and objections of persons involved in the case [2].

First of all, pay attention to the imprecise terminology used by the legislator. First of all, it concerns the expression "the correct resolution of the case". It is obvious that the criterion of "correctness" are the concepts of "legality and propriety", which would be invoked in this case.

The term "proving" is used in articles 62 to 65 CAS of the Russian Federation and article 26.1 of the administrative code, without good reason, is replaced by the concept of "clarifying the circumstances". Connotation is that "proving" is a more rigorous procedure than the conventional "explanation".

In the administrative legislation there is no definition of proof; it is formulated with the science of the administrative process. So, B. G. Gaprindashvili understand the proof as a cognitive identification of the logical-practical activities on collection, verification and evaluation of evidence in order to establish a formal truth about the circumstances relevant to the proper resolution of the case [3; 4]. D. V. Gorbunov believes that the proof is the procedural activity of the judges, officials and participants of proceedings on administrative offence for the collection, evaluation and use of evidence [4].

From the point of view of A. A. Vetrova, proof is a process of knowing the truth as a set of logical methods of justification of the truth of propositions [5]. The approval of the T. V. Kazina, proving is the process of finding, restoring, securing evidence, their research, and evaluation, which is characterized by progressiveness, dynamism, staging and recurrence [6].

We think that proof establishes only the formal truth; with this approach, obviously there are doubts as to the legality and validity of the decision on business about an administrative offence. Rather, we need to talk about the presumption of truth on the basis of research evidence. We believe that the proof is formal, that is, the procedural activity of the court and the participants in the administrative process for the collection, verification and evaluation of evidence, their relevance, acceptability and sufficiency for the proper resolution of the case on administrative offense.

In order to study evidence is important the definition of evidence, which is interpreted differently in the material and procedural norms of administrative legislation. Thus, according to part 1 article 26.2 of the administrative code, evidence is any actual data on the basis of which establishes the presence or absence of event of an administrative offence, guilt of the person brought to administrative responsibility, as well as other circumstances that matter for proper resolution of the case.

Part 1 of article 59 of the APC defines evidence as information on the facts on the basis of which establishes the presence or absence of circumstances substantiating demands and objections of the persons participating in the case, as well as other circumstances relevant to the proper consideration and resolution of administrative cases. If we assume that the expression "actual data" and "evidence" are synonymous, it is impossible to accept the statement of the legislator that the evidence can be any data. They must be received in the manner prescribed by Federal law, rightly indicated in part 1 of article 59 of the APC.

The contradiction between part 1 of article 26.2 of the administrative code of the Russian Federation and part 1 of article 59 of the APC regarding the role of evidence is explained by the fact that in the latter case, the legislator focuses attention on the procedural value of information about the facts. And yet, it seems that with the help of evidence establishes the circumstances to be clarified in administrative proceedings, which are listed in part 1 of article 26.1 of the administrative code.

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CUSTOMS CONTROL

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The organization of customs control and the features of its implementation, as well as the risk management system that is used by the customs authorities to implement the principle of selectivity of customs control objects are considered.

Keywords: principles of customs control, forms of customs control, risk management system.

ТАМОЖЕННЫЙ КОНТРОЛЬ

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Рассматривается организация таможенного контроля и особенности его проведения, а также система управления рисками, которая применяется таможенными органами для реализации принципа выборочности объектов таможенного контроля.

Ключевые слова: принципы таможенного контроля, формы таможенного контроля, система управления рисками.

Customs control is a set of measures taken by customs authorities, including using a risk management system, to ensure compliance with the customs legislation of the Customs Union and the laws of the Member States of the Customs Union. Customs control is one of the most important functions of customs authorities. Customs officials must be involved in customs control of goods transported across the customs border of the Russian Federation by individuals who have undergone professional training or education in the prescribed manner and who meet the moral, psychological, professional, educational, cultural, and ethical criteria defined by the regulatory legal acts of the Federal Customs Service Russia [1; 2].

The main goal of customs control is compliance by individuals and legal entities involved in customs activities with established customs rules and procedures. The nature and content of the activities of customs authorities are largely determined precisely by customs control [3].

Customs control does not include tax, monetary, export and other types of control, the right to exercise of which or to participate in the implementation of which is granted to customs authorities in accordance with the law.

The implementation of customs control is based on a system of principles for its implementation. The general legal principles include: legality; respect for rights and freedoms; humanity. The following principles can be singled out as special principles for conducting customs control: target orientation, selectivity, efficiency, cooperation, efficiency.

When conducting customs control, customs authorities apply the following forms of customs control (Article 322 of the EAEU Customs Code):

– receiving explanations;
– verification of customs, other documents and (or) information;
– customs inspection;
– customs inspection;
– personal customs inspection;
– customs inspection of premises and territories;
– customs check [4].

In each case, the customs authority during customs control selects those forms that, in the opinion of the customs authority, will be sufficient to ensure compliance with the law. The choice of the form of customs control depends on the nature and value of the imported/ exported cargo, the type of customs regime.

The risk management system is used in determining goals, choosing operations and objects of customs control. In this case, the risk is understood as the estimated by the customs authorities the possibility of non-compliance with the state customs legislation.

The risk management system (RMS) is used for efficient use of resources of customs authorities in the most important and priority areas of work of these bodies and is to determine the goods, documents and persons for whom customs control operations are applied.

The risk management system creates a modern system of customs administration, that ensures effective customs control based on the principle of selectivity, based on the optimal allocation of resources of the customs service in the most important and priority areas of the customs authorities to prevent violations of customs legislation [5].

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УДК 338.2

THE PROBLEM OF DEVELOPMENT OF THE INNOVATION SECTOR IN RUSSIA

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This article discusses the innovation sector of Russia. The concepts "innovation" and "information and communication technology" are presented. The problems of the innovation sector in Russia are revealed and recommendations are provided.

Keywords: innovation, innovation sector, information and communication technology.

ПРОБЛЕМА РАЗВИТИЯ ИННОВАЦИОННОГО СЕКТОРА В РОССИИ

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Рассматривается инновационный сектор России. Представлены понятия «инновация», «информационно-коммуникационные технологии». Выявлены проблемы развития инновационного сектора России и представлены рекомендации.

Ключевые слова: инновация, инновационный сектор, информационно-коммуникационные технологии.

Modern society has problems with unlimited human needs and limited resources. Any country needs innovative development to satisfy the needs of society and to form its well-being.

There are many definitions of the term "nnovation". In a broad sense, "innovation" is the use of profitable discoveries, such as new technologies, varieties of products and services of organizational, technical, social, and economic solutions of production, financial, or other nature [1]. In a narrower sense, "innovation" is a technical solution that is put into practice [2].

Today, many strategies and programs for the development of the Russian innovation sector are created and implemented. In the program for the development, the main areas of focus are presented in the form of the following innovations: economic development and innovative economy, science and technology, Information society, pharmaceutical and medical industries, improvement of transport network, rapid development of agriculture, and industry promotion.

In this article, we focus on innovation in the economic sector, because the economy is the dynamic development of a country, which contributes to a high level of competitiveness and is a prerequisite for the equal participation of a country in the world labor development.

The program for the development of the innovation sector of Russia identifies the main international economy of society: information and communication technologies, which have a great impact on society. Information and communication technology is a process that uses a range of means and methods of collecting, processing, and transmitting data (primary information) to obtain

information of new quality about the state of an object, process, or phenomenon (information product) [3]. According to E. Yu. Trunova, information and communication technologies are used in almost all innovative sectors where productivity and efficiency can increase [4]. The high pace of development of the sphere of information and communication technologies is largely due to the process of formation of the information economy and a significant increase in the importance of information as an important resource in business and society. Information and communication technologies contain the significant potential for increasing labor productivity [5].

Unfortunately, in Russia, there is no balanced innovation environment today. In addition to this problem, there are some problems and factors hindering the development of the innovation sector. Our state could look at the experience of other countries and try to avoid mistakes in the formation of activities and supporting organizations involved in the development of information and communication technologies in our country.

For example, telecommunications organizations invest large amounts of money to apply modern and advanced technologies in order to reduce costs to maintain equipment performance. Another important factor is that the development of information and communication technologies allows organizations to rationalize the costs of production and staff, and effectively manage production processes.

In the 21st century, rapid access to information and communication technologies plays an important role. An example of this is the use of the Public Services Portal of the Russian Federation. You can quickly submit or find out the necessary information without leaving your home. Thanks to this method of providing services, the load on the activities of state organizations is reduced. Taking into consideration all mentioned above, we can conclude that it is necessary to pay attention to the fact that all innovations are accessible to society, they do not require special abilities, they are informative and benefit society. All these recommendations will allow combining information and communication technologies and the economy (foreign and domestic policy, education, industry, trade).

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A MULTICULTURAL DIALOGUE: A CREATIVE METHOD
FOR CONTEMPORARY ATMOSPHERE

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In this work, we have given the examples of implementing multicultural communication to prove that it can be used not only as a way of conservation and holding history and traditions of our past in memory, but also as a way of exchanging this information helping both sides of these dialogue in the process of creating something modern and at the same time future-looking.

Keywords: multicultural dialogue, cross-cultural communication, exchange process, creating process, contemporary world.

ДИАЛОГ КУЛЬТУР: СПОСОБ СОЗДАНИЯ АТМОСФЕРЫ СОВРЕМЕННОСТИ

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Приведены несколько примеров применения диалога культур, для того чтобы доказать, что он может быть использован не только как способ сохранения своей истории и своих традиций в памяти, но как и способ обмена информацией, которая в результате может помочь обеим сторонам диалога в процессе создания чего-то нового.

Ключевые слова: диалог культур, межкультурная коммуникация, процесс обмена информацией, процесс создания, современный мир.

Culture is an initial and inevitable compound of every single human being all around the globe. It is invisible, we do not think about it, but we think and act in the frames of it and by its rules. Unfortunately, the perception of culture is sometimes quite underestimated. We understand culture as a collection of historical memories, artistic masterpieces, literature opuses, highlights of musical evolution in various periods of time. Cultural aspects are equal to memories of the past. What we wanted to emphasize is that, of course, it is of utter importance to remember about the past, but in the conditions of the modern world it is also as much important to create something new.

Firstly, we would like to examine how exactly cross-cultural communication works, why it is so significantly important in our life if we want to feel ourselves complete and how helpful it could be in terms of contemporary atmosphere creation.

According to the communication pattern of Mikhail Bakhtin, there are two main prototypes called "Me" and "Other". In his works, he claims that dialogism is peculiar to the nature of consciousness, to the nature of human life. Genuine personal life starts at the point of non-concurrence of us with ourselves. The full understanding of human identity as Bakhtin shows is possible only with the help of the dialogue, because humans can't understand themselves from the

inside and can't even become the real version of "themselves". To understand your own personality better you can't lose yourself, can't dissolve in another person, can't get into other spirits. In other words, identity couldn't be declared neither as an object of expressionless analysis, nor as an object of full solution in it – it should be opened itself in the dialogue with the "Other" [1]. As a result, we will have a whole new person, with a whole new perception of himself, of the environment, of every single little thing existing near him. And that is the process of creation.

Multicultural dialogue is not only about exchanging information, which was shaped with memories about past issues, traditions, and patterns, but it is also about building something new, reformation of old things in the process of connecting and mixing them, getting something absolutely revolutionary.

To prove it and to express the idea more brightly, it would be better to introduce an example illustrating the results of productive cross-cultural communication.

Being a student of the Civil and Industrial Engineering department means a lot to me and what's more important it means that my groupmates and I are a part of that group of society that is fully interested in the quality and up-to-date of the exterior look of our world. Furthermore, to be professional, to create something that would be much more effective, hi-tech and future-looking, we need to find answers and go by the works of the architects and engineers of the past.

The real example of using past experience in the modern sphere of construction is Norman Foster. He is one of the most outstanding architects in the world, award winner of the Imperial Prize and of the Pritzker Prize, the most up market award in the field of architecture. His projects are unleashed all over the globe which makes him an eagerly sought professional. One of his most distinctive already completed projects is the 30 St Mary Axe skyscraper situated in London and built in the form of a cucumber [2].

In numerous interviews, Foster was asked about his source of inspiration and he always answered that his teacher and his icon was a Russian architect and engineer Vladimir Shukhov, so that is why his works and the newest technologies he used in the design process are the source.

So, here it is, the result of multicultural dialogue, the result of combining two cultures: British and Russian, two visions of two different periods of times: 20th and 21st centuries, the result which nowadays lives in the conditions of the modern world and will continue living in a long time after, passing all the knowledge held together to build it.

To recap all things and examples mentioned above, we would like to draw a conclusion and to repeat the idea that multicultural dialogue implies not only holding in memory your past but also using, exchanging and mixing this information to create something new, something that in a few decades can also become a matter of history and an inspiration for someone who is searching for it in development and discovery processes.

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ACCOUNTING FOR CRYPTOCURRENCY OPERATIONS

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The article presents the results of theoretical research of accounting in crypt-currency operations. Since in the accounting and tax accounting of the Russian Federation there is no clear regulation of crypt currency, the subject of the crypt currency operations accounting and methods of its taxation is important.

Keywords: crypt currency, biktoin, mining, accounting.

БУХГАЛТЕРСКИЙ УЧЕТ КРИПТОВАЛЮТНЫХ ОПЕРАЦИЙ

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Представлены результаты теоретического исследования особенностей учета крип-товалютных операций в бухгалтерском учете. Так как в бухгалтерском и налоговом учете Российской Федерации нет четкого регулирования криптовалюты, то вопрос учета опера-ций по криптовалюте и способах ее налогообложения является актуальным.

Ключевые слова: криптовалюта, биткоин, майнинг, бухгалтерский учет.

Due to the development of digital economy business processes management of organizations is changing [5], including accounting and taxation. E-money, or crypt-currencies, has appeared, requiring new tools for accounting. The history of block-chain technology recognition in Russia begins in 2014 [4; 6; 7].

Normative framework of regulation and registration of cryptocurrency transactions is important for accounting and tax accounting [1–3]. At present the following operations with crypt-currency can be performed in Russia:

1. Mining – extraction of digital currency using electronic devices.

2. Exchange of crypt currency for other digital financial assets (e. g. tokens).

3. Exchange of crypt currency for roubles, foreign currency (purchase and sale of crypt currency).

4. Exchange of crypt currency for other assets (actually used as a means of payment in sale and purchase operations).

Here are the business operations that are directly related to the use and acquisition of cryptographic currency:

1. Purchases in roubles are recorded in the accounting records as follows:

Dt 58 Kt 76 – purchase of crypt currency;

Dt 76 Kt 51 – purchase of crypt currency.

In this case, the crypt currency will relate to financial investments that do not specify the current market value, and in accounting will be reflected at cost as of the reporting date (Order of the Ministry of Finance of Russia from 10.12.2002 N 126n, p. 19, 21 (ed. from 06.04.2015) "On Approval of Accounting Regulations "Accounting for Financial Investments" PBU 19/02" (Registered with the Ministry of Justice of Russia 27.12.2002 N 4085).

2. Mining of cryptocurrency.

If the crypt currency is derived from mining, there are two possible approaches in accounting for this business operation:

(a) Accounting for the appearance of crypt currency assets as donations. In this case one should make such an entry in the accounting:

Dt 58 Kt 91.1 – The operation of crypt currency generation as a result of mining;

(b) Recording mining as "production" operations. Computing capacities, electricity etc. are used for mining. Therefore, depreciation of the equipment used for mining, electricity spending (based on equipment consumption), salaries and insurance fees of the employee engaged in the process of mining (that related to mining) – all these expenses form the cost of the generated crypt currency.

In accounting, the cost of mining as a "production process" is reflected as follows:

Dt 20 (26) Kt 02 – depreciation of computing equipment used for mining;

Dt 20 (26) Kt 60 – electricity;

Dt 20 (26) Kt 70, 69 – salaries and insurance fees of the employee engaged in the mining process;

Dt 58 Kt 20(26) – operation of crypt currency generation resulting from mining.

3. Getting the crypt currency when dealing with buyers.

Sales of goods (works, services) in exchange for cryptocurrency are recorded as follows:

Dt 62 Kt 90.1 – Income from sales of goods (works, services);

Dt 90.3 Kt68.VAT – VAT accrued;

Dt 90.2 Kt 41 (26, 44, etc.) — cost of goods was formed;

Dt 58 Kt 76 – crypt currency has been received;

Dt 76 Kt 62 – debts set-off.

4. Payments for goods (works, services) in crypt-currency will be accounted for by the following entries:

Dt 41 (26,44 etc.) Kt 60 – receiving goods (works, services);

Dt 76 Kt 91.1 – withdrawal of crypt currency;

Dt 91.2 Kt 58 – write-off of crypt currency previously accounted as financial investments;

Dt 60 Kt 76 – offsets.

In summary, we can conclude that the cryptographic currency is already a part of financial and economic life. However, the accounting of cryptocurrency is not yet sufficiently developed in legislation, and therefore many unresolved problems remain. Today the Government of the Russian Federation is developing optimal solutions to regulate the crypt currency operations.

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COMMUNICATION SYSTEMS IN THE DECISION -MAKING PROCESS IN ENTERPRISES

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The article considers modern methods of communication used in decision-making. The problems of implementing communication systems in organizations are also emphasized.

Keywords: communications, communication system, organizations, solution, current, modern.

КОММУНИКАЦИОННЫЕ СИСТЕМЫ В ПРОЦЕССЕ ПРИНЯТИЯ РЕШЕНИЙ НА ПРЕДПРИЯТИЯХ

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Рассмотрены современные способы коммуникаций, используемые при принятии реше-ний. А также выделены проблемы внедрения коммуникационных систем в организациях.

Ключевые слова: коммуникации, коммуникационная система, организации, решение, актуальные, современные.

The communication process is very important for the effective work for any organization. The main questions are how to build a communication system more effectively and, which tools should be used to build it?

The communication system is a set of objects, actions, and rules that are used in the process of preparing and data transmission, that are necessary for personal, mass or industrial communication.

The most relevant communication methods used in decision-making are electronic communications, written communications [1], public speaking, webinars, seminars, and video conferences. Also, the most important elements of external communication are faxes, posters, telegrams, etc [2].

In different levels of management managers need to know how they organize different types of communication, that improve the company's activities and the atmosphere within the company, customers' and partners' cooperation.

Choosing a method of communication you must consider such factors as the personal assessment of the manager, the risk level, behavioral restrictions and decisions interconnection [3].

At the stage of introducing communication systems, managers of company meet with particular problems. Than we consider these problems and their solutions.

1. Selective or complete reorganization of the company structure. The reorganization can be conducted at a number of local points. This will not cause a large decline in the activity of current commercial activities.

2. Resistance of the company's employees. This causes a fear of innovation and job loss. The managers of the company should give the employees a sense of inevitability of introduction.

3. Temporary increase in workload on employees. The manager of the company has to increase the motivation degree of employees for study. It is important to take organizational measures to reduce the duration of parallel tasks.

4. The establishment of a competent group for system implementation and maintenance. A small working group is created that is fully trained to work with the communications network. Then this group works to introduce the technology and further develop it by other employees [4].

Consequently, while the implementing modern communication systems, company managers need to consider a large number of communication methods. All of them have their advantages and disadvantages. The choice of communication method is complicated by numerous factors, such as a manager's personal assessment, the level of risk, behavioral restrictions and the decisions interconnection. Also, during the implementing communication systems, there are some problems that will increase the effectiveness of decision-making in organizations.

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THE DIFFICULTIES OF LOCALIZATION USING THE EXAMPLE OF THE VIDEO GAME 'THE LAST OF US'

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The article discusses the problem of localization and analyses the main difficulties that the translator may encounter in the process of localization of video games. During the study, an analysis of the video game 'The Last of Us' was performed, and on the basis of this, possible difficulties of localization are identified, with recommendations being given to solve possible difficulties.

Keywords: localization and translation, video game, translation errors, translation difficulties.

ТРУДНОСТИ ОСУЩЕСТВЛЕНИЯ ЛОКАЛИЗАЦИИ НА ПРИМЕРЕ ВИДЕО ИГРЫ "THE LAST OF US"

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Рассматривается проблема осуществления локализации, анализируются основные трудности, с которыми может столкнуться переводчик в процессе локализации видео игр, дается определение термина 'Локализация', в ходе исследования был проведен анализ видео игры 'The Last of Us', на его основе выявлены возможные трудности локализации, даны рекомендации по решению возможных сложностей.

Ключевые слова: локализация и перевод, видеоигра, переводческие ошибки, трудности перевода.

Nowadays, translation is quite a popular occupation. In connection with the acceleration of scientific and technological process, this sphere is developing rapidly. Translation is the transmission of intentions, feelings and implicit messages without prejudice to the subtleties, features and inherent beauty of language. Translation means simultaneous communication and poetry [1]. Localization is also important. According to the Oxford dictionary, 'Localization is the process of adapting a product or content to a specific locale or market. Translation is only one of several elements of the localization process' [2]. It is easy to guess that localization is an integral part of translation, and most often the process of localization is limited to translation and cultural adaptation of software, video games or websites, so this article pays special attention to the issue of localization in the gaming industry, as it is at this stage of its development.

Every year a large number of video games are produced, which are very popular, and therefore, there is a need for high quality, professional localization. However, there are no set standards for the localization of video games in the Russian Federation; thus, the quality of translation is not at a high level.

The relevance of this study lies in the fact that in connection with the popularization of video games, there is a need to develop certain knowledge and skills for translators. It is necessary to understand and study the features of the game universe to carry out qualitative translation and to preserve the meaning intended by the author.

The aim of the research is to study and describe the main difficulties of localization, as well as suggest various ways to prevent errors caused by these difficulties.

To achieve this goal, the following tasks were identified. Firstly, it is necessary to study the basic concepts and clarify the relation between the terms 'translation' and 'localization'. Secondly, using the example of localization in the video game 'The Last of Us', the main inaccuracies in the translation should be identified as well as the difficulties that specialists in the localization of games may encounter. Thirdly, on the basis of the identified difficulties and translation errors, advice is given on resolving them.

Firstly, the term 'video game' should be defined; the Cambridge dictionary proposes the following definition: 'a video game is a game in which the player controls moving pictures on a screen by pressing buttons' [3]. Video games are in many ways artistic works; they immerse us in a certain world and evoke a large number of emotions in us during the game process. In this article, we have chosen a specific game product, namely 'The Last of Us'.

The atmosphere is vital to the game, and in order for the player to fully penetrate the story of the game, the quality of adaptation must be at a high level. 'The Last of Us' is a survival-action game from the Naughty Dog studio, developed exclusively for the PlayStation 3 platform. It talks about the survival of people in a world devastated by a modern plague, where nature-driven cities are abandoned and a few residents kill each other for food and weapons. Joel and Ellie have to come together and help each other through the ruins of the United States [4].

The first difficulty the translator may face is passing on the meaning of the characters' phrases and sentences without changing the perception of the plot or affecting the hero's personality. This is the most important part in the translation; it is done only to make the phrase sound more natural. In this game, numerous paraphrased expressions, so-called "artistic assumptions", are used. After analysing several passages from the game, we can give the examples in Table 1.

Table 1

Examples of artistic assumptions

Original:	Translation:	Literally:
– "fresh air" – "I want to see these guns" – "You'd be amazed at how many cars still got gas in 'em" [5]	– "kislorod" – "nam nuzhny eti pushki" – "prigoditsya, chtoby slivat' toplivo iz benzobakov"	– "oxygen" – "we need these guns" – "Will be useful to drain fuel from the gas tank"

The next possible difficulty is insensitivity to the game process or insufficient competence of the translator. A number of translation errors have been observed that have had an impact on perception. These kinds of mistakes can ruin the overall impression of the game. We reproduce a passage of dialogue in Table 2.

Table 2

Example of insensitivity to the game process

Original:	Translation:	Literally:
"Joel: Be careful. Tess: What if I am not? Joel: That's trick question?" [5]	Dzhoel: Ostorozhno Tess: Nu yasnoe delo Dzhoel: Vopros s podvokhom?	Joel: Careful Tess: Well, obviously. Joel: That's a trick question?

The phrase 'Well, obviously' does not fit the situation at all. Initially, a translation error was made, in consequence of which the sentence was translated incorrectly. In the original version, Tess flirtily and playfully answers Joel, whereas in the localized version the mood is lost, the given statement sounds ridiculous, and it can evoke a false idea in the player about the character.

One more example is given in Table 3. The context involves a girl getting into a room crammed with dead people.

A further example of insensitivity to the game process

Original:	Translation:	Literally:
"Ellie: Erm ... there's some pretty ugly stuff here..." [5]	Elli: Tut stol'ko vsego interesnogo	Ellie: There's so much interesting here!" (Vigorous voice)

In this fragment, a semantic mistake is made, since in the original version, the girl experiences a feeling of disgust, and in the translation, she seems to be happy with what she sees.

There is also a situation where translators make quite meaningful amendments to characters' remarks, with each line thought up qualitatively by the game's creators themselves, such as: 'He was a good man' translated as 'he was a good friend to me,' although essentially he was not a friend to her, he was just a good soldier. Table 4 contains an example of how a translator can influence the perception of characters' identities.

An example of how the translator can influence the perception of characters' identities

Original:	Localization:	Literally:
"Ellie: You know what? No! How about "Hey, Elly, I know it wasn't easy but it was either him or me? Thanks for saving me? You got anything like that for me, Joel?	Elli: Znaesh' chto, Dzhol? Skazal by: Elli, ya znayu, chto tebe ne legko, no ty spravilas', ty spasla mne zhizn'. Neuzheli eto tak trudno, Dzhoel?	Ellie: You know what, Joel? How about "It's not easy for you, but you did it. You saved my life." How is it so hard, Joel?
A return to this theme in the following cat scene: Joel: Just so we are clear about back there. It was either him or me. Ellie: You're welcome" [5]	Dzhoe: I znaesh', na schet togo raza, spasibo chto spasla mne zhizn' Elli: Na zdorov'ye	Joel: And you know about that time, thanks for saving my life. Ellie: You're welcome

Here, the main thing is that Joel is a harsh, stubborn character, and even after the situation that had happened, he could not thank her. Such moments are important, as in the game there is a focus on the personality of characters and features of their interrelations, and furthermore, this moment is a turning point in their relations.

The next, important stage in the implementation of localization is voicing. Voice actors have one of the most difficult tasks, namely the conveying of the necessary intonation. The voices of actors should be similar to the original voices, with the same emotional tones and accent present. After studying the voice acting in 'The Last of Us', both positive and negative aspects can be identified. Positive ones can include the voice of the secondary characters; it has sufficient emotion and a minimal number of deviations in the voices of the characters.

Vsevolod Kuznetsov voices the main character Joel [6]. He has a great voice and in general, it is pleasant to listen to him. He managed this task well. If you compare it with the original version, the difference is significant. The voices vary greatly, and besides, the original actor providing the speech turned out to be more emotional. Some scenes used incorrect intonation. For example, where irony or sarcasm was supposed to be heard in the character's voice, it was absent, which again changes the character personality. For some of the game's characters, inappropriate actors were chosen, and therefore, some elements of the character were lost. If you compare the original voice of Ellie and the voice actor, there is an incredible difference. In many ways, the intonation was distorted, and in the voice there were none of the emotions that were heard in the original dialogue. From the very beginning of the game, we hear the shortcomings of voice actors, and then the player has a false impression of the character. It is likely that the voice actors could have performed better, but nobody demanded it from them. The developers of the game wanted to create a commendable

product, and that is how it transpired for them after expending a lot of time and effort. Our Russian localization, in my opinion, ruined the impression of the game.

Qualitative localization is a very complex process, consisting of many stages, with many difficulties faced by our Russian localizers. Above were given only a small proportion of such examples. The localization of a video game is like a kind of art. In the analysis of the game 'The Last of Us', ways to solve the problem of localization are suggested. First of all, the translator is advised to fully examine the game itself and related materials before starting the translation. In a company that is engaged in localization, native speakers who specialize in the localization of games will be very useful. Translation must take into account all subtleties, from the specific terminology of a video game to the distinctive features of the game genre. Character dialogues must be adapted with creativity. Preserving the atmosphere and style of play is a major challenge. High-quality voicing is an important component of the localization process; it will help the player to fully immerse himself in the game and get maximum pleasure. Directors must make a strict selection for the voice of characters and control all stages of localization implementation. The timbre and intonation of the actor must correspond exactly to the character of the hero, and for this purpose, it is necessary to clearly understand the character, and study his personality and features. In order to completely eliminate possible errors, the game needs to be tested.

Video game localization and translation plays an important role in the spread of the video game industry around the world. One of the biggest disadvantages will be the lack of theoretical materials about the localization of video games in the Russian Federation. As a result, translators may not be ready for the difficulties that arise in the translation of the game. The study showed that the process of video localization is multifaceted and diverse. Recommendations were made that can qualitatively improve this process on the Russian market.

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THE USING FOCAL OBJECT METHOD TO EXPAND THE PRODUCT RANGE

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Due to the glut of the market with similar products, product development in the modern word requires an increasingly creative approach. The method of focal objects, unlike any other methods that affect the expand of the product range, is characterized by simplicity and unlimited possibilities for finding new points of view on the product being produced.

Keywords: product development, consumer, random object.

ИСПОЛЬЗОВАНИЕ МЕТОДА ФОКАЛЬНЫХ ОБЪЕКТОВ ДЛЯ РАСШИРЕНИЯ АССОРТИМЕНТА ПРОДУКЦИИ

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Совершенствование продукции в современном мире, в силу перенасыщения рынка похожими товарами, требует все более креативного подхода. Метод фокальных объектов, в отличие от любых других методов, влияющих на расширение ассортимента, отличается простотой и неограниченными возможностями поиска новых точек зрения на производимый продукт.

Ключевые слова: совершенствование продукции, потребитель, случайные объекты.

The method of focal objects appeared for the first time, in 1926, when Professor F. Kunze of the University in Berlin created the "Catalog method", which consists in randomly selecting any word from a book or dictionary, then connecting it with the name of the desired object and developing the resulting combinations with the help of associations. But this method could be intended primarily for solving technical problems, so Charles Whiting improved it in 1958 and called it "Focal object method" [1].

The purpose of the method is to overcome the primitiveness of thinking in solving various problems to abstract from the secondary properties of objects and activate the ability to innovate by transferring the features of randomly selected objects to the improving object.

This object must be in the focus of transfer, so the method is called focal [2]. The most important fact is that the generation of non-standard ideas occurs in any case, and their number depends on the number of randomly selected objects.

The relevance of the method lies in the fact that at the moment the market is oversaturated with a huge number of competitive products, which leads to the fact that continuous improvement of the product, using non-standard, original approaches, is almost the only opportunity for manufacturers to remain competitive and maintain leading sales positions [3].

The main idea of the method is to overcome the inertia of thinking. In general, stereotypical thinking has some advantages: it allows you to spend less effort on solving simple tasks.

However in such situations, when you need to attract the consumer's attention, it often paralyzes the mind and dramatically reduces the effectiveness of the activity. It is necessary to develop the creative component of thinking in order to solve this problem, which successfully occurs within the method.

The method implementation follows this algorithm of actions [4]:

1. The product that needs to be improved is determined.

2. Objects are selected randomly. Randomly found objects can be both objects of living and inanimate nature. Nouns are most often used to characterize auxiliary objects. As a rule, 4–5 words are enough at the first stage.

3. The characteristics of auxiliary objects are highlighted.

4. The selected properties are applied to the original object, and based on the new combinations, the search is conducted for really feasible ones.

5. New different types of the investigated product appear as a result of combining with the obtained hypotheses. Then we work with them as with new project ideas.

The transfer of properties of random objects come in a chaotic order, as a result there are a lot of imaginable and unimaginable solutions. The product is considered in the most unexpected concepts, but only real and effective of them are selected. Eventually there are several options to improve the object that allows you to create more than one item in the product range. Expanding the product range by this method allows manufacturing companies to attract the attention of different consumers, since they tend to try an unusual product despite the age, gender or a social status.

The focal object method unlike any other methods, that affect the expansion of the product range, has a large (unlimited) ability to find new points of view on the product being produced [5]. The free transfer of properties of random objects to the product under study allows you to see it in a new, unexpected light, which leads to improved product quality. By improving the product, you can increase its variety, thereby expanding the range of offers.

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УДК 659

ON THE SPECIFICS OF CHILDREN'S PERCEPTIONOF ADVERTISING ALPHAGENERATION

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In this article, the author studies the alpha generation as a generation of children born in the heyday of scientific technologies and the Internet and living in it since childhood. The life of the alpha generation will be strikingly different from the previous generations, because these children, from the very birth, own the Internet, consume a huge amount of information and advertising. Whether they react to advertising in the same way as their parents or consciously ignore it is a question to be answered in order to understand how to do advertising in the future.

Keywords: alpha generation, advertising.

О СПЕЦИФИКЕ ВОСПРИЯТИЯ РЕКЛАМЫ ПОКОЛЕНИЕМ АЛЬФА

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В данной статье автор исследует альфа-поколение как поколение детей, рожденных в эпоху расцвета научных технологий и Интернета и живущих в нем с детства. Жизнь альфа поколения будет разительно отличаться от жизни предыдущих поколений, ведь это дети, которые с самого рождения владеют интернетом, потребляют огромное количество информации и рекламы. Реагируют ли они на рекламу так же, как и их родители, или сознательно игнорируют ее – вопрос, на который нужно ответить, чтобы понять, как именно изменится индустрия производства рекламных материалов в будущем.

Ключевые слова: поколение альфа, реклама.

Children of the Alpha generation are children born after 2010. They are the youngest generation to have letters and numbers in their names. The eldest members of the generation are barely ten years old, so they are poorly understood, but the first characteristics can be identified now. Alpha children are children of the future, born in the heyday of computer technology. They have been consuming a huge amount of content since they were young and know augmented reality, social networks and, in principle, the Internet better than their parents. According to demographers, children of generation A are people born in the digital age, who use the Internet space on a par with reality, consuming a huge amount of information and content every day [1].

Their set of personal qualities is approximately as follows: they appreciate personalization and individual approach, they are balanced, they are less aggressive if compared to the previous generations, they have high moral data and principles, they get along better with parents and in general they are more positive. For children of this generation, virtual reality is no less valuable

than physical reality, and the consumption of multi-channel content forms such a skill as multitasking, but with one drawback – weak concentration of attention on one subject or source of information. They live in a world where thousands of news comes out in a fraction of a second, and focusing on one thing can fall out of that stream [2].

Banner or advertising blindness is a phenomenon that occurs in people of all ages, which is associated with direct ignorance or misunderstanding of advertising materials on websites, forums and possibly offline places or locations. Children of the Alpha generation have grown up in a media environment that is permeated by advertising banners, ads and videos, hence "congenital" blindness to advertising and native materials. If the presentation of advertising was conditionally the same for previous generations, now we can talk about new trends in the development of advertising. The Alpha generation needs a selective, personal approach that will force them to concentrate on a product or service. Positioned as consumers of the future, they will push marketers to increase the importance of attributes such as interactivity, accessibility, social impact and the green factor. As the purchasing power of the Y and Z generations is significantly higher, market advantage will more easily reach those marketers and manufacturers who can be adequate to the preferences of these generations in the battle for the minds and hearts [3].

The author of this work conducted a study among parents of children of the Alpha generation in order to identify the average age at which a child started actively using the Internet, the child's preferences and the impact of advertising on him or her. The following results were obtained: the average age of a child – a novice user – was equal to 5 years, the majority of respondents said that the child follows one or several projects on popular TikTok, YouTube and others, the majority of respondents mentioned that they repeatedly heard from the child mentioning certain brands or their separate products.

Based on the results of the study, it can be concluded that despite the natural innate ability to ignore advertising due to early use of the Internet, children are still unable to completely misunderstand the advertising materials. Colorful and accessible materials are also remembered by the Alpha generation.

The author observed a child of nine years old to study the sensitivity to advertising materials of the Alpha generation. The child really starts using the Internet and social networks early, dedicates a large part of his "working" day to it, watches over personalities or certain channels and then gives feedback based on the advertisements he sees. The child browse to buy a certain product, go to a movie session, etc.

Despite the fact that children of the Alpha generation have grown up in the Internet age, which permeates absolutely all spheres of life and is a source of instant access to a variety of information, they still do not have mechanisms of behavior that completely ignore advertising material, but this does not mean that this perspective will be relevant for several more years. The study found that children are still "subject" to the old mechanisms for advertising, but soon they will understand how it works. The perspective of the advertising industry is approximately as follows: very soon we will need to advertise the new generation – from the new generation to the new generation.

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THE DEMAND FOR A PROGRAMMER PROFESSION IN THE FUTURE: SEVERAL ASPECTS OF THE PROBLEM

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The article deals with the demand for a programmer profession in the future based on an analysis of the professions of the future, list expert opinions and research.

Keywords: automation, professions, Internet of things, programming, apps, computer security, virtual reality.

ВОСТРЕБОВАННОСТЬ ПРОФЕССИИ ПРОГРАММИСТ В БУДУЩЕМ: НЕКОТОРЫЕ АСПЕКТЫ ПРОБЛЕМЫ

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Рассматривается спрос на профессию программиста в будущем на основе анализа профессий будущего, списка мнений экспертов и исследований.

Ключевые слова: автоматизация, профессии, интернет вещей, программирование, приложения, компьютерная безопасность, виртуальная реальность.

At present, the technological process is developing very rapidly, many processes are automated. New technologies are pushing society toward the emergence of new professions. But scientific progress can lead not only to the creation of new professions, but also to the disappearance of already unclaimed ones. In this regard, there is such a problem as the need for a list of demanded professions for the next 10 to 20 years. The aim of the study is to reveal if the programmer profession will be in demand in the future.

Automation is a process in which control functions previously performed by humans are transferred to devices and automatic devices. An automated process is more stable than a process performed by people. Recently, automation of various processes is developing more and more intensively. Therefore, the demand for programmers is growing. Let's consider a list of future professions related to developing applications or systems.

The first is the scope of the Internet of things(IoT). The Internet of things is the concept of connecting any thing to the Internet so that a person can manage this thing, as well as to exchange data [1]. A thing can range from computers, telephones, washing machines, televisions, lamps, and practically to everything you can think of. For example, Smart home, IoT in trade, Remote control of the machine.

The next area where you cannot do without programmers is application development. Nowadays, as technology becomes more developed, more workers are required in the field of information technology. In this regard, there is a growing demand for software developers who

design, develop and maintain software. Specialists in this profession receive a good salary and work in prestigious organizations, e.g. in Google or Apple. It is possible that programming skills will soon become necessary for everyone, it will be difficult to get a job without them [2].

Another important profession in the future is a computer security or cybersecurity specialist, one of the professions that is rapidly gaining momentum at present [3]. Computer security is the protection of data on your computer. You can access other people's information using viruses, hacker attacks, etc [4]. The aim of a computer security specialist is to install data protection on a computer by special software – anti-spyware – programs that are designed to detect unauthorized spyware modules and malware and then delete them. Cybersecurity includes protecting networks, computers, programs and data from attacks, damage or unauthorized access.

Another specialty whose employees will be in demand in the future is the augmented or virtual reality developer [5]. Augmented reality is an environment that complements the world that we see with digital data. Virtual reality is a computer-generated three-dimensional environment with which a person can interact, fully or partially immersed in it. Augmented reality can ultimately have a serious impact on everyone's personal and professional life, as it is likely to affect every industry, event, and public space. Virtual reality developers are needed to intelligently design and plan for the safe and efficient use of this technology.

Consequently, no automation of the process occurs without its initial creation by the programmer and subsequent maintenance.

To get a detailed assessment, let's consider the opinions of experts on this question.

James Scott, a senior fellow at the Institute for Critical Infrastructure Technologies, says that it is already necessary to strengthen cybersecurity in the West now, because national security directly depends on it, and experts are too patient about it [6].

Alexandra Balod, HR Director of 404 Group, thinks that about another ten years, a programmer should not worry about his profession, since throughout this time the demand in the market will be lower than offers. And even if there is an oversupply of personnel, it will not happen quickly.

Bob Martin says programmers have a future, but they will inevitably be regulated like other engineering disciplines. He suggests that eventually, if we continue along the path that we are following and are also not disciplined, the software will cause a rather large-scale disaster. Therefore, it is our own interest to begin to regulate ourselves [7].

Having conducted the research in the form of a poll, we have found that:

Would you like to work as a programmer?

- Yes
- No

Do you consider this profession in demand at present?

- Yes
- No
- Difficult to answer

Do you consider this profession will be in demand in the future?

- Yes
- No
- Difficult to answer

Do you have a lot of familiars who work or are going to work as a programmer?

- Yes, many
- No, few
- I don't have such friends

In your opinion, which profession is more be in demand in society?

Doctor
Programmer
Manager
Fireman

25%
12,5%
62,5%

Which of the following professions is the highest paid?

Doctor
Programmer
Manager
Fireman

25%
12,5%
37,5%
25%

In your opinion, which profession is the most relevant?

Doctor
Programmer
Manager
Fireman

25%
62,5%
12,5%

Determining how much a profession will be in demand in society in the next 10–20 years is a rather complicated process, because it depends on many factors. But on the basis of the poll, we can assume that the profession of a programmer will be in demand in one form or another in the next 10 years.

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Wissenschafts- und Forschungsarbeiten auf Deutsch

DIE VERWENDUNG ELASTOMERHALTIGER MATERIALIEN ZUM SCHUTZ VON PROZESSAUSRÜSTUNGEN UND ROHRLEITUNGEN VOR KORROSION

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Die Möglichkeit der Verwendung elastomerhaltiger Materialien als Schutzbeschichtungen wird in Betracht gezogen. Die Zweckmäßigkeit der Durchführung von Arbeiten auf dem Gebiet der Entwicklung elastomerhaltiger Materialien zum Schutz von Prozessausrüstungen und Rohrleitungen vor Korrosion wird bestimmt. Die grundlegenden Kriterien für die Auswahl eines elastomerhaltigen Materials für den Korrosionsschutz werden beschrieben.

Suchbegriffe: Schutzbeschichtung, elastomerhaltige Materialien, korrosionsbeständige und aggressivbeständige Zusammensetzungen.

ПРИМЕНЕНИЕ ЭЛАСТОМЕРСОДЕРЖАЩИХ МАТЕРИАЛОВ ДЛЯ ЗАЩИТЫ ТЕХНОЛОГИЧЕСКОГО ОБОРУДОВАНИЯ И ТРУБОПРОВОДОВ ОТ КОРРОЗИИ

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Рассмотрена возможность применения эластомерсодержащих материалов в качестве защитных покрытий. Определена целесообразность проведения работ в области разработки эластомерсодержащих материалов для защиты технологического оборудования и трубопроводов от коррозии. Описаны основные критерии при выборе эластомерсодержащего материала для защиты от коррозии.

Ключевые слова: защитное покрытие, эластомерсодержащие материалы, антикоррозионные и агрессивостойкие композиции.

Technologische Geräte und Rohrleitungen in verschiedenen Branchen sind während des Betriebs mechanischen und klimatischen Einflüssen, der Einwirkung biologischer und chemischer

Faktoren sowie deren komplexen Einflüssen ausgesetzt. Die am stärksten aggressiven Faktoren beeinflussen diese Ausrüstung in Industrieunternehmen, beispielsweise bei der Synthese von Polymeren, Wärmekraftwerken usw.

Eine der wirksamen Möglichkeiten zum Schutz von technologischen Geräten und Pipelines besteht darin, auf ihrer Oberfläche (innen und außen) eine Schutzbeschichtung [1] zu bilden, die den langfristigen Betrieb gewährleistet.

Als Schutzbeschichtungen werden verschiedene Materialien verwendet, an deren besonderer Stelle elastomerhaltige Zusammensetzungen stehen, deren Wirksamkeit durch ihre Herstellbarkeit, hohe chemische Beständigkeit und Barriereeigenschaften bestimmt wird [2-7]. Darüber hinaus schützen Elastomerbeschichtungen aufgrund ihrer Elastizität Metalloberflächen vor mechanischer Beschädigung.

Gegenwärtig werden allgemeine Kautschuke (Butylkautschuk, Butadien, Naturkautschuk usw.) und Spezialkautschuke (Thiocols, Fluorkautschuk, Chloropren, Butadiennitril usw.) als elastomere Komponente von aggressionsbeständigen Beschichtungszusammensetzungen verwendet [2–8].

Von den Spezialkautschuken zur Herstellung von Schutzzusammensetzungen verschiedener Typen sind Nitril-Butadien-Kautschuke von größtem Interesse, die gegenüber Ölen, Kraftstoffen, bestimmten Lösungsmitteln und einer Reihe aggressiver Umgebungen hochbeständig sind [8; 9]. Die Strategie der PAG "SIBUR-Holding" [10], die auf die Entwicklung innovativer Materialien abzielt, einschließlich neuer Nitrilbutadien-Kautschukqualitäten mit verbesserten Klebeeigenschaften am Standort Krasnojarsk (AG "Krasnojarsk Synthetic Rubber Plant"), macht es zweckmäßig, Entwicklungsarbeiten durchzuführen Elastomermaterialien zum Schutz der Geräte vor Korrosion.

Bei der Auswahl von Korrosionsschutzgummimaterialien zum langfristigen Schutz von technologischen Geräten und Rohrleitungen in chemischen Anlagen ist deren chemische Beständigkeit bei erhöhten Temperaturen von entscheidender Bedeutung. Gleichzeitig ist bekannt [3; 8], dass Universalkautschuke, die gleichzeitig alle betrieblichen Anforderungen erfüllen, nicht möglich sind. Infolgedessen werden Harze auf Basis verschiedener Phenole und Aminoaldehydharze [11] am häufigsten für gezielte Änderungen der Eigenschaften elastomerhaltiger Schutzbeschichtungen in den Zusammensetzungen [11] verwendet, die sich in Abhängigkeit von den Parametern Kondensation, pH-Wert, Katalysatoren und Verhältnis der Ausgangskomponenten ändern können Klebrigkeit, Viskosität, Verstärkungsfähigkeit und andere Eigenschaften in einem weiten Bereich. Die Wirksamkeit ihrer Verwendung bei der Zusammensetzung von Elastomerzusammensetzungen beruht auf ihrer hohen Verträglichkeit mit einer Carbocenmatrix mit hohem Molekulargewicht [11].

Es ist zu beachten, dass die Auswahl der Korrosionsschutzbeschichtungen immer unter Berücksichtigung des Materials, der Größe, der Konfiguration und des Zwecks des geschützten Objekts erfolgt. In diesem Fall muss das Schutzbeschichtungsmaterial unter Berücksichtigung seiner Temperatur und Konzentration gegenüber dem Korrodenten, mit dem es in Kontakt kommt, beständig sein.

Die technischen Eigenschaften des entwickelten elastomerhaltigen Schutzmaterials sollten Betriebseigenschaften wie Elastizität, Hysterese, statische oder dynamische Scherung, Kompressionsmodule, wiederholte Kompressionsermüdung, Rissbildung, Kriechbeständigkeit, Beständigkeit gegen Öle und Chemikalien, Permeabilität und Sprödtemperatur sowie akzeptabel umfassen Temperaturbereich [5].

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NUMERISCHE INTEGRATION DURCH STATISCHE FUNKTIONSPRÜFUNGEN MEHRERER VARIABLEN

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Der Artikel beschreibt die Vorteile der Monte-Carlo-Methode zur Berechnung von Flugzeugparametern im Vergleich zu anderen Methoden der numerischen Integration sowie ein numerisches Experiment zur Suche nach dem Integral.

Suchbegriffe: statistische Testmethode, numerische Integration.

ЧИСЛЕННОЕ ИНТЕГРИРОВАНИЕ МЕТОДОМ СТАТИЧЕСКИХ ИСПЫТАНИЙ ФУНКЦИЙ НЕСКОЛЬКИХ ПЕРЕМЕННЫХ

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Рассматриваются преимущества метода статистических испытаний для расчета параметров летательного аппарата в сравнении с другими методами численного интегрирования. Проводится численный эксперимент по нахождению интеграла.

Ключевые слова: численное интегрирование, метод статистических испытаний.

In der Luft- und Raumfahrtindustrie sind Integrale weit verbreitet. Mit Hilfe von Integralen werden verschiedene Eigenschaften des Flugzeugs gefunden: Trägheitsmoment, Masse, Festigkeitsparameter. Ohne Integration ist es unmöglich, die Bewegung des Flugzeugs entlang dieser Flugbahn [1] und die Parameter der Flugbahn zu finden.

Sehr oft besitzt der Integrand jedoch keine analytische Repräsentation des Antiderivativs [2]. In solchen Fällen ist es unmöglich, ein bestimmtes Integral mit der Newton-Leibniz-Formel zu berechnen und Integral nach der Newton-Leibniz-Formel zu berechnen. Um solche Probleme zu lösen, wird eine numerische Integration verwendet, mit der wir den Wert eines bestimmten Integrals näherungsweise ermitteln können.

Es gibt verschiedene Methoden zur numerischen Integration. Sie lassen sich in folgende Gruppen einteilen:

1) Methoden, die eine Funktion über die Knoten mit einer anderen Funktion interpolieren, deren analytischer Wert für das Integral bekannt ist (Newton-Cotes-Methoden) [3];

2) Methoden, die die Erweiterung von Funktionen in einer Reihe für die spätere Integration verwenden.

Bei der Betrachtung beider Methoden sind die Nachteile zu erwähnen. Der Nachteil der ersten Gruppe ist die Schwierigkeit, sich auf den mehrdimensionalen Fall auszudehnen. Was der zweiten

Gruppe betrifft, ist die Unmöglichkeit, einige Funktionen hintereinander zu erweitern. Fehlererkennung dieser Methoden ist häufig mit dem Auffinden der Ableitung des Integranden [4] verbunden, die möglicherweise nicht differenzierbar ist.

Eine Methode ohne diese Probleme ist die statistische Testmethode (Monte-Carlo-Methode). Es wird vorgeschlagen, es in diesem Artikel zu verwenden. Der Algorithmus dieser Methode lautet wie folgt:

1) der Funktionsgraph ist durch ein Rechteck beschränkt, dessen Fläche als Sp berechnet wird. Und im Fall eines multiplen Integrals durch ein n-dimensionales Parallelepipedon;

2) N Punkte werden zufällig im Rechteck erzeugt;

3) dann wird die Anzahl der Punkte M bestimmt, die unter den Funktionsgraphen fallen;

4) Annäherungswert des Integrals ergibt sich aus der folgenden Formel (siehe Abbildung):

$$\int_a^b f(x)dx \approx \frac{M}{N} \cdot (d-c) \cdot (b-a) + c \cdot (b-a). \qquad (1)$$

Integration durch statistische Testmethode

Nach der "Drei-Sigma-Regel" [5] wird der Fehler berechnet. Um die minimale Probengröße zu berechnen, um eine gegebene Genauigkeit ε zu erreichen, wurde die folgende Formel erhalten:

$$N = \left(\frac{1,5 \cdot (d-c) \cdot (b-a)}{\varepsilon} \right)^2, \qquad (2)$$

Dabei wird N auf die nächste ganze Zahl Abrundung.

Um die Zuverlässigkeit der statistischen Testmethode zu überprüfen, bestand die Aufgabe darin, die Integrale der Funktionen von einer und zwei Variablen zu finden, die in der Tabelle dargestellt sind. 1 und Tabelle 2 jeweils. Um diese Aufgabe zu lösen, wurde ein Programm in C ++ geschrieben.

Es sendet Anforderungen an den Benutzer, in denen Sie Folgendes angeben müssen:
− bestimmtes oder doppeltes Integral;
− die Berechnungsgenauigkeit;
− integrierbare Funktion;
− die Schranke der Integration;
− Werteschranke der integrierbaren Funktion.

Es erfolgt eine Validierung der Dateneingabe. Bei korrekter Eingabe startet das Programm die Integration nach dem beschriebenen Algorithmus. Während des Integrationsprozeß werden dem Benutzer folgende Daten angezeigt:
− die Anzahl der in die Berechnungen einbezogenen Punkte;
− Integrationswert;
− Integrationszeit;
− Programmausführungszeit.

Um einen Bericht zu erstellen, werden die Integrationswerte in eine Textdatei geschrieben.

Die Ergebnisse von numerischen Experimenten unter Verwendung eines PC, der auf einem AMD RYZEN 3 2200U (2,50 GHz) basiert, sind in der Tabellen 1 und 2 dargestellt.

Zusammenfassend lässt sich sagen, dass die statistische Testmethode einige Mängel anderer Methoden der numerischen Integration nicht aufweist und es uns ermöglicht, den Wert der Integrale mit der erforderlichen Genauigkeit zu finden.

Das Verfahren ist in der Luftfahrtindustrie durch Reduzierung des funktionsbeschränkenden Bereichs sowie eine Ausweitung des Verfahrens auf den Fall von unbeschränkten Integrationsbereichen zur Berechnung ungeeigneter Integrale von praktischer Bedeutung.

Tabelle 1

Die Ergebnisse der Suche nach bestimmten Integralen

Funktion $f(x)$	Integrationsbereich	Funktionswertebereich	Ergebnis	Laufzeit des Algorithmus
x^2	$x \in [0;1]$	$y \in [0;1]$	0,333	3,9 c
e^{-x^2}	$x \in [0;1]$	$y \in [0;1]$	0,746	4,6 c
$e^{-\frac{1}{x^2}}$	$x \in [0;1]$	$y \in \left[0;\frac{1}{e}\right]$	0,089	0,6 c
$\sum_{n=0}^{\infty} \frac{\cos(3^n \pi x)}{2^n}$	$x \in [0;0,5]$	$y \in \left[-\frac{1}{2};2\right]$	0,273	24,3 c

Tabelle 2

Die Ergebnisse der Suche nach Doppelintegralen

Funktion $f(x,y)$	Integrationsbereich	Funktionswertebereich	Ergebnis	Laufzeit des Algorithmus
$\sin(xy)$	$(x,y) \in [0;1] \times [0;1]$	$z \in [0;1]$	0,240	6,0 c
e^{-xy}	$(x,y) \in [0;1] \times [0;1]$	$z \in \left[\frac{1}{e};1\right]$	0,797	2,6 c
$e^{-\frac{1}{xy}}$	$(x,y) \in [0;1] \times [0;1]$	$z \in \left[0;\frac{1}{e}\right]$	0,051	6,7 c
$\sum_{n=0}^{\infty} \frac{\cos(3^n \pi xy)}{2^n}$	$(x,y) \in [0;0,5] \times [0;0,5]$	$z \in [0,4;2]$	0,350	21,5 c

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DIE AKTUALITÄT DER RESERVIERUNG GLOBALER SATELLITENNAVIGATIONSSYSTEME MIT TERRESTRISCHEN RADIONAVIGATIONSSYSTEMEN

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In dem Artikel werden allgemeine Informationen zu Navigationssystemen besprochen. Die Autoren untersuchen die Gründe für das Auftreten von Verletzungen der globalen Navigationssatellitensysteme, die Art und Weise ihrer Reservierung durch Puls-Phase-Radio-Navigationssysteme.

Suchbegriffe: Die Navigation, globales Navigationssystem, Impuls- und Phasenradionavigationssystem.

АКТУАЛЬНОСТЬ РЕЗЕРВИРОВАНИЯ ГЛОБАЛЬНЫХ НАВИГАЦИОННЫХ СПУТНИКОВЫХ СИСТЕМ НАЗЕМНЫМИ РАДИОНАВИГАЦИОННЫМИ СИСТЕМАМИ

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Приведены общие сведения о навигационных системах. Рассмотрены причины возникновения нарушений глобальных навигационных спутниковых систем, пути их резервирования импульсно-фазовыми радионавигационными системами.

Ключевые слова: навигация, глобальная навигационная спутниковая система, импульсно-фазовая радионавигационная система.

Eine der wichtigsten Aufgaben, die seit Jahrhunderten bestehen, ist die Standortbestimmung. Die Wissenschaft, die bei der Lösung dieser Aufgabe entstanden ist, wird als Navigation bezeichnet.

Die Navigation ist die Wissenschaft über Methoden, um optimale Routen für die Bewegung von Fahrzeugen und anderen Objekten zu erstellen. Die vorrangige Aufgabe dieser Wissenschaft besteht darin, die Lage, Geschwindigkeit und Orientierung des Navigationsobjekts zu bestimmen und einen optimalen Pfad zu finden [1].

Die Navigationsaufgabe besteht darin, die genauen räumlichen und zeitlichen Koordinaten des Objekts, seine Geschwindigkeit und seine Bewegungsrichtung zu definieren.

In Radionavigation werden Radionavigationssysteme eingesetzt, um die Aufgabe der Messung von Bewegungselementen zu lösen. Radionavigationssysteme werden als funktechnische Extraktionssysteme bezeichnet, in denen die Position des Objekts anhand von Strahlung, Empfang

und Verarbeitung von Funkgeräten bestimmt wird. Ihre Aufgabe ist es, bei allen Wetter-, Klimabedingungen, zu jeder Tages- und Jahreszeit Auskunft über die aktuellen Koordinaten des Objekts und dessen Geschwindigkeit zu geben.

Die bestehenden Radionavigationssysteme werden in Satelliten- Radionavigationssysteme und Bodenradionavigationssysteme unterteilt. Derzeit spielen globale Navigationssysteme (GLONASS/GPS/Galileo etc.) eine führende Rolle bei der Bereitstellung des Objekts für koordinative und zeitliche Informationen, die eine Reihe von Vorteilen bieten: sowohl die Bereitstellung von Navigationsinformationen überall auf der Welt, als auch die hohe Genauigkeit der Definition von Koordinaten.

Die internationale Erfahrung im Betrieb der Systemdaten zeigt aber, dass es Risiken für Störungen ihrer Leistungsfähigkeit gibt, die auf verschiedene Ursachen zurückzuführen sind. Die Auswirkungen der natürlichen Phänomene lassen sich auf unvoreingenommene Gründe zurückführen. Da die Arbeitsfrequenz der globalen Navigationssysteme im Dezimeter-Bereich der Radiowellen liegt, kann sich die Empfangsstufe der Signale von Satelliten unter dichten Laub von Bäumen oder bei sehr großer Wolkendecke verschlechtern. Die normale Aufnahme von Signalen der globalen Navigationssysteme kann unkommentierte Störungen von verschiedenen Funkquellen sowie Magnetstürme schädigen. Zu den vorsätzlichen Gründen der Störung der Funktionsfähigkeit der globalen Navigationssysteme gehören die Auswirkungen von Betroffenen und Parteien, die vorsätzlich gegen die normale Arbeit der Systeme verstoßen.

In diesem Zusammenhang ist eine unabhängige Reservierung der globalen Navigationssysteme sinnvoll und für diese Rolle eignen sich am besten Bodenradionavigierungssysteme, die eine Art von Impuls- und Phasenradionavigiersystemen sind.

Mit dem Ziel, die erforderlichen Arbeitsbereiche und neue Funktionen der Impuls- und Phasenradionavigierungssysteme zu gewährleisten (Einschließlich der Datenübertragung) sowie zur Erhöhung der Genauigkeit der Koordinations- und Zeitdefinitionen für Impuls- und Phasenradionavigierungssysteme in strategisch bedeutsamen Regionen sind die Entwicklung, Herstellung und Inbetriebnahme neuer automatisierter stationärer und transportierter Übertragungsstationen sowie die Modernisierung bestehender stationärer Stationen erforderlich, die ihre Funktionalität deutlich erweitern und die Eigenschaften für die Verbraucher verbessern sollen. Insbesondere sollte der Ortsfehler des Objekts von dem für die Systeme "Loran-C" und "Möwe" typischen Wert 250...500 m auf die Werte der Reihenfolge 8... 10 m reduziert werden, die mit ähnlichen Eigenschaften der globalen Navigationssysteme [2] verbunden sind.

Auf diese Weise ist es sinnvoll, die Methoden der Signalgenerierung mit hohem Nutzungsfaktor in Systemen zu verwenden, die in den Amplitudenmodi der Eingangsspannung arbeiten, um die taktisch-technischen und betrieblichen Eigenschaften der Bodenimpulse-Phasenradionavigierungssysteme zu verbessern und zu einer unabhängigen Ergänzung der globalen Navigationssysteme und gegebenenfalls deren Reserve zu werden.

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Masters' research

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DESIGN FEATURES OF REFRIGERATING SYSTEMS
FOR THE FOOD INDUSTRY

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This paper is devoted to the study of the design of refrigeration systems for the food industry. The specific features of the meat refrigeration process are considered using a cold-storage chamber for frozen beef as an example. The design of the cold-storage chamber with the use of modern equipment (compressor, condenser, evaporator) is presented.

Keywords: refrigeration system, food industry, cold-storage chamber, design.

ОСОБЕННОСТИ ПРОЕКТИРОВАНИЯ ХОЛОДИЛЬНЫХ СИСТЕМ
ДЛЯ ПИЩЕВОЙ ИНДУСТРИИ

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Исследуются вопросы проектирования холодильных систем для пищевой индустрии. На примере камеры для хранения мороженой говядины рассмотрены специфические особенности процесса холодильной обработки мяса. Представлено проектное решение для холодильной камеры с использованием современного оборудования (компрессор, конденсатор, испаритель).

Ключевые слова: холодильная система, пищевая индустрия, холодильная камера, проект.

The food industry in Russia and the CIS countries is one of the most significant sectors of the economy. This industry provides the population with food, workplaces, and export supplies. Improving the quality of food production is a vital task [1, p. 97].

It is necessary to use modern technologies and equipment in order to provide the development of food industry. This paper presents a research of the modern refrigeration systems design for the food industry using the example of a refrigerating chamber for storing frozen beef.

The purpose of our research is to analyze the design features and operating modes of the beef refrigeration unit. The level of this research is practical and theoretical. The novelty of the study lies in the use of modern refrigeration technologies, modern refrigeration equipment, and analysis of the distinctive features of the process of meat refrigeration. As a test task, a refrigeration unit for storing 180 tons of frozen beef in the city of Krasnoyarsk was designed.

Frozen meat is stored in special chambers, which are prepared for this in the same way as freezers. The load norm per 1 m2 for beef is 450 kg.

The stowing density depends on the weight (mass) condition of the meat carcasses, the methods of cutting and dressing the carcasses, as well as on the permissible loads on the refrigerator floors [2, p. 38].

The storage conditions of the frozen meat are as follows: the relative humidity of the air in the chambers is 95–100 %, the air circulation is natural with pipe cooling and artificial moderate with air cooling. For frozen meat, a storage temperature of at least −18° C is recommended; frozen meat is stored at −20 and −30° C in some countries [3, p. 75].

When storing frozen meat, a number of changes occur. Physical changes are changes in consistency, color, and mass. The consistency mainly changes during freezing due to the formation of ice crystals of various sizes.

In addition, with prolonged storage, muscle tissue decreases due to drying of the meat. Meat fat becomes grainy and crumbles. The color of meat on the surface becomes darker than of a fresh one. The lower the storage temperature of frozen meat, the less these changes.

Biological changes in frozen meat can occur when storage is breached. So, bacteria colonies are usually found in thawed places of frozen meat; mold appears in places where there is no free access to air. These changes can be eliminated by optimal placement of products in the chamber, ensuring the conditions of refrigeration processing, proper sanitary maintenance of storage rooms.

Thus, to ensure the quality of meat products, it is necessary to observe strictly the refrigerated storage conditions, which can be provided with usage of modern refrigeration equipment.

As a result of solving the test problem, a chamber for storing frozen beef was designed. This is a single-chamber refrigerator with a temperature in the chamber – 18 ºC. The building area of the chamber is 624 m2. The working fluid for the refrigeration unit is R134a.

The compressor was selected using the Bitzer equipment selection program. A 6GE-30Y-40P piston semi-hermetic compressor was selected with a cooling capacity of 20.9 kW and a power consumption of 10.35 kW. The selection of the evaporator was made using the Guntner equipment selection program. Two ASHN 050.2F / 24-ANS / 6P evaporators with a capacity of 20 kW were selected. The capacitor was selected using the Guntner equipment selection program. A GCHCRD 050.2 / 13-50-018305M capacitor with a power of 62 kW was selected.

In conclusion, during our work we have found a design solution for a cold storage chamber for meat with the application of modern equipment. This solution provides a stable storage conditions and product quality.

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ANALYSIS OF THE TRANSITION TO DIGITAL BROADCASTING

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This article contains information about the positive qualities of digital broadcasting and a comparison of digital broadcasting standards with analog standards, studies on the possibility of introducing digital radio to improve the quality of services.

Keywords: broadcasting, broadcasting standards, digital broadcasting.

АНАЛИЗ ПРОЦЕССА ПЕРЕХОДА К ЦИФРОВОМУ РАДИОВЕЩАНИЮ

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В данный момент в мире происходит цифровизация радио. Проведено сравнение цифровых стандартов радиовещания с аналоговыми, исследованы возможности их внедрения для улучшения качества услуг.

Ключевые слова: радиовещание, стандарты радиовещания, цифровое радиовещание.

Nowadays several broadcasting services are used for broadcasting, they differ in goals, technical parameters and service areas. The table shows the frequency ranges allocated for the broadcasting service by international agreements for Europe, including Russian Federation, and also provides one of the possible classification variations for broadcasting systems:
analog:
– amplitude modulation (AM) systems, which use frequencies below 30 MHz;
– frequency modulation (FM) systems, frequencies of 30...300 MHz are used;
digital:
– systems with sequential digital stream management (TDM), operating in the UHF and SHF bands;
– systems with parallel digital stream management (FDM), operating in the VHF and UHF bands and at frequencies below 30 MHz [1].
The broadcasting systems presented in the table are specified according to the broadcasting format. The systems mentioned above are either recommended by International Telecommunication Union for worldwide implementation, or standardized by the European Telecommunications Standards Institute.
Ground-based DBCs (Digital Broadcasting) combine many advantages for both listeners and broadcasters, such as: he potential for universal coverage; special coverage (local, regional, national); fixed, portable (indoors) and mobile reception options; easy-to-use receivers with easy

tuning to the required frequency of the radio channel; important information tool for road traffic warning and rescue operations; the quality of sound and multimedia information does not depend on the number of listeners (unlike Internet radio) [2].

Classification of broadcasting systems

Broadcasting Ranges		Broadcasting Formats			
		Analog		Digital	
Name	Frequency ratings, subranges	AM	ЧМ	Single-frequency network (TDM)	Multi-frequency network (FDM)
LF	30…300 kHz	+	–	–	DRM30
MF	300…3000 kHz	+	–	–	DRM30
HF	3…30 MHz	+	–	–	DRM30
VHF 30…300 MHz	Band I – 65,9…74 MHz	–	+	–	DRM+
	Band II – 87,5…108 MHz	–	+	–	DRM+ HD Radio
	Band III – 174…240 MHz	–	–	–	T-DAB/DAB+ ISDB-TSB
UHF 0,3…3,0 GHz	L – 1,45…1,49 GHz	–	–	World Space	T-DAB/DAB+
	S – 1,93…2,70 GHz	–	–	Sirius XM Radio Digital System E	ISDB-TSB
SHF	Ku – 10,7…14,8 GHz	–	–	DSR (till1999 г.) and ADR	–

The total financial costs for broadcasting in digital format are significantly lower than for FM broadcasting. This is due to the fact that digital radio:

− allows to broadcast several radio programs from one transmitter at once;

− allows to implement a single-frequency network, i. e. broadcasting on a single frequency, thereby providing consistent and efficient service;

− reduces energy costs due to the fact that the power of a digital radio transmitter is much lower than that of an FM transmitter.

The main incentive for the introduction of digital broadcasting is a significant improvement in sound quality. The usage of digital standards in the LF, MF, HF ranges implies a significant improvement in the provided services compared to analog AM-broadcasting. However, in the lower bands of the VHF range (Band II), not all listeners feel the improvement in sound quality due to the usage of digital technologies. In many countries, these frequencies are heavily used by several competing FM broadcasters; moreover, in some areas the spectrum is so oversaturated that the addition of new services significantly reduces the coverage area of the station, increasing the level of interference. This problem needs to be solved by digital technologies, thanks to which the number of possible broadcast channels increases several times. However, not every digital radio standard can easily replace FM broadcasting. For example, Eureka 1147 / DAB was developed back in the mid-eighties. The MPEG-1 Layer II compression method used in it has already been

outdated, and the applied digital speed (bitrate) of 128 kbps is not enough to ensure that the sound matches CD quality. A higher bitrate could solve the problem with sound quality, but in this case the number of active radio stations in the assigned frequency band is reduced. Therefore, DAB loses one of its main advantages – a large number of radio stations in a limited frequency band [3].

According to the Geneva-06 agreement, many countries have permission to use the T-DAB standard in the upper band of the VHF (Band III) – as soon as analog television is turned off in this band. Radio stations are likely to use DAB + and T-DMB broadcast formats, which will solve the problem of efficient use of the RF band (DMB is a variant of the DAB standard, designed to distribute video, audio, and data with emphasis on video content, and DAB + is another evolution of DAB, which, in particular, features an improved MPEG AAC audio coding scheme). Nowadays, these standards are used by more than 500 million listeners around the world, consuming more than 1000 services. However, for several reasons, the introduction of digital technology in broadcasting is much slower than the implementation of digital television. In particular, this can be explained by the following factors:

– existing FM receivers provide high quality reception, in connection with which the audience does not feel the urgent need for the transition to digital standards, continuing to use analog technology;

– there are no new attractive services;

– there are a large number of cheap AM and FM receivers;

– the confusion and fragmentation of the market, due to many standards;

– there are no cheap multistandard receivers on the market.

However, there is currently a gradual transition from analogue to digital broadcasting worldwide. There has not yet been a massive disconnection of analogue radio stations, but the transition from analogue to digital technology is an inevitable step for all electronics. Humanity has to switch to digital radio, as analog radio becomes inappropriate in the digital age. But in reality, everything looks a little different.

Countries with highly developed economies are at different stages of radio digitization, and there is no single solution that would be applied in Europe, Asia, Australia and America. In countries such as the UK and Norway, the transition from analogue to digital broadcasting has been successful. In other countries, such as Spain, the switch to digital radio has failed. In India, the explosive growth of analog FM radio is being observed, while digital radio in DRM30 format is being successfully introduced.

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DETERMINING THE THERMAL CONDUCTIVITY COEFFICIENT OF A COMPOSITE MATERIAL USING THE MULTILAYERED STRUCTURE METHOD

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In this paper, we consider a method for determining the thermal conductivity coefficient for a composite material with a multilayer structure in a stationary mode. This technology may find further application in the design of radiation protective screens in spacecraft.

Keywords: multilayer structure, conductance, composite materials, dielectric, radiation screen

ОПРЕДЕЛЕНИЕ КОЭФФИЦИЕНТА ТЕПЛОПРОВОДНОСТИ КОМПОЗИТНОГО МАТЕРИАЛА МЕТОДОМ МНОГОСЛОЙНОЙ СТРУКТУРЫ

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Рассматривается методика определения коэффициента теплопроводности для композитного материала многослойной структуры при стационарном режиме для дальнейшего применения к радиационно-защитным экранам космических аппаратов.

Ключевые слова: многослойная структура, теплопроводность, композиционные материалы, диэлектрик, радиационный экран.

Radiation screens are a multilayer structures (Figure 1). The first layer is a dielectric, to which functional additives were introduced to improve the thermal conductivity of the composite material [1].

Fig. 1. Multilayer structure

From the beginning, a thin, uniform, rectangular plate was considered. There are two types of such plates: 1) limited; 2) infinite.

In the first case, this is a plate, the width and length of which are infinitely large compared to its thickness. Thus, an unlimited plate is a body bounded by two parallel planes. The temperature changes only in one direction (along the thickness of the plate). Therefore, it is one-dimensional. The temperature remains the same everywhere in each such layer.

The second case is a rectangular plate of a specific size ($a{\times}b$). It is possible to neglect the thickness of the plate, supposing that it is too thin compared to its size. Here, the temperature already depends on two coordinates – x, y, so this is a two-dimensional case. In this situation, the physical meaning is to find the temperature at a specific point. This is a significant difference from the previous case.

Let us consider the process of stationary heat conduction through a three-layer flat wall. The layers are available in thicknesses (δ_1, δ_2, δ_3) adhere to each other and have different values of thermal conductivity (λ_1, λ_2, λ_3). This process is stationary, that is, the heat flux q = const, and is directed along the x axis (Figure 2).

Fig. 2. Temperature distribution in a multilayer flat wall

Constant temperatures T_{c1} and T_{c4} are applied to the surfaces of the outer planes, with $T_{c1} > T_{c4}$ between the temperature layers T_{c2} and T_{c3}.

The heat transfer equation through each layer are written as

$$q = \frac{\lambda_1}{\delta_1}(T_{c1} - T_{c2}), \tag{1}$$

$$q = \frac{\lambda_2}{\delta_2}(T_{c2} - T_{c3}), \tag{2}$$

$$q = \frac{\lambda_3}{\delta_3}(T_{c3} - T_{c4}). \tag{3}$$

These equations for the temperature difference can we rewritten as

$$T_{c1} - T_{c2} = q\frac{\delta_1}{\lambda_1}, \tag{4}$$

$$T_{c2} - T_{c3} = q\frac{\delta_2}{\lambda_2}, \tag{5}$$

$$T_{c3} - T_{c4} = q\frac{\delta_3}{\lambda_3}. \tag{6}$$

The equations 4–6 can be added

$$T_{c1} - T_{c2} + T_{c2} - T_{c3} + T_{c3} - T_{c4} = q\frac{\delta_1}{\lambda_1} + q\frac{\delta_2}{\lambda_2} + q\frac{\delta_3}{\lambda_3} = \left(\frac{\delta_1}{\lambda_1} + \frac{\delta_2}{\lambda_2} + \frac{\delta_3}{\lambda_3}\right), \tag{7}$$

Then

$$q = \frac{T_{c1} - T_{c4}}{\dfrac{\delta_1}{\lambda_1} + \dfrac{\delta_2}{\lambda_2} + \dfrac{\delta_3}{\lambda_3}} = \frac{T_{c1} - T_{c4}}{\Sigma_i \dfrac{\delta_i}{\lambda_i}}, \tag{8}$$

Values $\dfrac{\delta_i}{\lambda_i}$ are the thermal resistance of the individual layers comprising the multilayer wall.

The equation of thermal conductivity of a flat wall with a steady process of heat transfer will has the following view

$$Q = A \frac{T_{c1} - T_{c4}}{\dfrac{\delta_1}{\lambda_1} + \dfrac{\delta_2}{\lambda_2} + \dfrac{\delta_3}{\lambda_3}} = A \frac{T_{c1} - T_{c4}}{\Sigma_i \dfrac{\delta_i}{\lambda_i}}, \tag{9}$$

where A is the surface of the body.

For each layer, in thickness, the temperature will change linearly; in general, the temperature profile is a broken line, and $\lambda_2 > \lambda_1 > \lambda_3$.

The low thermal conductivity of many composite materials is explained by their porosity; the pores contain air with a thermal conductivity of about 0,027 W/(m · K).

For most pure metals, thermal conductivity λ decreases with the increasing temperature. The presence of impurities in metals significantly reduces their thermal conductivity [2].

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BIG DATA APPLICATION ANALYSIS FOR FINDING AN EFFECTIVE DIMENSION

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The paper considers the method of principal components for finding the effective dimension of space. A brief description of method a and the NIPALS algorithm is provided. Issues related to finding the main components and determining the dimension of space are considered.

Keywords: principal component method, algorithm, orthogonality.

ПРИМЕНЕНИЕ АНАЛИЗА БОЛЬШИХ ДАННЫХ ДЛЯ НАХОЖДЕНИЯ ЭФФЕКТИВНОЙ РАЗМЕРНОСТИ

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Рассматриваются метод главных компонент для нахождения эффективной размерности пространства. Приведено краткое описание метода и алгоритм NIPALS. Рассмотрены вопросы, связанные с нахождением главных компонент и определения размерности пространства.

Ключевые слова: метод главных компонент, алгоритм, ортогональность.

The idea of the method is to search in the initial space for a hyperplane of a given dimension with the subsequent projection of the sample onto a given hyperplane [3]. In this case, that hyperplane is chosen for which the data design error for which is minimal in the sense of the sum of the squared deviations. Consider an arbitrary orthonormal basis in space R^A: $w_1, \ldots, wA$, $w_i^T w_j = \delta_{ij}$, where $\delta_{ij} = (i = j)$ is the Kronecker symbol. Without loss of generality, we assume that the first d vectors of this basis $w_1, \ldots, w_d$ form the basis of the desired hyperplane. Then the points of the hyperplane are defined as

$$x = w_1 t_1 + \ldots + w_a t_a + \mu = Wt + \mu. \tag{1}$$

where in $t_1, \ldots, t_d$ – coordinates of a point x in the basis of the hyperplane

$W = \left(w_1 | \ldots | w_a \right) \in R^{A \times a}$ – matrix whose columns are the basis vectors $w_1, \ldots, w_a$, $\mu \in R^A$ is the shift vector. The search for a hyperplane providing the minimum quadratic design error can be written as

$$J = \sum_{n=1}^{N} \left\| x_n - Wt_n - \mu \right\|^2 \to \min_{w_1, \ldots, w_a, t_1, \ldots, t_a}. \tag{2}$$

We introduce the following notation:

$$\bar{x} = \frac{1}{N}\sum_{n=1}^{N} x_n \text{ -- sample means;}$$

$$S = \frac{1}{N}\sum_{n=1}^{N}(x_n - \tilde{x})(x_n - \tilde{x})^T \text{ -- sample covariance matrix.}$$

Consider the eigenvectors and eigen values of the matrix S: $S = Q\Lambda Q^T$, where $\Lambda = diag(\lambda_1, ..., \lambda_A)$, Q is the orthogonal matrix ($Q^T Q = I$), in the columns of which there are eigen vectors .

Assume, without loss of generality, that the eigen values are sorted in descending order $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_A$. It can be shown that the optimization problem (3) has the following analytical solution: *of* $w_1, ..., w_a$ are the eigenvectors of the matrix S corresponding to d the largest eigen values $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_a$, $\mu = \tilde{x}$, $t_n = W^T(x_n - \tilde{x})$. Moreover, the value of the criterion J at the minimum point is equal $\sum_{n=a-1}^{N}\lambda_i^2$. Thus, the amount of design error for optimal hyperplane is the amount of data dispersions cast by the dimensions determined eigenvectors $w_{a+1}, ..., w_A$. Along with the criterion of minimizing design errors, we can consider an alternative criterion for the search for a hyperplane associated with maximizing the spread of the designed sample points.

Let $\hat{S}$ – sample covariance matrix for the projected points in the cleanup. Then the spread can be defined as $tr(\hat{S})$. In the one-dimensional case, this criterion coincides with the variance of the data. It can be shown that the solution to problem (2)

$$tr\hat{S} \to \min_{w_1, ..., w_a, t_1, ..., t_a \cdot \mu}, \qquad (3)$$

coincides with the solution of problem (2). Moreover, for the optimal hyper plane, the value of the criterion $tr\hat{S} = \sum_{i=1}^{a}\lambda_i$, where, as before, λ_i – are the eigen values of the sample covariance matrix S for the original sample.

So, the principal component method involves the transition from the original basis to the basis of the eigenvectors of the covariance matrix S with further discarding the projections of the sample onto the eigenvectors corresponding to $A = a$ to the smallest eigen values. In the basis of eigenvectors, the covariance matrix S has the diagonal form $\Lambda = diag(\lambda_1, ..., \lambda_d)$. Thus, features obtained using the principal component method are uncorrelated. Transitioning to uncorrelated traits is often a smart method for preprocessing raw data.

Scheme of the method of principal components. Suppose we have a matrix of variables X dimension ($M \times N$), where M – the number of samples (rows), and N – is the number of independent variables (columns), which is usually much ($N \gg 1$). The principal component method uses new, formal variables t_a ($a = 1A$), which are a linear combination of the original variables $\mathbf{x}_j$ ($n = 1, N$):

$$t_a = p_{a1}x_1 + ... + p_{an}x_n. \qquad (4)$$

Using these new variables, the matrix X can be decomposed into the product of two matrices T and P

$$X = TP^t + E = \sum_{a=1}^{A} t_a p_a^t + E. \qquad (5)$$

The matrix T is called the matrix of *accounts*. Its dimension ($M \times A$).
The matrix P is called the *load* matrix. Its dimension ($N \times A$).
E is a *residual* matrix *of* dimension ($M \times N$).

Fig. 1. Decomposition into main components

New variables t_a called *principal components,* and therefore the method is called the method of principal component analysis (*the PCA*).The number of columns is t_a in the matrix T, and p_a in the matrix P, equal to A, which is called the *number of principal components* (*PC*).This value clearly less than the number of variables N and the number of samples M.

An important property of the PCA is the *orthogonality* (independence) of the main components. Therefore, the matrix of accounts T *is* not rebuilt with an increase in the number of components, and just another column is added to it – corresponding to a new direction. The same happens with the matrix of loadings P.

Most often, to build *PCA* accounts and loads, a recurrence algorithm is used NIPALS (*Nonlinear Iterative Partial Least Squares*) [2], which calculates one component at each step. First, the original matrix X *is* transformed (centered) and transformed into the matrix E_0, $a = 0$. Next, apply the following algorithm.

Check the stopping criterion; if not, return to step 2 of the algorithm.

After computing the next component, we set $t_a = t$ and $p_a = p$. To obtain the next component, we need to calculate the core $E_a + 1 = E_a - t\, p^t$ and apply the same algorithm to them, replacing the index a with $a + 1$.

As input data, the probabilities of the frequency of occurrence of a sequence of 3 amino acids in the DNA of chloroplasts of the weed were selected. After executing the program, we obtained the load matrix P and the matrix of accounts T, as well as the value of the residual matrix E for each number of principal components pa.

Finding effective dimension using an algorithm *as NIPALS.* The *NIPALS* algorithm was implemented in *C++*. As input data, the probabilities of the frequency of occurrence of a sequence of 3 amino acids in the DNA of chloroplasts of the weed were selected.

After executing the program, we obtained the load matrix P and the matrix of accounts T, as well as the value of the matrix of residuals E for each number of principal components p_a.

In order to determine the dimension of space, one needs to study how the quality of the description changes with an increase in the number of *PCs*, namely, how the sum of the squares of the residual matrix changes.

Fig. 2. Graph of changes in the values
of the matrix of residues E

Figure 2 shows the dependence of the sum of squares of the residual matrix on the number *PC*. It can be seen that the change in their behavior is quite smooth. Therefore, it is difficult to determine the correct number of principal components, which could correctly describe the effective dimension of space.

Thus, the NIPALS algorithm was considered, with the help of which the effective dimension of space was found.

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A REVIEW OF AUTOMATED DEEP-LERNING BASED ELECTROENCEPHALOGRAPHIC SIGNAL RECOGNITION

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The paper represents the review of the current state-of-the-art in deep learning electroencephalogram processing for the research and the clinical domain aims.

Keywords: electroencephalogram, EEG, neural networks, deep learning, data resources, review

ОБЗОР МЕТОДОВ АВТОМАТИЧЕСКОГО РАСПОЗНАВАНИЯ ЭЛЕКТРОЭНЦЕФАЛОГРАФИЧЕСКОГО СИГНАЛА НА ОСНОВЕ ГЛУБОКОГО ОБУЧЕНИЯ

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Представлен обзор современного состояния в области автоматизированной обработки электроэнцефалограмм на основе глубокого обучения для исследовательских целей и клинической практики.

Ключевые слова: электроэнцефалограмма, ЭЭГ, нейронная сеть, глубокое обучение, источники данных, обзор.

Electroencephalogram (EEG) is widely used for clinical inspection of patients with epilepsy. Seizure disorders affect badly the quality of life of people exposed to this disease. In addition, EEG is used for patients with Mild Cognitive Impairment, Depression affects, Alzheimer's disease and many another disorders. EEG is useful for a brain-computer interfaces (BCIs) and sleep monitoring.

The manual review of an EEG requires lot of experience, is a laborious and tedious process. Automatic analysis can alleviate the time consumption caused by manual visual inspection of EEG. Automated recognition of encephalograms (EEGs) is important because can reduce the diagnosis time.

In this paper the state of researches of automated EEG processing is examined from the point of view of the following questions:

1. What topics of deep learning (DL) technology research in area of automated electroencephalograms interpretation addressed?

2. What EEG processing methods researchers are used for this task?

3. What data resources used in studies for training, validation and test phases of deep learning algorithms?

"*The scalp electroencephalogram (scalp EEG)* is a non-invasive measure of the electrical potentials generated by the activity of tens of millions of neurons within the brain" [6]. EEG time series data is a non-stationary signal, its statistics vary across time. Recently, deep learning technology has been widely applied to perform time series processing tasks.

Fully-connected (FC) network. "FC layers are composed of fully-connected neurons, i. e., where each neuron receives as input the activations of every single neuron of the preceding layer" [5].

Convolutional Networks (CNN) are a specialized kind of neural network for processing data like time-series data and image data. Convolutional networks employs a mathematical operation called convolution in place of general matrix multiplication [1]. Convolutional layers impose a particular structure where neurons in a given layer only see a subset of the activations of the preceding one [5].

Recurrent Neural Networks (RNN) are a family of neural networks for processing variable-length sequential data [4].

An autoencoder (AE) is a neural network what is trying to copy its input to its output. But, they copy only approximately, and copy only input that resembles the training data. It often learns useful properties of the data [1].

Restricted Boltzmann machines (RBM) are undirected probabilistic graphical models containing a layer of observable variables and a single layer of latent variables. RBMs are the most common building blocks of deep probabilistic models [1].

A deep belief network (DBN) is a hybrid graphical model involving both directed and undirected connection. A deep belief network could be efficiently trained using a greedy layer-wise pretraining strategy [1].

Generative adversarial network (GAN) are generative modeling approach based on differentiable generator networks [1].

According to Roy Y. et al. as result of analyzing 156 studies published between January 2010 and July 2018 applying deep learning to EEG data "most studies (86 %) focused on using DL for the classification of EEG data, most notably for sleep staging, seizure detection and prediction, brain-computer interfaces (BCIs), as well as for cognitive and affective monitoring. Around 9 % of the studies focused instead on the improvement of processing tools, such as learning features from EEG, handling artifacts, or visualizing trained models. The remaining papers (5 %) explored ways of generating data from EEG, e. g. augmenting data, or generating images conditioned on EEG" [5].

Figure shows the most often used architectures for EEG processing.

a   *b*

Deep learning architectures most recently used in the studies [5]
a – architectures; *b* – distribution of architectures across years

Because the collecting of EEG data have the relatively high cost, more than half the studies used publicly available data [5] such as the TUH EEG CORPUS [2] and CHB-MIT [7]. The Table represents a comparison of two public EEG datasets for detecting epileptic seizures.

Comparison of selected public EEG datasets [7]

Dataset	Data type	No. of subjects	Total duration	No. of samples	Labeled info
TUH	Seizure/ epilepsy	14000	~ 16 000 h	N/A	Seizure types
CHB-MIT	Seizures	22	916 h	173 seizure events	Seizure

The TUH EEG CORPUS is the largest publicly available dataset of EEG records, which consist of a set of EEG sessions. This dataset contains EEG records labelled as either clinically abnormal or normal. For example, the TUH Abnormal EEG Corpus, which is the part of TUH EEG CORPUS, consists of 1488 abnormal and 1529 normal EEG sessions. The dataset is demographically balanced with respect to gender and age of patients. It also was divided into a training set (1361 abnormal/1379 normal samples), and a test set (127 abnormal/150 normal samples) [2–4].

In this paper, we have focused on EEG processing methods and datasets for deep learning research. Machine learning approaches are capable to predicting seizure events with high accuracy. Automatic evaluation and classification of electroencephalographic (EEG) data are currently very important subjects of research. Current challenges in EEG processing are low signal-to-noise ratio and variability of EEG due to physiological differences between individuals.

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MODELING THE OPERATION OF THE ELECTRIC DRIVE USING THE SIMINTECH

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The SimInTech simulation environment allows researching the static and dynamic characteristics of the designed pair: an electric DC motor – gearbox. To conduct the study, a model of the designed pair is developed.

Keywords: electric drive, SimInTech simulation environment, model of a pair of DC motor – gear.

МОДЕЛИРОВАНИЕ РАБОТЫ ЭЛЕКТРОПРИВОДА С ПОМОЩЬЮ СРЕДЫ SIMINTECH

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В среде моделирования SimInTech выполнено исследование статических и динамических характеристик спроектированной пары: электрический двигатель постоянного тока – редуктор. Для проведения исследования была разработана модель спроектированной пары.

Ключевые слова: электропривод, среда моделирования SimInTech, модель пары двигатель постоянного тока – редуктор.

The stages of production and operation of on-board measuring instruments of aircraft include tests, which are an integral part of the production process [1].

To conduct laboratory research on the characteristics of on-board measuring instruments at the Department of Automatic Control Systems, a test bench is being developed to create external angular impact on on-board measuring instruments at heading, pitch, and roll angles. The test bench is a three-stage rotary support device (electric drive) with a platform to install the device under test.

According to the definition given in GOST R 50369–92, an electric drive is an "electromechanical system consisting of electric converters, electromechanical and mechanical converters, control and information devices and devices for interfacing with external electrical, mechanical, control and information systems, designed to bring in the movement of the executive bodies of the working machine and control this movement in order to implement the process" [2]. From this definition we can see that a modern electric drive is a combination of electrical machines, converters, devices and their control systems.

Designing electric DC drives is a multi-stage process consisting of several basic steps: selecting an electric motor and gear ratio of a gearbox, building a structural diagram of a system,

choosing elements of an unchanged part of an electric drive, synthesizing the dynamic characteristics of a tracking system, choosing the type of controllers, calculating their parameters and determining static and dynamic characteristics of the electric drive [3].

The purpose of the research is to determine the static and dynamic characteristics of the designed pair: an electric DC motor – gearbox.

Modeling the static and dynamic characteristics of the designed pair is carried out in the SimInTech package [4].

Figure shows the developed electric drive model, which provides an investigation of the operating modes of pair "electric motor – gear".

Electric drive model

$$\begin{cases} \dfrac{dq_{\text{н}}(t)}{dt} = \omega_{\text{н}}(t), \\[2mm] \dfrac{d\omega_{\text{н}}(t)}{dt} = \dfrac{M(t)}{J}, \\[2mm] M(t) = f_3\left[\dfrac{d_{\text{дв}}(t)}{i} - d_{\text{н}}(t) - k \cdot \omega_{\text{н}}(t)\right]. \end{cases}$$

In the above diagram, two blocks are considered: a gear and a direct current motor (DCM). The first block implements a mathematical model of the gearbox without taking into account the inertia of the intermediate stages of mechanical transmission and the phenomenon of friction in elastic elements. 3 equations of block's dynamics are used: two differential equations and one algebraic.

The equations contain: i – gear ratio; J – load moment of inertia, kg·m^2; k – friction factor applied to the load shaft, N·m·s; $q_{\text{н}}(t)$ – angle of rotation of the load shaft (output shaft), rad; $\omega_{\text{н}}(t)$ – angular velocity of the load shaft, rad/s; $q_{\text{дв}}(t)$ – angle of rotation of the motor shaft (input shaft), rad; $M(t)$ – moment that developed in the elastic element, reduced to the load shaft, N·m; $f_3[\ldots]$ – designation of non-linearity of the type "dead zone" with the parameters "a" and "c".

The input signal in this block is the angle of rotation of the input shaft in radians. Output signals: angle of rotation of the load shaft (rad), angular velocity of the load shaft (rad / s) and the moment developed in the elastic element, reduced to the load shaft (N · m).

DCM block implements a mathematical model of a DC motor with independent excitation.

$$\begin{cases} M_{\text{д}}(t) = k_{\text{м}}i(t), \\[2mm] \left(R + L\dfrac{d}{dt}\right) \cdot i(t) = u(t) - k_{\text{č}} \cdot \dfrac{dq(t)}{dt}, \\[2mm] J \cdot \dfrac{d^2q(t)}{dt^2} M_{\text{д}}(t) - M_{\text{в}}(t). \end{cases}$$

This mathematical model contains: $u(t)$ – voltage applied to the motor armature, V; $i(t)$ – current in the motor armature circuit, A; $q(t)$ – angle of rotation of the motor shaft, rad; $M_\text{д}(t)$ the moment developed on the motor shaft, N · m; $M_\text{в}(t)$ – disturbing moment on the motor shaft, N · m; $k_\text{с}$ – counter-emf coefficient; $k_\text{м}$ – moment coefficient; R – motor armature circuit resistance, Ohm; L – motor inductance, GN; J – moment of inertia of the rotor of the engine, kg · m^2 (for absolutely rigid mechanical transmission without play, instead of the moment of inertia of the rotor of the engine, the reduced moment of inertia $(J + Jni^2)$, where Jn is the moment of inertia of the load) should be considered.

The input signal in this block is the moment and voltage, and the output signals are the angle of rotation of the shaft, the angular velocity (frequency) of rotation and the moment developed on the motor shaft [5].

The performed modeling and tuning of the electric drive model made it possible to evaluate the correctness of the results obtained during the design process and to carry out preliminary tuning of the electric drive parameters. The graphs obtained during modeling showed that the designed system provides the specified quality of transients.

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USING VISUALIZATION AND EDUCATIONAL EQUIPMENT IN THE STUDY OF SPECIAL DISCIPLINES

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The paper presents the importance of visual aids in teaching special disciplines. It is shown that training technical training aids to expand educational opportunities need to be created on the basis of microcontrollers and functional modules of the Arduino family.

Keywords: visualization, training technical training aids, microcontroller, Arduino family.

ИСПОЛЬЗОВАНИЕ НАГЛЯДНОСТИ И ТЕХНИЧЕСКИХ СРЕДСТВ ОБУЧЕНИЯ ПРИ ИЗУЧЕНИИ СПЕЦИАЛЬНЫХ ДИСЦИПЛИН

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Представлено значение применения наглядных средств обучения при преподавании специальных дисциплин. Показано, что тренажерные технические средства обучения для расширения образовательных возможностей, нужно создавать на базе микроконтроллеров и функциональных модулей семейства Arduino.

Ключевые слова: наглядность, тренажерные технические средства обучения, микроконтроллер, модули семейства Arduino.

The Department of Automatic Control Systems is training bachelor students in the direction of 03.24.02 "Motion control systems and navigation", specialist students in the direction of 05.24.06 "Aircraft control systems" and graduate students in the training direction 04.24.02 "Motion control systems and navigation". Students are trained for further work at enterprises in the aerospace industry, such as:

– Joint-Stock Company «Krasnoyarskiymashinostroitel'nyyzavod» (Krasmash) is the largest enterprise in the military-industrial complex of Russia, the main manufacturer in Russia of ballistic missiles for submarines, as well as the base module of the booster block for «Zenit» and «Proton» launch vehicles;

– Reshetnev Joint-Stock Company "Information Satellite Systems" is a leading Russian enterprise in the development of spacecraft for communications, broadcasting, relaying, navigation, and geodesy;

– Joint-Stock company Central Design Bureau "Geophysics" of the Federal Space Agency;

– Joint Stock Company Design Bureau "Iskra". The company is one of the three largest satellite communications operators in Russia, and confidently occupies a leading position in the communications market of the Siberian region;

– Joint-Stock company Scientific-Production Enterprise "Radiosvyaz's". It is one of the high-tech enterprises of the Krasnoyarsk Territory and Russia.

These enterprises produce sophisticated high-tech equipment. Therefore, the professional training level of graduates who come to work for these enterprises should be very high. The achievement of the required quality of graduate training is facilitated by the use of modern material teaching aids, which are also called didactic aids.

Didactic teaching aids are an indispensable element in the equipped classrooms and their information-subject environment, as well as the most important component of the educational material base of educational institutions of various types and levels. The learning aids include various material objects especially for educational purposes and those involved in the educational process.

Currently, much attention is paid to the use of teaching tools that meet one of the basic principles of pedagogy – the principle of visibility. This is due to the fact that the methods of using visualization allow us to show complex phenomena, processes in their development, their dynamics, manage the process of assimilation of knowledge by transmitting educational information in specific doses and in a certain sequence.

The principle of visibility is based on the following strictly fixed scientific laws:

– human senses have different sensitivity to external stimuli, the vast majority of people obtains the most sensitive organs of vision;

– bandwidth of communication channels from receptors to the central nervous system is different: optical communication channel – 1.6×106 bits / sec; acoustic – 0.32×106 bps; tactile – 0.13×106 bps. This means that the organs of vision "pass" into the brain almost 5 times more information than the hearing organs, and almost 13 times more than the tactile organs;

– information entering the brain from the eyes (through the optical channel) does not require significant transcoding, it is imprinted in a person's memory easily, quickly and firmly [2].

The figurative visual form of representation of the studied material contributes to its better assimilation. For example, the great Russian teacher K.D. Ushinsky wrote: "Whoever did not notice that our memory better keeps those images that we perceive through contemplation, and that to such a picture that crashed into us, we easily and firmly bind even abstract ideas that would have quickly erased without that" [3].

The principle of visualization is reflected in the teacher's use of visual teaching aids (technical teaching aids), the use of which "in the process of teaching special disciplines has certain features related to the specifics of their content and study methods. If in the study of general educational disciplines the visual aid helps better understand the principle, the basic idea, then in the study of technical disciplines the main ones are the specific structure of the object, the working scheme, the interaction of details and mechanisms" [4].

When organizing the educational process, various technical teaching aids are used that allow students to implement the desired didactic function using special technical devices. From the whole variety of technical means used in this work, we single out training technical means (TTM) – "specialized training devices that are designed to form initial skills. The use of simulators in training is based on the use of specially designed action programs compiled on the basis of the process of modeling the activity being mastered. TTM are especially widely used in the process of teaching technical specialties" [5].

With the advent and development of digital technology, devices used in education, in particular, training equipment began to develop. They began to connect with computing devices, and using these devices to control the functions of training equipment.

Microcontrollers are widely used as computing devices. The microcontroller built into the training equipment can be programmed so that the TTM can be used not only as a simulator when teaching students, but also as an examiner when checking students' level of training. Moreover, the microcontroller will allow depending on the quality of answers to questions to determine the final grade and keep statistics for each student.

From the whole variety of microprocessor technology and peripherals, a platform based on Arduino boards and modules can be distinguished. Despite its simplicity, Arduino boards can play a key role in turning any technical ideas into the desired finished product and significantly reduce the cost of developing automated systems [6].

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FACTORS OF INNOVATIVE ACTIVITY OF SCIENTIFIC ENTERPRISES

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This article provides a definition of such concept as a science-intensive enterprise; it defines the range of basic science-intensive industries, explores the factors affecting innovative activity of science-intensive enterprises.

Keywords: innovative activity, factors of innovative activity, science-intensive enterprise.

ФАКТОРЫ ИННОВАЦИОННОЙ АКТИВНОСТИ НАУКОЕМКИХ ОРГАНИЗАЦИЙ

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Дается определение такого понятия, как наукоемкое предприятие, определяется круг базовых наукоемких отраслей промышленности и, исследуются факторы, влияющие на инновационную активность наукоемких предприятий.

Ключевые слова: инновационная деятельность, факторы инновационной активности, наукоемкое предприятие.

Historically, science-intensive enterprises are the ones that have production facilities with high absolute and relative (in relation to total costs) R&D costs. Efforts in the research and development field allow high-tech enterprises to develop and implement the newest innovative technologies, which can then be used in other less technological sectors, which increases the overall competitiveness of industry products.

Most science-intensive enterprises are developing in high-tech industries.

In the Soviet period, high-tech industry and production included major part the engineering industry, chemical industry, microbiology, and other related fields. As science and technology move forward, so do the high-tech industries.

Russia's high technology field currently includes [1]:
– pharmaceutical product industry;
– office equipment and computer production industry;
– production of components and parts for radio, television and communication;
– production of medical equipment, instruments for measurements, control, management and testing;
– optical instruments, photo and film equipment;
– production of aircrafts, including space industry.

These production industries require permanent assessment of the level of their innovative development. The term "level of innovative activity" widely known in the scientific sources may be used as a tool for such assessment. Innovative activity is a complex dynamic characteristic determined by the degree of effectiveness, intensity, rationality and timeliness of innovative activities of an enterprise which depends on the innovative climate and is aimed at ensuring the competitiveness of the enterprise. Considering the fact that innovative activity is a complex and dynamic characteristic, it is being permanently affected by various factors – both external and internal. Thus, knowing these factors and the ability to manage them becomes the essential part of the success of any high-tech enterprise.

The main external factors affecting innovation activity include demand, supply, competition, legislation, and geopolitical environment in the country.

One of the key factors in the innovative development of science-intensive enterprises is a market demand. The demand for technological innovations from society depends on the possibility of the industrial introduction of innovations and production of specific goods and services required by the world and domestic markets. As an example of imbalance in supply and demand we can use a marketing research of the state of innovative development of micro- and nano-electronics enterprises in the Zelenograd technology-innovative zone. The respondents included representatives of such companies as RIME and Mikron OJSC, MV Milander JSC, Decima LLC, ZNTCs JSC, etc. The survey was carried out in the form of independent written filling out of the questionnaire by the respondents. With a very high evaluation of the novelty of own developments and innovations (75 % of respondents believe that they correspond to world analogues), the answers to the question "Do you have difficulties promoting innovations on the market, and if so, how often?" indicate that 90 % of respondents have difficulties.50 % of respondents always face difficulties, 30 % face them from time to time,10 % – sometimes [2].

The supply of financial, scientific-production and human resources for the implementation of effective innovation is also an important factor in innovation activity. Such factors as aggregate market supply and demand or competition have a significant impact on the direction and intensity of the development of innovative activities of an enterprise. To win in the market competition battle, science-intensive enterprises must strive for technical and technological leadership, they must be able to find new markets and transform the old ones. The rate of equipment modernization, developing and introducing new technologies in production is turbulent in nature, which leads to increased competition. Having a high innovative potential, the vast majority of enterprises in the Russian Federation have low competitiveness in the world market.

One of the important factors in the increasing of the innovative activity of science-intensive enterprises is a free access to the international market of technical and technological innovations. Therefore, foreign trade and customs factors play a key role in increasing the innovative activity of science-intensive enterprises. The development of innovative activities of science-intensive enterprises is closely connected with innovations in customs authorities and promising areas of development in the management system of customs authorities [3]. Introduction of electronic technologies of declaration and payment of customs fees significantly reduces the terms of customs clearance, which ultimately allows to speed up the exchange of goods and services between countries, facilitates the access of enterprises to world scientific achievements and technology and, as a result, increases the innovative activity of enterprises [4].

We should also mention the difficulties caused by the current geopolitical situation. Many science-intensive industries use components with a "sanctioned" status. In this regard, science-intensive enterprises face two opposite poles based on import substitution. Import substitution, as a factor in the innovative development of enterprises, can have both positive and negative effects on the innovative activity of enterprises. On the one hand, import substitution plays a stimulating role in the innovative development of domestic enterprises which produce a component base for science-intensive enterprises, creating comfortable environment for production.

The main internal factors of innovative activity include:

1. Production and technological resources that characterize the production base of science-intensive enterprises; the ability of an enterprise to hold innovative activities and maintain a research and development department, a design department, specialized laboratories, as well as patent, licensing, and information departments.

2. Human resources. Innovative activity of key employees ensures a high level of efficiency of innovative activity of a science-intensive enterprise. The most important characteristics of the human resources of a high-tech enterprise are: susceptibility to innovation; intensity and timeliness of actions aimed at transforming novelties into innovations; the ability to mobilize the required potential for commercialization of innovations. Thus, the innovative activity of the staff can be presented as an integral part of the innovative activity of the enterprise.

The factors listed below determine the effectiveness of innovative activities of science-intensive enterprises, which, on the one hand, makes it possible to influence the innovative activity of enterprises, and, on the other hand, to analyze the innovative activity of enterprises by assessing these factors and the degree of their influence on innovative activity.

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JOINT 3D FACE RECONSTRUCTION AND DENSE ALIGNMENT WITH POSITION MAP REGRESSION NETWORK

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This article describes 3D face reconstruction of a human face based on position map regression network.

Keywords: layer, convolutional neural network, image, face, loss function.

СОВМЕСТНАЯ 3D-РЕКОНСТРУКЦИЯ ЛИЦА И ПЛОТНОСТНОЕ ВЫРАВНИВАНИЕ С ПОМОЩЬЮ РЕГРЕССИОННОЙ СЕТИ КАРТЫ ПОЛОЖЕНИЙ

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Рассмотрено создание 3D-модели человеческого лица на основе регрессионной сети карты положений.

Ключевые слова: слой, сверточная нейронная сеть, изображение, лицо, функция потери.

Estimation of facial shapes has a fundamental place for face transfer and face animation. Precise 3D face reconstruction often applies expensive and iterative approaches which are inappropriate for real-time usage [1].

Position Map Regression Networks (PRN) is a new approach to jointly regress dense alignment and 3D face shape in an end-to-end manner. This approach was proposed by Yao Feng. According to him this new method needs only 9.8ms for one pass per image because this method is based on a light-weighted model. It outperforms all previous methods at both 3D face alignment and 3D face reconstruction [2].

Yao Feng and his team propose a UV position map as the representation of a 3D facial structure. This UV map is a 2D image which is used to store a dense collection of 3D coordinates of points from 3D model with its semantic meaning. Then simple encoder-decoder network is trained with a weighted loss to regress the UV position map from a single 2D facial image. Figure 1 shows the UV position map and extracted UV textures.

When the input RGB image is converted into position map image, an encoder-decoder structure is employed to learn the conversion function. The encoder part consists of 11 layers:1 convolution layer and10 residual layers which reduce the $256 \times 256 \times 3$ input image into $8 \times 8 \times 512$ output feature maps. The decoder part consists of 17 transposed convolution layers which are used to create the predicted $256 \times 256 \times 3$ position map. All kernels have identical size of 4 for all

convolution or transposed convolution layers. ReLU function is used as an activation function. Figure 2 represents the architecture of the network.

Fig. 1: The illustration of UV position map. Left: 3D plot of input image and its ground truth 3D point cloud. Right: The first row is the input 2D image, extracted UV texture map and corresponding UV position map. The second row is the x, y, z channel of the UV position map. Since the position map stores a dense collection of points from 3D facial model with its semantic meaning, the 3D facial model and dense alignment result can be obtained simultaneously by using a CNN to regress the position map directly from 2D images.

Fig. 2: The architecture of PRN. The Green rectangles represent the residual blocks, and the blue ones represent the transposed convolutional layers.

As shown in Figure 3, the weight mask is a gray image. It includes value of the weights for each point on position map. Points are separated into four groups. Each group has its own weights in the loss function. The position of 68 facial key points has the highest weight, so that to ensure the network to learn accurate locations of these points.

Fig. 3: The illustration of weight mask. From left to right: UV texture map, UV position map, colored texture map with segmentation information (blue for eye region, red for nose region, green for mouth region and purple for neck region), the final weight mask.

The loss function is defined as

$$Loss = \sum \| P(x, y) - \tilde{P}(x, y) \| * W(x, y).$$

Table represents the run time results. The hardware used for evaluation is an NVIDIA GeForce GTX 1080 GPU and an Intel(R) Xeon(R) CPU E5-2640 v4 @ 2.40GHz.

Run time in Milliseconds per Image

3DDFA	DeFA	3D-FAN	3DSTN	VRN-Guided	PRN
75.7	35.4	54.7	19.0	69.0	9.8

PRN method needs only 9.8ms for both 3D reconstruction and dense alignment [3].

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NEURAL NETWORKS FOR DETERMINING THE OPTICAL FLOW

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In this article various neural networks for finding of optical flow are considered and their main advantages and disadvantages are described.

Keywords: optical flow, neural network, movement, pyramidal convolution network, convolution layer.

НЕЙРОННЫЕ СЕТИ ДЛЯ ОПРЕДЕЛЕНИЯ ОПТИЧЕСКОГО ПОТОКА

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Рассмотрены различные нейронные сети для определения оптического потока, описываются их преимущества и недостатки.

Ключевые слова: оптический поток, нейронная сеть, движение, пирамидальная сверточная сеть, слой свертки.

Optical flow is a technology used in various areas of computer vision to determine shifts, segmentation, object extraction, video compression [1]. Optical flow can be determined using various algorithms or neural networks. Currently, development based on neural networks is gaining popularity.

One of the developments is the determination of optical flow using a pyramidal convolutional neural network of long short-term memory (LSTM) with learning without a teacher [2]. The structure of this network consists of three modules: a universal module of the convolutional neural network used to extract special features, a motion detection module that allows to determine motion vectors, and an optical flow receiving module that determines the optical flow based on the received motion data. As the main network in this development, the ResNet18 universal neural network is used as a network for determining the parameters used for subsequent processing. In addition to this network, ConvLSTM is used, which is necessary to capture the dynamics of movement on the CNN pyramid. This type of network is used to train long-term dependencies. When training ordinary neural networks, in particular convolutional neural networks, we can store small information at each training step, which every time is overwritten by newly acquired information. LSTM modules help to avoid this problem by storing values at different time intervals [3]. This is due to the fact that these modules do not use the activation functions inside serial components, but transmit all the information along the entire network chain. Thus, when using the back-propagation method during network training, the stored value is not destroyed, but only partially modified using special filters.

Filters can be varied, usually the update process consists of four stages. At the first stage, the information that can be destroyed is selected. Values from the previous layer are passed through the function, after which those values that are closer to 0 are discarded. In the second step, the appropriate data is selected to update the state of the cell. At the third stage, the cell values are updated with the new values, but are not overwritten, just changed using various formulas. At the last stage, the result is fixed and the output information is obtained based on the current state of the cell. In this way, all network layers are updated. Of the most commonly used types of filters are used: peephole connections, combined filters, Gated recurrent units, Deep Gated recurrent neurons, and Clockwork RNN. ConvLSTM network is similarly arranged in the development described above. This network uses four "gateways" to control the flow of data and self-renewal: the input gateway, the forget gateway (it was mentioned in the first stage of network modification during training), the cell update gateway, and the data output gateway. Entrance cards of objects are received and a convolution operation between them is performed. To determine the optical flow, developers approach this task as an image restoration task. According to the developers, the resulting structure is able to efficiently study the optical stream in real video, and the motion characteristics and restoration of the optical stream are distributed, which allows to reduce the number of errors when processing multi-frame sequences. Testing was performed on the data sets HMDB51 and UCF101. Networks based on the convolutional neural network model for determining the optical flow of FlowNet also took part in testing. This development allowed to reduce the time of determining the optical flow by more than 2 times, compared with the FlowNet2 neural network and by 3 times, compared with the FlowNetC neural network. Regarding the accuracy of the determination, this neural network shows 53.5 and 82.8 percent accuracy on the HMD51 and UCF101 datasets, respectively. For comparison, in FlowNet2 these indicators are 52.3 and 80.1, in the TV-L1 algorithm, which does not use neural networks, 56 and 83.9, in the FlowNet neural network, it is even worse – 38.6 and 55.3. However, although the performance of the algorithm without the use of neural networks is slightly higher, while FlowNet2 practically does not differ, it is worth noting that the processing time is much lower, as mentioned earlier.

The second development is a simple method for determining the optical flow based on a convolutional neural network with a review of data accuracy and regularization [4].

We give the comparative characteristics of networks.

As in the previous development, the basis is the use of two non-interconnected modules, one of which is responsible for obtaining features of movement, and the second receives an optical stream. The generic name is LiteFlowNet, which includes two subnets called NetC and NetE. The first of them converts a pair of images into two feature pyramids of each images, and NetE consists of stream output and regularization layers. The decoder evaluates the two received streams from NetC using intermediate values on different layers of the module. This approach resembles a solution with a long short-term memory in the previous development, when intermediate values were not overwritten and were used in subsequent training. Much attention is paid by developers to regularization. Regularization is used in machine learning to set additional restrictions in order to solve an incorrectly posed problem or prevent retraining. In this neural network, regularization is applied between convolutional layers and it is a functionally-controlled local convolution. The kernels of this convolution are adaptive to the characteristics obtained from the encoder and to the flow estimation. This approach allows you to make regularization oriented both to the stream and to the image.

Compared to the FlowNet2 neural network, this network consists of two "short" neural networks, while FlowNet2 is a "long" network. This feature allows you to work this network 1.5 times faster than the popular FlowNet2 network. In addition, the developers modified their network and introduced the second version of LiteFlowNet2, which is 2.2 times faster than the first version of the network and 3.1 times faster than the FlowNet2 network. In accuracy, thesenetworks of the first and second versions are not inferior to existing developments and often surpass them.

Thus, in these neural networks, an approach was used using two neural networks: a feature detection module and an optical flow determination module. This allows us to simplify the

architecture of the neural network (compared to FlowNet2) and reduce the cost of computing resources. In addition, the separation approach made it possible to increase the accuracy of determining the optical flow, due to the reduction of errors arising from the training of a single neural network.

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DESIGNING AN INTELLIGENT SYSTEM FOR INDIVIDUALIZED LEARNING PROCESS

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The article considers the actualization of the problem of individualization and differentiation of the learning process in educational organizations, through the introduction of the program StudentPro. The necessity of using information technology and computer-aided training programs in the learning process is proved. As a solution to the problems identified, StudentPro was developed and described.

Keywords: information technology, learning process, individualization of learning, training program.

ПРОЕКТИРОВАНИЕ ИНТЕЛЛЕКТУАЛЬНОЙ СИСТЕМЫ ИНДИВИДУАЛИЗАЦИИ ОБРАЗОВАТЕЛЬНОГО ПРОЦЕССА

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Рассматривается актуализация проблемы индивидуализации и дифференциации процесса обучения в образовательных организациях, с помощью внедрения программы StudentPro. Доказана необходимость применения информационных технологий и обучающих компьютерных программ в учебном процессе. В качестве решения выявленных проблем разработана и описана программа StudentPro.

Ключевые слова: информационные технологии, образовательный процесс, индивидуализация обучения, обучающая программа.

At present the learning process needs constant improvement, since there is a rapid change in priorities and social values. Actually scientific and technological progress is increasingly recognized as a means of achieving such a level of production that is most responsive to meeting the constantly increasing human needs, the development of the spiritual wealth of the individual. Therefore, the current situation in the training of specialists requires a radical change in the strategy and tactics of learning at the university.

Indeed, improving the individual learning process cannot do without various modern information and communication technologies (ICT). By these technologies we mean devices and methods for obtaining, processing and transmitting information thanks to computer software [1].

Moreover, teachers with ICT skills are considered to be one of the main parts of modernizing the quality of education. The teacher must create a learning environment that will spawn all the

conditions for the implementation of the individual educational orientation of a student moving along his own educational trajectory.

However, to increase the efficiency of using new ICT in the learning process, it is necessary to improve the quality of electronic textbooks and software. To do this, it is necessary to develop scientific and technical cooperation among universities on this issue. Due to the accumulation of educational information resources, innovative technologies will occupy a worthy place in the learning process of the university, thus, it will be possible to form different levels of training and retraining programs for specialists on their basis [2].

In the educational environment that has formed nowadays, new areas of activity are being designed and implemented that ensure the transition to modern information technologies. The main stage of the transition is the use of training programs that will contribute to the maximum activation of students, the individualization of their work and provide students with the opportunity to manage their cognitive activities independently [3].

To implement the individualization of the learning process, StudentPRO automated learning environment was created. It consists of a database and a management program.

StudentPRO is a powerful and convenient software package with an intuitive interface for testing students on certain topics of the discipline or in several subjects in an automated mode, selecting a personal task in accordance with the level of their training. To implement multi-user access, the program is installed in a network folder that contains a database and a program, as well as folders with theoretical material, practical tasks and pictures.

Before starting work with the program, the administrator registers users in the database. The program considers four types of users, each with its own specific functions (see Table):

Types of users and their functions in the program

Type of user	Functions
Student	Takes a test to determine the level of knowledge on topics or several disciplines; receives practical tasks for independent implementation and theoretical material; looks through the performance of the material.
Teacher	Keeps an electronic journal; adds questions and practical tasks in accordance with the level of knowledge, theory; monitors the progress of the students.
Deanery	Generates reports on performance, both about an individual student, and about the whole group or about the whole institute.
Administrator	Tests and debugs the program, manages the database.

The main objective of the StudentPRO software package is to give an opportunity to evaluate the level of students' training in disciplines independently (without the involvement of a teacher).

Thus, the previously traditionally prevailing function of the teacher is transformed into the task of supporting learning. The student's position, in turn, goes from a passive state to an active one. Namely, the student, who previously was only the recipient of the finished information, now takes an active part in cognitive activity and independently obtains and processes information.

The introduction of this program in the learning process minimizes the routine of the teacher, increasing the speed of mastering the material and individualizing the learning process, as well as conveniently generating reports on students' performance.

The main feature used in StudentPro is an individual approach to each student and an emphasis on the active participation and interest of the student in learning. It is realized by using a gradation of levels of knowledge on the topics. The differences between the levels are illustrated in Figure.

Levels are used as follows. Before starting to study a topic, the student must prepare for it, review the literature and basic aspects of a new topic. Then, in a classroom session in the StudentPro program, the student must obtain admission to this topic. Admission is a test of basic questions on a new topic. The student's level of knowledge is determined based on the results of admission. Subsequently, this level determines what grade the student can expect. Thus, this approach "encourages" the student to pass the admission as best as possible in order to get good

grades. Therefore, the student will study the base of the new topic in advance, will "dig deeper". Moreover, this approach really helps to determine the level of knowledge of students on this subject, since there is no subjective approach to learning; the program simply determines the real knowledge of the student.

Levels of knowledge in StudentPro.

Individual approach to the student is implemented in other aspects. It is advantageous for the teacher to make tests with different options for a more accurate assessment of knowledge. All you need is an extensive question pool. The program will give students questions and answer options in different order, which will allow you to create individual test options for each student.

Individual versions of practical tasks are another method that implements active independent training of students, because it will be impossible to cheat, as everyone has different options. The only condition for the teacher is again an extensive pool of practical tasks.

Having analysed all the information mentioned above, we can draw the conclusion that the program StudentPRO can be used by any educational institution (university, college, school) both in order to identify the level of knowledge in any academic subject, and for educational purposes.

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PROCESS APPROACH IN THE QUALITY MANAGEMENT SYSTEM

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The relevance of the article is determined by the trend of introducing quality management systems in the organization, but without a specific choice of management method and choice of management approach. The aim of the article is to study and analyze the advantages of the process approach of managing a quality management system. The author shows a quality management system based on a process approach. The authors try to highlight the main aspects that should be biased in the implementation and operation of the quality management system, as well as the need to take measures to finalize the quality management system.

Keywords: quality management system, process approach, management, quality.

ПРОЦЕССНЫЙ ПОДХОД В СИСТЕМЕ МЕНЕДЖМЕНТА КАЧЕСТВА

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Актуальность статьи определяется тенденцией внедрения систем менеджмента качества в организации, но без определенного выбора метода управления и выбора подхода к управлению.

Целью статьи является изучение и анализ преимуществ процессного подхода управления системой менеджмента качества. Показана система управления менеджмента качества на основе процессного подхода. Выделены основные аспекты, на которые стоит сделать уклон при внедрении и эксплуатации системы менеджмента качества, а также необходимость провести мероприятия по доработке системы менеджмента качества.

Ключевые слова: система менеджмента качества, процессный подход, менеджмент, качество.

According to the annual report of ISO in 2010 in Europe, including Russia, 530722 certificates of ISO 9001:2008 were issued. However, the so-called "process approach" in management on which this standard is based, like many other ISO standards, is far from clear to everyone.

In the text of ISO 9001:2008 its principle is interpreted very fluently – the main focus is on practical application. It says that in order to apply a process approach, an organization should "identify" and manage "multiple and interconnected activities". After these clarifications, the standard describes the PDCA cycle – Plan-Do-Check-Act. The creation of mechanisms to carry out this seemingly straightforward cycle is part of the great work on the implementation of the QMS.

What do you plan? How to act? What is the essence of the process approach? Understanding this, limiting ourselves only to the text of the standard, is not easy.

This topic is covered by a special guide issued by the 176 ISO committee that worked on the development of ISO 9001. It's called: "Guide to the concept and use of the process approach for control systems". In the circles of quality specialists, this text is considered to be the most accessible explanation of the essence of the process approach and its practical application.

So, the process approach is specific methods of working with quality, which are based on the vision of the organization in terms of the processes that occur in it. A process is a combination of interconnected and interacting activities in an organization. The process and actions are synonyms, determined by a number of initial requirements and resources, other conditions that management sets in them.

Processes, which there are many in any system, convert input to output, are the results in the broadest sense of the word. Input data can include a very wide range of aspects of organizational activity: people, materials, equipment, methods, measurements, environment.

Ultimately, everything that can affect the effectiveness of a process is in the hands of decision-making management.

Processes in organizations: market research, procurement, resource management – are constantly repeated, so the output of one process can be at the same time the input of another. Understanding the work of organization from a process point of view may seem terminological shuffling, especially if it has not yet introduced a process approach.

In practice, it most often happens that the most important consequences of certain actions for which resources are spent fall out of sight. This happens simply and naturally. Even those who have been systematically engaged in quality for a long time and implement standards in their company may be mistaken.

The validity of this statement is well illustrated by the example described by J. Nive, a student of the creator of the process approach, W. Deming, an American mathematician-statistician. This book is called Dr. Uncle Deming's Universe. Nive writes that he observed the implementation in the English company of a quality management system based on statistical data, that is, mainly by mathematical methods of quality.

By mistake, the company adjusted the result of the analysis in accordance with the quality system, and not vice versa, as it should be. Such errors are fraught with serious losses, therefore it is very important not only to understand the work of the company as a process, in all the complexity of this phenomenon, but also to build a system in which the process and its properties are the core elements.

The PDCA cycle is the "schedule" of the process approach. It gives an idea of when and in what sequence it is necessary to apply the management tools developed within the framework of this approach. Constant repetition of PDCA allows not only to maintain the quality of products or services that a company is engaged in, but also to improve it.

To plan means just to identify all the processes important for the result, create new ones, if it turns out to be expedient, to develop goals, in other words, planned outputs, formulate a quality policy at the enterprise, establish criteria for monitoring the processes that are launched, to determine indicators by which it will be possible to judge the evolution of processes. At this stage, it is recommended, where possible, to use statistical methods for evaluating the process.

To do means to implement the processes that were created.

To check implies an analysis of the output, which is not real without the "bookworm" in its thoroughness of documenting processes. The analysis is based on data from process monitoring that was carried out in the course of activities. The results are checked against the policies and goals in the field of quality, product requirements. Information on the results of the analysis should be appropriately communicated to all specialists involved in working with ISO 9001. The expected exits are planned again. Last but not least, at this stage, specific opportunities are identified for improving the production process.

Finally, to act means to make organizational conclusions from the analysis and make the necessary changes at the input level.

In addition, to the process approach to management, there are a number of other theoretical developments: a situational approach, an integrated, marketing and a number of others. The main advantage of the process approach over them is the carefully designed horizontal control, that is, control at the borders of the processes.

The process approach is based on the fact that the types of activities, that make up the entire work of an enterprise or organization, interact. If you organize this interaction, you can get a huge synergistic effect.

It is very important that forced control by the management of joint processes during their interaction creates continuous control, which is not achieved by most other approaches. It is unlikely that this will be possible to evaluate in numerical terms, because not all processes can be expressed in terms of statistics, but the whole cannot be reduced to the sum of the parts – a break – and there is a possible profit. Among other specific advantages that the process approach promises are: transparency of operations within the organization, cost optimization, a clearer idea of all employees about their responsibilities, a clear prioritization in the field of quality.

To summarize, the important key points that are paid great attention to when implementing the process approach are: understanding and fulfilling the prescribed requirements; the need to consider processes in terms of added value; consideration of the results of processes; performance and continuous process improvement. These moments help the process approach to take up over other approaches when implementing the QMS in the organization.

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HIERARCHICAL CLUSTERING

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The paper provides an overview of hierarchical clustering methods. In general, clustering methods slice the data set into nonoverlapping clusters based on similarity of objects. The two main visualization techniques for hierarchical clustering are provided. There are details and main features of several enhanced hierarchical clustering algorithms.

Keywords: hierarchical clustering, linkage method, dendrogram, cluster heatmap.

ИЕРАРХИЧЕСКАЯ КЛАСТЕРИЗАЦИЯ

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Представлен обзор методов иерархической кластеризации. В целом, методы кластеризации разделяют набор данных на непересекающиеся кластеры на основе сходства объектов. Предоставлены две основные техники визуализации иерархической кластеризации. Приведены детали работы и основные особенности нескольких улучшенных алгоритмов иерархической кластеризации.

Ключевые слова: иерархическая кластеризация, метод связи, дендрограмма, кластерная тепловая карта.

Nowadays, technology evolution leads humanity in the world where one of the biggest challenges is dealing with huge amount of data that are produced every day. The data are considered so important because they often hide useful information and dependencies. Automatic pattern recognition is a way to bring insights in practice.

The main goal of clustering is to find groups of objects, which are similar within the group and dissimilar with other group's objects. Hierarchical clustering algorithms [1] produce not only one partition of the data, but a sequence of nested cluster partitions, with a single all-inclusive cluster at the top and single-point clusters at the bottom. Such hierarchy structure of subsets leads to better understanding the data (in contrast with partitional clustering methods), especially at the exploratory data analysis.

Agglomerative hierarchical algorithms [2] are probably the "most intuitive" approach to grouping data, because they approach the problem in a similar way to how a human would implement. At the start, each data point is an individual cluster. These atomic clusters are merging into larger and larger clusters, until all of the objects are finally lying in a single cluster. At every step, the algorithm is joining the most similar clusters, the total number of clusters decreases by one.

In contrast, divisive hierarchical methods [3] are top-down clustering methods. Starting from single cluster, which includes complete set of the data, at each step one of existing clusters is divided into (usually) two smaller subclusters. The number of clusters is decreasing by one until it becomes equal to the size of the data set.

An important objective of hierarchical cluster analysis is to provide a picture of the data that can easily be interpreted. The results from hierarchical clustering are typically presented as a dendrogram [4]. Dendrograms list the clusterings one after another. Each leaf node is a data point, while the root node represents the whole data set. The height expresses the distance between a pair of data points or clusters. The greater the difference in height, the more dissimilarity.

More advanced representation of clustering results is a cluster heatmap [4], sometimes called a double dendrogram. In general, a heat map is a two-way display of a data matrix in which the individual cells are displayed as colored rectangles. The color of a cell is proportional to its position along a color gradient. The order of the variables is determined by performing hierarchical cluster analyses of the variables. This tends to position similar variables together on the plot. Heatmap representation helps you easily pick important dataset features. Therefore, hierarchical clustering can be a valuable tool for rearranging variables and observations in a data set in order to highlight interesting patterns [4].

To define distances between each pair of points from data set certain metric is used. It might be Euclidean distance, Manhattan distance or some other [2]. The question is how to measure the similarity of clusters? In other words, we need to compute the distance between an object and a cluster and the distance between two clusters. How this distance will be determined has a significant effect on clustering results.

There is no "the best" linkage method, it really depends on the type of application [1]. The average linkage is aimed at finding roughly ball-shaped clusters. Being relatively robust, this method can even deal with rather potato-shaped clusters. The nearest neighbor rule has the chaining effect: whenever both clusters come too close to each other, even when this happens at just one point, the clusters immediately stick together. This property can be useful as well as not. The nearest neighbor method is well suited for finding elongated clusters. On the contrary, the furthest neighbor method has no chaining effect. Instead, it leads to produce very compact clusters, which means that they have a small diameter. The resulting clusters are not necessarily well separated, because clusters will not be joined when they contain at least one pair of too distant points.

The weakness of classical hierarchical clustering algorithm is a lack of robustness and sensitivity to noise and outliers. Once an object is assigned to a cluster, it cannot move in other clusters in a hierarchy. In fact that means the algorithms cannot correct possible previous misclassification. As a result of such requirements, many new clustering methods, with hierarchical cluster results, have appeared and improved the clustering performance.

Balanced Iterative Reducing and Clustering Using Hierarchies (BIRCH) [5] algorithm describes clusters not by the member points, but using cluster's summary. The Clustering Feature vector includes the number of points in the cluster, the linear and the square sum of the data points. The cluster hierarchy is built as a height-balanced Clustering Feature Tree where nodes represent clusters by their Clustering Feature vector. The algorithm has such advantages as ability to deal with large data sets and the robustness to outliers.

The similar idea to store not all cluster members is implemented in Clustering Using Representatives (CURE) [6] algorithm. A constant number of well-scattered representatives defines a cluster. A set of points instead of one helps to discover non-spherical shapes and reduces sensibility to outliers. A combination of random sampling and partitioning makes CURE able to handle large databases.

The core of Hierarchical Clustering Algorithm Using Dynamic Modeling (CHAMELEON) [7] is an adaptive dynamic model, which takes into account both the inter-connectivity as well as the closeness of the clusters. Two clusters are merged only if they are close to each other and homogeneous (similar internal inter-connectivity). The clustering starts from pre-clustering: k-nearest neighbor graph constructed according to the initial data is split with minimal edge cut into

a large number of relatively small sub-clusters. That core sub-clusters is an entry point for applying the dynamic model. CHAMELEON can discover natural clusters of different shapes and sizes, because its merging decision dynamically adapts to the cluster features.

Thus, since large datasets cannot be observed and processed by human, automatic pattern recognition becomes important. Suitable clustering method depends on application domain and on the natural structure of the data. Hierarchical clustering is a good tool for getting a first impression of the data structure and identify natural clusters, often without any priori information of the data structure. Moreover, it produces a sequence of nested partitions, revealing more information than non-hierarchical algorithms that returns a unique partition. However, for large datasets many computational efforts are needed, therefore hierarchical clustering is still a challenge for big data applications.

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FEATURE DETECTION AND MATCHING IN COMPUTER VISION

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This article discusses the possibility of using genetic algorithms in augmented reality in combination with the concept of feature detection and matching.

Keywords: augmented reality, computer vision.

КОНЦЕПЦИЯ ОБНАРУЖЕНИЯ И СОВМЕЩЕНИЯ В КОМПЬЮТЕРНОМ ЗРЕНИИ

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Рассмотрена возможность использования генетических алгоритмов в дополненной реальности в сочетании с концепцией обнаружения и совмещения в компьютерном зрении.

Ключевые слова: дополненная реальность, компьютерное зрение.

Augmented Reality (AR) technology is a type of Virtual Reality (VR). Augmented reality is an environment that in real time supplements the physical world with digital data using any devices (tablets, smartphones or others) and the software part. In augmented reality, virtual objects are projected onto the real environment, while virtual reality is a world which is completely created by technical means. Thus, virtual reality creates its own world, where a person can plunge, while augmented reality adds virtual elements to the real world.

Virtual reality technologies completely immerse a person in a synthetic environment. Being immersed, a user cannot see the real world surrounding him/her [1]. Unlike virtual reality, the augmented reality allows a person to feel the real world together with virtual objects superimposed on the environment. Thus, AR integrates and complements the real world.

The theory of computer vision is fundamental to the development of augmented reality technologies, especially, in the field of the use of markers. The main direction of this discipline is the analysis and processing of images (including video stream). Computer vision algorithms allow to highlight the feature features in an image (angles and area boundaries), search for shapes and objects in real time, perform 3D reconstruction of several photographs, and so on [2].

Genetic algorithms are the heuristic search algorithms used to solve optimization and modeling problems by randomly selecting, combining, and varying the desired parameters using mechanisms reminiscent of biological evolution. In this case, they can be used to search for an object of a certain class in an image or video. First, one needs to train the algorithm using two different sets of images:

– "Good" images containing the desired object.

– "Bad" images containing the false images without the desired object.

However, the need for training makes a use of genetic algorithms quite problematic. Large number of different images are required for good result. Thus, the construction of a classifier for each object can take a long time.

The concept of feature detection in computer vision refers to methods that are aimed at calculating the abstractions of an image and highlighting feature points in it. These features can be either in the form of isolated points, curves, or related areas [3].

Most often, the algorithms that search and compare images by feature points are used to search for markers in AR technology. The feature point is a certain part of the picture that is distinctive for a given image (Fig. 1). The algorithm determines what exactly will be considered the feature point of an image.

Fig. 1. Example of detected feature points in an image

Three components are used to find the feature points and then compare them. The first component is a feature detector, the second component is a descriptor extractor, and the third component is a matcher. The feature detector searches for feature points in an image. The descriptor extractor makes a description of the found feature points evaluating their position through a description of the surrounding areas. The matcher constructs correspondences between two sets of points.

First, through the operation of the detector, feature points are searched in an image. Then the resulting points are described using a descriptor. This information is stored in a separate file or database in order to non-repetition of this process. In the case of processing a video stream in order to search for a given pattern, the described algorithm is performed for each frame [4]. To establish the correspondence between the feature points, a matcher is used (Fig. 2).

Fig. 2. The correspondence between the feature points of the template and test images

It is reasonable to assume that different algorithms work with different speed and efficiency. In the context of using them to build augmented reality, it is necessary to use only those algorithms that show high speed with fairly good quality tracking of the positions of feature points. Otherwise, the performance when detecting and adding tokens will be low.

To increase the speed of feature point detection algorithms, various filtering methods are used. This happens in order to minimize their number and weed out incorrect combinations. Thus, it is possible to achieve not only high speed of calculations, but also an improvement of a quality of tracking markers.

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DOME COVERINGS FOR LARGE-SPAN BUILDINGS

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This article gives an overview of the features of dome coverings. The classification of such coatings is considered after it. The main focus is on the mesh domes, methods of cutting their surface – meridional cutting of the surface of rotation or the application of regular polyhedra inscribed in a sphere. During the design of the structure of the mesh dome (diameter 60 m) reaching the conclusion about rational cut of connectable elements.

Keywords: Dome covering, span, spacer system, ribbed dome, mesh dome, structural morphology.

БОЛЬШЕПРОЛЕТНЫЕ КУПОЛЬНЫЕ ПОКРЫТИЯ

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Представлен перечень различных видов купольных покрытий. Представлена классификация таких покрытий. Основное внимание сконцентрировано на сетчатых куполах, способах разрезки их поверхности – меридиональной разрезки поверхности вращения или применения правильных многогранников, вписанных в сферу. При проектировании сетчатого купола диаметром 60 м сделаны выводы о выборе сечения соединяемых конструкций.

Ключевые слова: купольное покрытие, распорная система, ребристый купол, сетчатый купол, формообразование поверхностей.

There are many domed coatings with a metal frame in the world. The dome, which is a spacer system in its structural design, has significant rigidity due to positive Gaussian curvature. In ancient times, dome coverings were built of stone, they had a maximum span of up to 40 m, the smallest shell thickness was 1/15 of the diameter [1; 2].

The purpose of this research is to determine the most preferred type of dome cover with a radius of 30 m for a public building and to calculate such coverage on the effect of the main loads. The interest to this is explained by the widespread erection of frame-dome structures in the buildings of shopping centers, sports facilities, exhibition complexes. In fact, there are many advantages of dome coverings: the most rational use of space, the lower weight of the coating reduces the load on the foundation, it is convenient to arrange a ventilation, heating and conditioning, this type of construction is windproof due to its streamlined shape, etc. [3].

According to the design scheme, the domes made of metal structures can be ribbed, ribbed-circular, ribbed-circular with ties and mesh. In mesh domes, bonds are located in each cell without intermediate ribs (Fig. 1). The improvement of various systems of mesh domes occurred

by changing the method of shaping their surfaces, that is, dividing surfaces into structural elements.

The meridional variant of partitioning the surface of revolution and the use of regular polygons inscribed in a sphere are distinguished. In systems based on the use of polygons inscribed in a sphere, spatial point lattices of the icosahedral type are most widely used for constructing constructive networks of polyhedral domes [4].

According to the technique described in [4], we take under consideration the spatial dotted lattice of the icosahedral type for our dome, performing the operation of duplicating the icosahedron, we calculate the coordinates of the nodes for configurating the dome in the form of a 320-facet (Fig. 2).

We have applied the load and performed an analysis of the obtained values. Also, we have calculated the dome deformation schemes in the LIRA calculation complex. The results show that it is advisable to use round diameter pipes as a section of rods, since this type of section is optimal from the point of view of rational metal consumption. Practical values of the length of the rods constructed in the calculation complex confirm the previously obtained theoretical data. It shows that the optimal length of the rod in the cutting sector is 1/4 – 1/7 span [1].

Fig. 1. The Scheme of the Mesh Dome

Fig. 2. The Scheme of the Dome Specified for Calculation in the PC "Lira"

A nodal connection of the "IFI" type can be assigned for a circular pipe cross-section. It allows connecting the rods regardless of their mutual location.

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CALCULATION AND DETERMINATION OF ACTUAL AND REQUIRED LEVELS OF SERVICEABILITY OF THE UTAIR-ENGINEERING AIRCRAFT FLEET

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Ensuring and maintaining a given level of reliability of aircraft, as well as ensuring safety, the regularity of flights and economic efficiency are the main tasks of technical operation. The purpose of this work is to calculate and determine the actual and required levels of serviceability of the aircraft fleet of UTair-Engineering.

Keywords: helicopter, serviceability, aircraft, airline, operation indicators.

РАСЧЕТ И ОПРЕДЕЛЕНИЕ ФАКТИЧЕСКОГО И ПОТРЕБНОГО УРОВНЕЙ ИСПРАВНОСТИ ПАРКА ЛЕТАТЕЛЬНЫХ АППАРАТОВ АВИАПРЕДПРИЯТИЯ ЮТЭЙР-ИНЖИНИРИНГ

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Обеспечение и поддержание заданного уровня надежности авиатехники, безопасности полетов и регулярности рейсов, а также экономическая эффективность являются главными задачами технической эксплуатации. Целью данной работы является расчет и определение фактического и потребного уровней исправности парка ЛА авиапредприятия «ЮТэйр-Инжиниринг».

Ключевые слова: вертолет, исправность, летательный аппарат, авиапредприятие, эксплуатация показатели.

UTair-Engineering is a world leader in providing helicopter services. The airline owns the following types of helicopters: MI-8T, Mi-8AMT, Mi-8MTV, Mi-26, N125, AS 355, Ka-32.

To perform the work, it was decided to make the calculation of serviceability indicators for the MI-8 helicopter, since this type of helicopter performs the main production tasks of the airline. The analysis involved MI-8 helicopters modifications T, AMT, MTV.

The list fleet of aircraft of the air enterprise in each concrete interval of time is in various states of process of technical operation. Part of the Park LA performs flights, a significant part for various reasons is on the ground. A certain part of the list fleet of aircraft can be located at repair plants due to major repairs, control and restoration works, modifications of the structure.

A number of indicators of downtime and malfunctions of aircraft were used in the work, such as: specific downtime of aircraft when performing flights; the ratio of the time during which the aircraft are in good condition to the total Fund of their working time for the reporting period in hours; specific downtime of aircraft when performing flights, etc.

The basis for the calculation was the processing of statistical data obtained from form No. 34-HA for the reporting period from the first of January 2017 to the thirtieth of June 2018. All calculations were made quarterly.

The mathematical expression 1 is used to calculate the annual factor.

$$K_{\text{испр}} = \frac{8760 \cdot N_c - T_{\text{ПТ}} \cdot N_c}{8760 \cdot N_c} = \frac{8760 - T_{\text{ПТ}}}{8760} \cdot 100 \text{ \%}.$$

Mathematical expression 1. Expression for the indicators serviceability calculation.

During the calculations, it was converted into an expression to calculate the quarterly factor.

Figure shows the graphical dependence of the serviceability coefficient on the quarterly flight hours for the entire analyzed period.

Graphical dependence of the serviceability coefficient on the quarterly flight hours

On the ordinate axis, the average values of the serviceability coefficient in percentage terms are postponed, on the abscissa axis-the average time of flight of aircraft by quarters. In this graph, you can see that in the second quarter of 2017, there was a decline in the serviceability coefficient, while from the fourth quarter of 2017 to the 1st quarter of 2018, there is a stability of this coefficient.

In the future, it was necessary to determine the required indicators of serviceability of the Park for a given period. The required level of serviceability of the airline's JIA fleet is determined for the planned period of operation, depending on the planned flight hours on the list fleet of a certain type of JIA.

The required serviceability factor depends on the estimated planned flight hours, quarterly time Fund and the number of aircraft fleet boards. By setting different values, you can get a certain dependence of the change in the required coefficient of serviceability on the number of boards and quarters.

For further calculations, the range of values of the planned quarterly flight was determined, which the airline can choose when planning both quarterly and annual flight. The range was decided to choose from 1000 hours of quarterly flight to 13000 hours of quarterly flight.

Knowing the coefficient of downtime for technical reasons and the planned quarterly flight hours time determined the required coefficient of serviceability. Table presents a quarterly comparison of actual serviceability indicators and required serviceability indicators for the reporting period of 2017 and the 1--2 quarter of 2018

Quarterly presentation of actual serviceability indicators and required serviceability indicators

Quarter	Actual level of serviceabilities, %	Required level of serviceability, %
1st quarter, 2017		95,9
2nd quarter, 2017	98,1	98,84
3rd quarter, 2017	98,3	98
4th quarter, 2017	98,7	98,1
1st quarter, 2018	98,7	96,8
2nd quarter, 2018	98,1	99,4

As a result of comparison, we can see that 2017 and the 1st quarter of 2018 do not meet the requirements of the required indicators of serviceability. Only the second quarter of 2018 meets the requirements of the required serviceability coefficient. The analysis of work and identify actual and required levels of serviceability of the helicopter fleet of the aviation enterprise JSC "UTair – Engineering" according to the static data form HA-34 for the period 2017 and 1–2 quarter of 2018 revealed that the actual level of health is very high in percentage and meets the required level of serviceability. Such high rates are achieved due to timely, high-quality maintenance and Repair, regular training of technical personnel, as well as the use of highly reliable and modern equipment by the airline.

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APPLICATION OF AUGMENTATION AND A GENERATIVE-ADVERSARIAL NEURAL NETWORK TO INCREASE DATA SETS

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This article discusses the automatic extension of datasets for training neural networks. The main methods of expanding data sets are presented, in particular using augmentation, as well as a generative-adversarial neural network. The principles and the scheme of operation of GAN networks are described, the algorithm of the generator and discriminator operation is described, the difficulties of their application and the difficulties encountered in learning are considered.

Keywords: neural networks, data sets, training set, augmentation, generative adversarial neural network, generator, discriminator.

ПРИМЕНЕНИЕ АУГМЕНТАЦИИ И ГЕНЕРАТИВНО-СОСТЯЗАТЕЛЬНОЙ НЕЙРОННОЙ СЕТИ ДЛЯ УВЕЛИЧЕНИЯ НАБОРОВ ДАННЫХ

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Рассматривается автоматическое расширение наборов данных для обучения нейронных сетей. Представлены основные способы расширения наборов данных, в частности с помощью аугментации, а также генеративно-состязательной нейронной сети. Приведены принципы и схема работы сетей GAN, описан алгоритм работы генератора и дискриминатора, рассмотрены трудности их применения и возникающие сложности при обучении.

Ключевые слова: нейронные сети, наборы данных, обучающая выборка, аугментация, генеративно-состязательная нейронная сеть, генератор, дискриминатор.

Currently, neural networks have become very popular in our lives, as they allow us to solve complex problems and improve existing solutions. Of particular importance in the process of working with neural networks is the stage of their training. The obtained accuracy of work in solving the task depends on it. For accurate and quality training, you must have a prepared data set. However, a situation often arises when the necessary data is not enough for quality training. This is especially true for deep neural networks, since they are very demanding on large amounts of data for the convergence of training [1].

There must be a lot of data for successful training and obtaining an accurate result. In some cases, the process of collecting the necessary information for training in itself turns into a mini-project. Thus, the search for ways to expand data sets is an urgent task.

Currently, there is publicly available information for creating data sets. However, this process is complicated if there are any additional requirements for the data or if there is not enough data.

For example, to train a neural network with a million parameters, you need a lot of training examples that are not always easy to find.

Multiplication methods can be used to increase the data set; this is especially true for digital sets. Images can be distorted, flipped, or changed the tone. This process is called augmentation – this is a technique for creating new learning data based on existing data. Using this method, you can significantly increase the selection of images [2].

Augmentation types can be divided into the following groups: geometric, brightness, additive (overlapping two images), noise. Transforms are usually selected based on possible deformations in the images. For example, in the problem of recognizing characters captured by a digital camera [3], smoothing, projection distortions, changes in brightness, adding Gaussian noise and rotations are most relevant. When recognizing symmetrical objects, you can use reflections along the axis. Augmentation works very well if training takes place on artificially generated data. Deformations of "ideal" created images make them more realistic and increase the overall variability of the data.

There are a lot of ways to augment data. The most popular are: horizontal flip, random crop, and color jitter. It is also possible to apply various combinations, for example, simultaneously perform image rotation and random scaling. In addition, you can change the saturation value and the value of all pixels (components S and V of the HSV color space). In particular, you can increase these components to a degree from the interval from 0.25 to 4, multiply them by a factor from the interval from 0.7 to 1.4, or add to them a value from the interval from –0.1 to 0.1. You can add a value from –0.1 to 0.1 to the hue of all pixels (component H of the HSV color space) [4]. Similar transformations can be applied to image fragments.

The main methods of increasing data:
1) flip the image vertically or horizontally;
2) rotate the image to a predetermined degree;
3) move one part of the image as a parallelogram;
4) crop the image: the object appears in different positions and in different proportions;
5) zoom in, zoom out;
6) change the brightness or contrast.

And there is also another effective way to multiply images – this is the use of Generative adversarial network (GAN). The architecture of this network is two separate networks. The first neural network – the generator, which is designed to generate random new data, and the second – the discriminator, serves to evaluate and the authenticity of the generated data. Thus, the discriminator decides whether the data instance belongs to the training data set or not.

There is also a variation of this architecture called DGAN (Deep Convolutional Generative Adversarial Networks). This model replaces with convolutional layers the completely connected layers of the generative adversarial network. This network can be effectively applied with an existing data set [5].

The generator creates new images, which it passes to the discriminator for evaluation. The purpose of the generator is to generate such data as will be accepted by the discriminator. The purpose of the discriminator is to determine if the image is genuine (see Figure). Moreover, the generator has no idea what the source data is and is trained based on the discriminator's answers, changing the results of its work with each iteration. The generator takes a random noise vector as its basis and generates data based on it.

When using the GAN network to generate images, there is a certain difficulty in training this network. There are a number of rules that should be followed, for example, when training a discriminator, it is necessary to keep the generator values constant and vice versa. That is, each network must train against a static "opponent".

There may also be a situation with uneven learning, for example, when the discriminator is too well trained, it will return values very close to 0 or 1 and the generator will have difficulty reading the gradient vector. If the generator is well trained, then it will use the inaccuracies of the discriminator, which will lead to a false positive [6].

Another problem may be the duration of training. It is necessary to have large computing power. Learning on one processor can take a long time.

GAN working principle

For the task of replenishing the data set, trained neural networks can be applied, the result of which can be used as input for a trained neural network. For example, there are networks for constructing significance maps in the form of a heat map. The results of such networks can be used in networks for tracking objects on video sequences or in networks designed for image segmentation.

A well-prepared dataset is a very important component of a quality learning process. At present, finding the right information is not difficult, but there is a difficulty in processing it in large quantities. The process of creating a finished data set takes place in several stages, depending on the current situation. Only after a long process of collecting and structuring information can it be used in machine learning. Deep networks that require a long learning process are particularly demanding on large data sets.

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OPERATION LOGIC OF THE PAYLOAD ANTENNA SYSTEM INSTALLED ON THE EXPRESS SERIES SPACECRAFT

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This article describes the composition of the payload antenna system installed on the Express series spacecraft and its operation logic, as well as the main tasks performed by the antenna deployment and pointing mechanism.

Keywords: spacecraft, payload, antenna system.

ЛОГИКА ФУНКЦИОНИРОВАНИЯ АНТЕННОЙ СИСТЕМЫ ПОЛЕЗНОЙ НАГРУЗКИ КОСМИЧЕСКОГО АППАРАТА СЕРИИ «ЭКСПРЕСС»

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Рассмотрен состав антенной системы полезной нагрузки космического аппарата серии «Экспресс» и ее логика функционирования, а также основные задачи, выполняемые механизмом раскрытия и наведения антенн.

Ключевые слова: космические аппараты, полезная нагрузка, антенная система.

The Express series spacecraft are designed to provide high-quality fixed and mobile communications services, digital TV and radio broadcasting, high-speed Internet access and data transmission in the Russian Federation and the CIS countries. The performance of the spacecraft's target tasks depends directly on the antenna system.

The payload antenna system of the Express series spacecraft is designed to amplify and filter signals and form receive and transmit service areas [1].

The antenna system is composed of the following:

1) receive/ transmit feed system;

2) reflector;

3) antenna deployment and pointing mechanism;

4) hold-down and release mechanism;

5) thermal hardware;

6) backup structure.

Antenna deployment and pointing mechanisms (ADPM) perform the following tasks:

1. Securing the antenna reflectors on the spacecraft structure during transportation and launch.

The antenna reflectors are secured during launch using hold-down and release mechanisms (HRM). HRM is a tripod with reflector hold-down and release elements. The antenna reflector is secured by four HRMs. They are released by pyro devices. Each HRM includes one pyro device with main and backup power lines. The platform supplies power simultaneously to the main and backup power lines of the pyro, as a result of which the pyro is fired and the reflector is released from the hold-down mechanism. The voltage supply scheme for the pyro device is shown in the Figure.

Voltage supply scheme for the pyro device

2. Deployment of antenna reflectors and their pointing in operating direction.

Deployment of antenna reflectors and their pointing in operating direction is carried out by the antenna deployment and pointing mechanism (ADPM), which is a two-phase stepper motor. This mechanism includes two motors which are located at an angle of 90 degrees relative to each other and provide the movement of the reflector in two mutually perpendicular planes (azimuthal and elevation).

Antenna motors are controlled by commands sent from the ground control station which are executed on board the spacecraft through the payload interface unit [2].

Commands sent from the ground control station include: motor number, number of steps, direction of movement and current magnetic state of the motor.

After receiving a motion command, the ADPM begins to implement the program tracking. The payload interface unit sends corresponding combinations of electric phases to the motor windings, starting with a combination determined by a magnetic state, and sequentially generates subsequent combinations of phases, in accordance with a commanded direction of movement. The number of phase combinations corresponds to a commanded number of steps. Each subsequent combination results in a change in the position of the motor by one step. Possible combinations of phases are shown in Table.

Motor phase states

Magnetic state	Phase			
	A	B	C	D
0	+	−		
1			+	−
2	−	+		
3			−	+

3. Generation and provision of information about the current position of the antenna reflector and operating modes of the motor.

ADPM includes two sets of potentiometers, coarse and fine, that provide information about the current position of the antenna reflector by comparing the applied voltage on the potentiometer with the measured voltage. Each of the potentiometers has 1:1 cold redundancy. To exclude an

uncertain value in the potentiometer reading, the fine potentiometers (primary and backup) are positioned 180 degrees apart from each other, overlapping the uncertainty zone of one of the potentiometers (primary or backup). Thus, if uncertainty arises in one of the sections of the primary fine potentiometer, then information on the position of the motor can be obtained from the readings of the back-up fine potentiometer or vice versa [3].

Having described the payload antenna system of the Express series spacecraft and the tasks performed by it, we can conclude that this system is one of the fundamental components of the spacecraft payload, since it performs mission tasks requiring high accuracy. High accuracy is ensured by antenna deployment and pointing mechanisms, thus minimizing shaping losses and improving communication quality.

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PROBLEMS AND PROSPECTS FOR THE DEVELOPMENT
OF ADDITIVE TECHNOLOGIES IN RUSSIA

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This article is devoted to the modern development of additive technologies and their application in industry. The article reflects the problems of the development of additive technologies in Russia and gives recommendations on the introduction of additive technologies in the radio-electronic industry.

Keywords: 3D-technologies, additive manufacturing, SLM-technologies, SLS- technologies, radio-electronic industry.

ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ РАЗВИТИЯ АДДИТИВНЫХ
ТЕХНОЛОГИЙ В РОССИИ

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Данная статья посвящена современному развитию аддитивных технологий и их применению в промышленности. Отражены проблемы развития аддитивных технологий в России и даны рекомендации по внедрению аддитивных технологий в радиоэлектронной промышленности.

Ключевые слова: 3D-технологии, аддитивное производство, SLM-технологии, SLS-технологии, радиоэлектронная промышленность.

Any modern production has a goal to make profit. In the early 80s, new methods ofproduction based on layer-by-layer cultivation began to develop, using the methods of additive technologies.

At the present stage, this technology has stepped far forward and moved on to the manufacture of parts that do not require the slightest refinement of powders. Additive technologies produce not only parts, but also human organs, stem cells, houses, bridges, and much more.

Thus, additive manufacturing technologies have made a quantum leap. The modern additive manufacturing market is over $1 billion. Russia's share in this market is 1–1.5 %, while the US leaders in this area are 39.1 %.

These technologies penetrate all sectors of life from production to construction and medicine, and further, this market will develop at a tremendous pace. The advantage of these technologies lies in their accuracy, functionality and relative profitability (intermediary costs are reduced) [1].

There are two main technologies for additive manufacturing: selective laser sintering technology (SLS technology) and selective laser cooking technology (SLM technology).

There are many problems in Russia, the solution of which is the reserve that will significantly increase the share of domestic additive production on the international market.

The development of additive production in Russia is fraught with a number of problems [2]:

1. The lag in the engineering industries focused on the high-tech sector, unfavorable conditions for economic development, the predominant orientation of the domestic business on the import of ready-made solutions.

2. Due to sanctions, the best samples of foreign equipment are not always available, and those that are offered for purchase, in some cases, are characterized by insufficient productivity and do not have the required characteristics.

3. Another problem of industrial Russian production in the introduction of technology is the lack of adequate resources of appropriate quality. In particular, there is a need to develop technologies for the production of powders of the required size and composition, their subsequent certification. Today, the solution to this problem is in its infancy.

4. In addition, there is a need to take into account the storage problems of powders, for example during their transportation, as a result of which their deformation may occur: clumping.

5. As a result, the need to develop domestic software codes. The program code is necessary to ensure the operation of the installations of additive technologies [3].

6. Finally, it is extremely important to monitor parts formed using additive technologies for defects. Due to the peculiarities of the physical processes occurring during the formation of such products, not only defects, usually characteristic of the materials used, but also fields of mechanical stresses can arise in them.

The radio-electronic industry (REP) is one of the key sectors of any national economy, covering all spheres of society. In any products of high conversion there are either simple electronic components, or entire electronic components and modules. But at the same time, the influence of radio electronics on the development of modern weapons and military equipment remains very significant.

In today's world, manufacturing technology of printed circuit boards with integrated components is gaining momentum. The technology makes it possible to reduce the overall dimensions of the boards, reduce the length of the communication lines, provide effective heat dissipation and protection against moisture, solve electromagnetic shielding issues, and increase the mechanical strength of the boards.

Another area of using additive technologies at the enterprise may be the production of product housings.

The use of additive technologies in this industry will greatly increase the quality of products manufactured by REP enterprises. The use of 3D printing technologies will allow to qualitatively improve the characteristics of products (reduce weight, increase strength), as well as reduce production time and cost of products. However, for the mass production of products using additive technologies, it is necessary to create a 3D printer farm, which will require significant investments in the enterprise.

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APPLICATION OF MULTIMEDIA IN MANAGEMENT OF PRESCHOOL EDUCATIONAL INSTITUTION

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The article discusses the importance of using multimedia technologies in the management system of preschool educational institutions and advantages of using multimedia tools for teaching children with different abilities as well.

Keywords: multimedia technologies, training tools, interactive game, electronic learning systems.

ПРИМЕНЕНИЕ МУЛЬТИМЕДИЙНЫХ СРЕДСТВ В СИСТЕМЕ УПРАВЛЕНИЯ ДЕЯТЕЛЬНОСТЬЮ ДОШКОЛЬНОГО ОБРАЗОВАТЕЛЬНОГО УЧРЕЖДЕНИЯ

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Рассматривается важность применения мультимедиа технологии в системе управления деятельностью дошкольного образовательного учреждения, а также преимущества использования мультимедийных средств для обучения детей с разными способностями.

Ключевые слова: мультимедийные технологии, обучающие средства, интерактивные игры, электронные системы обучения.

Today, multimedia technologies are one of the promising ways to develop in lots of human activities, including preschool education. Multimedia provides new opportunities in developing the creative abilities of students. Information that is transmitted by multimedia resources affects every humans senses. It is due to simultaneous effect to different perception channels the desire product turns into a powerful didactic tool. The aim of multimedia technologies is to provide information transfer in different ways. Adding video, soundtracks, using a high-quality graphics and animation allows to create informational-rich and friendly product.

Multimedia learning tools are created on the basis of multimedia technologies that allow to effectively organize the educational process in an interactive mode.

Training systems using multimedia help to prepare younger generation for living in modern information conditions. The opportunities of multimedia training systems help to easy perceive information and learn various ways of communication with technical tools. Using multimedia as educational tool has a positive impact to children's educational institution.

Information computer technologies allow implementing optimal conditions to reveal talents and evolve abilities of students. Therefore, interactive educational programs and games based on

the hypertext structure and the use of multimedia resources give an opportunity to conduct education for children with different skills and capabilities.

We can distinguish four main types of educational programs, classifying by their purposiveness [1; 2]:

1. Training and controlling. This type of training programs consolidate already formed skills and abilities. Various tasks are given to child and after the number of correct and incorrect answer is calculated. In case of positive result child deserve a reward, otherwise the child receives a hint or help.

2. Mentoring training programs. This type of training programs gives child a theoretical knowledge. Tasks and questions are used to manage a human-machine dialogue in order to control educational process. If child's answers are incorrect, the program can return him to repeat the poorly studied topic.

3. Simulation training programs. This type of programs based on graphic and computational machine capabilities. Using this type of training program, children are given an opportunity to watch a process on the screen. They can affect to the progress of this simulation by giving commands from the keyboard or mouse.

4. Educational game. This type of training programs allows the child to immerse himself in an imaginary environment that exist only in the computer world. The child has a set of features and implementers in these games.

Figure shows an extended diagram of the types of training programs.

Types of training programs

The initial stage of using developing multimedia products in a children's educational institution is multimedia games [3]. Their popularity is explained by entertainment tendency. Children gradually explore the world of computer games.

In addition to games, we should mention multimedia encyclopedias – this tool doesn't require high production coast, but can be effectively used in education [4].

Systematic use of e-learning with multimedia tools increases the educational process effectiveness as compared traditional teaching methods. Multimedia technology provides better memorizing an information by affecting on all children's senses and thus gives an opportunity to transfer information at any level of perception.

Multimedia training tools, as the most adaptive to special aspects, are increasingly used for teaching children with disabilities. The appropriate use of multimedia tools in the education of such children allows them to eliminate the effect of disabilities in educational process, as well as to apply to acquired knowledge in practice. The child begins to perceive information more easily. Unknown early knowledge, skills and abilities become available to him. It gives him a faith in himself.

Multimedia is an extremely useful educational technology, due to interactivity, flexibility and various types integration of educational information. It is allow to adjusting an educational process for any person with any abilities.

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MONITORING AND CONTROL OF PAYLOADS BASED ON THE DIGITAL TRANSPARENT PROCESSOR

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This article describes the concept of the Digital Transparent Processor (DTP) and the role of its application on board a spacecraft. The principle of DTP operation is addressed. Advantages and disadvantages of payload control using DTP are given. The specifics of the DTP software are described in detail.

Keywords: payload, DTP, digital transparent processor, payload control, telemetry.

МОНИТОРИНГ И УПРАВЛЕНИЕ ПОЛЕЗНЫМИ НАГРУЗКАМИ НА БАЗЕ ЦИФРОВОГО ПРОЗРАЧНОГО ПРОЦЕССОРА

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Описывается концепция цифрового прозрачного процессора (DTP) и роль его применения на борту космического корабля. Принцип работы DTP рассматривается. Приведены преимущества и недостатки управления полезной нагрузкой с использованием DTP. Особенности программного обеспечения DTP подробно описаны.

Ключевые слова: полезная нагрузка, DTP, цифровой прозрачный процессор, управление полезной нагрузкой, телеметрия.

Nowadays, building spacecraft with onboard digital signal processing is becoming more relevant, despite the high price of such developments. Digital on-board equipment with dynamic routing of ground station signals is currently of great interest. Using routing on board the spacecraft will certainly facilitate the structure of the ground data and communication networks. However, a more promising and relevant approach is building spacecraft with on-board equipment providing flexible channelization with transparent routing. These functions are performed by the Digital Transparent Processor (DTP).

The operation of a communication satellite using a DTP is as follows: input signals are sampled through analog-to-digital converters and processed using numeric algorithms in Application Specific Integrated Circuits (ASICs) to implement routing. After this, amplification occurs at the digital level. The result of digital processing (DTP) is converted to analog signals via digital-to-analog converters. The signals at the output of a DTP are amplified by traditional equipment (travelling wave tube amplifiers, solid state power amplifiers) prior to transmission to the ground.

The DTP is used to provide flexible channelization and dynamic routing for modern spacecraft payloads.

The DTP function is to provide flexibility in terms of connectivity, channel allocation and frequency plan. This function is shown schematically in Figure below.

Channel Allocation Flexibility Scheme

The modular architecture of a DTP enables the reuse of major building blocks (ASICs and digital boards) for various capacity DTPs. This is implemented thanks to appropriate equipment architecture based on the modular mechanical packaging. [1]

Generic signal processing ASICs can be used for DTPs with different capacity. This allows using a modular approach to the development of units. Such a standardization approach is an important step for the development of spacecraft payloads.

ADTP manages a large frequency spectrum. If requested by the ground, a DTP can provide about 100 times more information compared to traditional payloads in periodically requested telemetry data.

When using a DTP on board the spacecraft, it is necessary to employ a computer on-board the spacecraft and on the ground (payload control software (PCS)). The digital signal processing performed by a DTP means large amount and complexity of the embedded configurations. These configurations offer completely new functionality (ranging from monitoring the input signal power to monitoring the software control fields). This monitoring is carried out by requesting spacecraft telemetry from the ground station. However, due to the greater volume of requested data and the increase in the number of telemetry elements, the number of failure cases increases.

To automate the execution of satellite operation procedures, the development of a special software environment is necessary. Thanks to its generic and system-independent approach, the homogeneity across different platforms and satellite control systems is ensured. It reduces risks in satellite operations by increasing automation, improves readability of procedures and their operational efficiency, therefore reducing operational costs.

Thanks to the developed software environment, it becomes possible to expand the list of DTP operations, as well as to build specialized payload control software required for DTP operations.

There are types of DTP that have a wide range of capabilities and are designed to accept high-level commands like "Create a routing channel from A to B". But the use of such processors on board is not always a profitable and practical solution, both from an economic point of view and from the point of view of DTP control. The DTP accepting low-level commands that define the configuration of each ASIC that contributes to the creation of a channel is more profitable [2].

Since a DTP is a hardware-controlled processor, it performs the operations and implements configurations that are sent on board the spacecraft from the ground control station. However, it is necessary to ensure consistency of configurations in the ground-based and on-board software. The ground-based software shall have the function of protection against accidental errors so that operator errors are not transmitted to the on-board software [3]. The on-board hardware shall have a rewrite function so that the PCS can set or reset the required configuration.

However, this type of a digital processor has the following disadvantages:

1. The DTP has a low-level command interface ("ASIC coefficients"). Low level commands have large volume. Therefore, the execution time of any command can take a very long time

2. The "compilation" of a high-level command into "ASIC coefficients" requires perfect knowledge of the current DTP configuration on board. Therefore, storing this data on the backup servers without errors is essential to maintain the operability of the system.

3. In more complex DTPs with existing routing software, the high-level channel routing tables shall be maintained on the ground, and if they are not synchronized with the satellite, outages may occur.

4. Since DTP "understands" only low-level commands, any sequence of high-level commands stored in the host spacecraft computer would require the conversion of complex PCS algorithms to low-level commands.

5. The cost of the ground-based embedded software and equipment for its placement, including the cost of testing, is much lower than the cost of the equipment for space use;

6. There is no way to easily update software;

7. The DTP is a much more complex on-board system, which obeys the ground instructions only with the help of special control commands due to the use of specialized ASICs for digital processing.

For multibeam spacecraft, the DTP is an important component that allows adapting and routing traffic according to market needs.

The developed product can be the core of future payload, offering customers the flexibility of a frequency plan, high connectivity capacity, sufficient granularity and broadcast or multicast capability.

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TRENDS IN THE DEVELOPMENT OF MODERN ADVERTISING

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The article concerns the issue of advertising technologies in the modern constantly developing world. This article discusses the trends in the development of modern advertising, typical for any format of product promotion to the masses.

Keywords: advertising, trends in advertising, video content, virtual reality in advertising.

ТЕНДЕНЦИИ РАЗВИТИЯ СОВРЕМЕННОЙ РЕКЛАМЫ

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Затрагивается тема рекламной технологии в современном постоянно развивающемся мире. Раскрываются тенденции развития современной рекламы, характерные для любого формата продвижения продукта в массы.

Ключевые слова: реклама, тенденции в рекламе, видеоконтент, виртуальная реальность в рекламе.

Technologies in the modern world are constantly changing and cannot be ignored. Technology is developing, and new information technologies are emerging. Advertising must adapt to these changes in a timely manner in order to influence the consumer as effectively as possible, thus arouse the interest in the product and encourage the consumer to perform certain actions. In an era of information overload, it is becoming increasingly difficult to build the end consumer's loyalty. Advertising agencies need creative and fresh ideas that will help them retain their old customers and attract new ones.

Video content is a video based on the needs of the target audience and their perceptual skills [1]. Video content has become the undisputed leader in attracting customers. Based on TNS Web Index research, it is safe to say that video materials cover 60 % of the World Wide Web audience [2]. The remaining 40 % shared photos and text. This success of video content is due to several aspects: first, video saves time. It is much faster and easier for a person to turn to a small video clip and extract the main idea from it than to spend much more time reading text materials, analyzing them and selecting the required information. Second, video content increases customer trust and eliminates misunderstandings. Text materials are limited as they only convey meaning. The video is able to convey the author's gestures, facial expressions, tone of voice, intonation. Thus, the video eliminates the possibility of being misinterpreted.

The latest trend that attracts a lot of attention is VR and AR. Virtual reality (VR) is a technical means that is transmitted to a person through their senses: hearing, vision, touch, smell, and others [3]. Augmented reality (AR) refers to technologies that complement the real world by adding various sensory data.

Currently, large companies actively conduct their advertising campaigns based on additional and virtual reality. Instead of a small part of the target audience participating in an event, and the rest of the users broadcasting the result, VR and AR allow anyone who wants to participate in this event. In addition, you can always create new content. Augmented and virtual reality provides consumers with a short but memorable experience, which in turn increases customer loyalty to the brand, which is quite difficult to achieve using conventional 2D videos.

So the IKEA group of companies presented the IKEA VR Experience application, which allows the user to put on a VR headset to be in a virtual kitchen of real dimensions, which he can fully explore and, if necessary, redesign its elements to suit his taste, choosing, for example, a different finishing material or color scheme of some element. The app takes into account the individual characteristics of the user. To do this, one must specify his gender, height, and IPD (distance between the center of the eyes in millimeters), and then calibrate the manual controllers. System requirements: Operating system: Windows 7 or higher. Processor: Intel (R) Core (TM) i7-4790K CPU @ 4.00 GHz. RAM: 16 GB. Video card: GeForce GTX 980. Disk space: 2 GB. Additional equipment: HTC Vive VR headset with two working hand controllers [4].

Using such VR and AR tools in the advertising campaigns is currently a competitive advantage. The effectiveness of interactive technologies as a sales promotion tool is no longer in doubt.

In order to be always in trend, create unique, fresh and popular advertising projects, one need to monitor the development of advertising. Undoubtedly, advertising is a reflection of the society in the present time, so all changes in this area are associated with the rapidly developing world of technology.

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CURRENT STATE AND PROBLEMS OF SCIENTIFIC AND TECHNICAL DEVELOPMENT OF NON-FERROUS METALLURGY

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The article discusses the current state and problems of scientific and technical development of non-ferrous metallurgy enterprises on the example of the enterprise "Krastsvetmet". The main technologies of precious metal mining at world-class enterprises are considered. The process of extracting pure metal is described. The main problems of non-ferrous metallurgy in Russia and the company "Krastsvetmet" in particular are presented. The main positive points are touched upon.

Keywords: deposition, refining, mother liquor, refined precious metals, platinum group metals, sorption, extraction.

СОВРЕМЕННОЕ СОСТОЯНИЕ И ПРОБЛЕМЫ НАУЧНО-ТЕХНОЛОГИЧЕСКОГО РАЗВИТИЯ ЦВЕТНОЙ МЕТАЛЛУРГИИ

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Рассматривается современное состояние и проблемы научно технологического развития предприятия цветной металлургии на примере компании ОАО «Красцветмет». Рассмотрены основные технологии извлечения драгоценного металла на предприятиях мирового уровня. Описан процесс извлечения чистого металла. Вынесены основные проблемы цветной металлургии России и компании ОАО «Красцветмет» в частности. Затронуты основные положительные моменты.

Ключевые слова: осаждение, аффинаж, маточный раствор, аффинированные драгоценные металлы, металлы платиновой группы, сорбция, экстракция.

The technology of "deposition" of precious metals is the most common in the Russian Federation. The main drawback of this technology is the duration of the production process, as well as the inability to fully extract gold, silver, platinum group metals and base metals even after several processing cycles. Byproducts of the deposition are complex in the processing of the mother liquors and intermediate products.

Methods of selective extraction of precious metals, extraction and sorption, are replacing sedimentation technology. The most promising of these methods is sorption. Its main advantage is to reduce the refining time up to 10 times by reducing the number of cycles of operations for obtaining refined metal, and also increases the extraction of high-purity metal by 99.9 %. The

sorption method is more environmentally friendly, reducing emissions into the atmosphere, and reducing energy consumption during operations.

The sorption method is successfully applied at the largest refining plants in Singapore, Japan, South Africa, and China, it can be used in Russia. Some refineries have already implemented extraction or sorption technologies, but their use is limited.

Sorption technology is currently used in the Russian Federation for metals with high silver content and low MPG content (platinum group metals), which limits the prospects for its application.

The introduction of this technology in Russia is cost-effective, since solutions containing PM (precious metals) produced in the Russian Federation fully meet the requirements of sorption technology. A necessary condition for the introduction of PM sorption technology at enterprises is the development of sorbents for obtaining chemically pure metal.

Considering the development trends of the world's affinage giants, we can conclude that providing access to imported raw materials is a key success factor, and technology industries are no less important.

The success of oil affinage does not depend on whether the country has its own resources and is a leader in the production of PM. The reservoirs where the largest oil refineries are located process imported raw materials due to the absence of duties and taxes on VAT, as well as have a more technological method of processing, and produce high-quality products in a short time.

In all of the leading affinage countries – Switzerland, Germany, and Australia-there is a relationship between refining production and industrial consumption of PM, while all of these countries, with the exception of Australia, are not leaders in production.

In modern history, there are two models of interaction between industry and oil affinage: cluster organization and "integration down" within the holding structure. Both options have been successfully used in the global market for many years, proving the effectiveness and efficiency of the link between production and industrial consumption. [2]

China is one of the world's largest gold mining country, with the specific market rules of regulation of PM. All the raw materials that are extracted in the state are processed in the country and create attractive conditions for imported raw materials. Exporting of PM is strictly prohibited by law, with the exception of the special rules of the economic zones of Shanghai and Hong Kong.

International experience shows that the development of affinage services requires a relaxed state policy aimed at:

– the weakening or total abolition of customs and tax restrictions on access to imported raw materials containing precious metals;

– changing the current tax system for services and products produced by affinage;

– establishing close links between industry and affinage;

– supporting clusters creation.

JSC «Krastsvetmet» is planning to make a number of changes until 2025, aimed at improving the quality of the company's work, as well as increasing the processing of uranium. A project has been developed that provides for the construction of a residential analytical center for scientific research, and the development of a project for the construction of a hull affinage is almost completed. This project is in limbo because of the plan to build the "NORILSK Nickel" refinery, which is one of the main suppliers of raw materials for processing. Since the production base of JSC «Krastsvetmet» was created in the forties, it is worth understanding that the company lags behind in the field of hardware, infrastructure support and its own logistics. These shortcomings are especially noticeable against the background of new world technologies. The result of this lag is inflated costs for the production of refined PM, as well as working capital.

The company is experiencing significant problems with production equipment. The period of efficient use of most machines and equipment, both at enterprises and at the objects of continuous casting of blanks, has ended, the commissioning of most of the equipment occurred in the mid-90s. This indicates that the equipment is outdated both mentally and physically. This situation increases the duration of the production process. According to the results of the analysis of the production

process, on average, 1–2 emergency stops of the induction furnace for continuous casting of blanks occur in one working day. It will take about 30 minutes to determine the cause, fix the problem, and restart the equipment. A simple continuous casting furnace is about 8.75 % of the working time. As a result, the duration of the production cycle increases. [4]

Currently, there are more productive and high-tech equipment. As an example, we can take furnaces with magnetohydrodynamic mixing of the melt and with a system of pulsating force mixing. Furnaces allow you to get an industrial product with significantly improved characteristics, which is currently relevant for the section of melting finished products and the section of pyrometallurgical enrichment of raw materials. To achieve the highest productivity, the most technologically advanced equipment for melting is the vertical induction continuous casting furnaces with microprocessor control.

JSC "Krastsvetmet" operates on the classic «sedimentation» technology. The technology is inevitably accompanied by the formation of industrial products and masterbatch solutions, which leads to multi-operational processes and a decrease in end-to-end extraction of RPM (refined precious metal). The existing technology that provides for selective extraction of satellite metals and platinum group metals, regardless of the method of extraction is implemented (extraction or sorption) and has prospects for development and application. It should be noted that a number of Russian enterprises have implemented extraction technologies (Prioksky non-ferrous metals plant, JSC) and sorption technologies (Uralelectromed, JSC). However, at present, extraction technology is practically not used due to the lack of raw materials at the enterprise, and sorption technology is mainly associated with the processing of silver-containing raw materials with a low content of palladium and platinum. It proceeds with the use of nitric acid solutions and is currently not widely used, since in the production of platinum metals, chloride (hydrochloric acid) solutions are formed.

Thus, one of the most important tasks of the company is the introduction of technologies that provide:

– reducing the number of stages of the production process;
– reducing the time of the RPM extraction process;
– reducing the number of chemical reagents.

The introduction of advanced technologies for processing oil refining raw materials will allow us to successfully solve the environmental and technological problems of the enterprise.

PM affinage involves the use of a large number of chemical reagents that have a negative impact on the environment. This includes first of all:

– chlorine;
– concentrated solutions of nitric acid;
– concentrated hydrochloric acid solutions;
– organic reagents and solvents (when using extraction processes).

Collecting, storing and processing secondary raw materials is a serious risk. Since the waste of the electronic industry, secondary electronic scrap includes organic components (plastics of various types, materials based on polyvinyl chloride, phenol formaldehyde), as well as an almost complete set of heavy metals. Metals such as lead, antimony, mercury, cadmium and arsenic, which are part of electronic components, under the influence of external conditions turn into organic and soluble compounds and become the strongest poisons. Recycling of plastics containing aromatic hydrocarbons and organic compounds of chlorine origin is an urgent environmental problem for enterprises [3]

It is worth noting the emissions of boiler gases, which bring much more harm compared to production emissions.

Another problem of the company is low capacity utilization, which is about 28 %. One of the reasons is the low profitability of this business. The margin for processing and trading metals does not exceed 1 %, while imports of gold-containing raw materials until recently were subject to import duties from 6 to 20 %. In this situation, it is not necessary to talk about the economic effect of importing raw materials. The duty on mineral raw materials was reset from 2016 until December 31, 2017, and the duty on secondary raw materials-until December 31, 2019.

However, it is not necessary to talk about full-fledged competition in the world market yet. Russian affinage companies and JSC Krastsvetmet, in particular, cannot provide attractive working conditions for foreign producers until VAT is reset when importing gold-containing raw materials for processing-the so-called "insurance premium". When importing raw materials from abroad for processing, you must pay 20 % of its cost. After processing, this amount must be returned to the company within 3 months. Taking into account the high price of gold, freezing working capital for this period is not good. Moreover, the tax authorities return this amount based on the results of an in − house audit, which may reveal inaccuracies in the preparation of documents, and as a result there can be a refusal to refund VAT.

If we talk about the positive aspects, the construction of the new building will create an automated compact production, which is planned to be launched in 2020. The developed measures are planned to be implemented at the expense of their own sources (net profit and depreciation), without attracting third-party funds.

There is a number of projects aimed at reducing emissions of harmful substances into the atmosphere, reducing the formation of industrial waste, and reducing waste water discharge, which is a priority task of the company.

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COMPARATIVE ANALYSIS OF FREE SOFTWARE TOOLS FOR 3D RECONSTRUCTION OF OBJECTS OF HISTORICAL AND CULTURAL LEGACY

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The application of 3D modeling software tools for reconstructing objects of historical and cultural legacy, examples and capabilities of these tools are considered, a comparative analysis is carried out, the advantages and disadvantages are also showed.

Keywords: 3D modeling, software, computer-generated graphics, software tool.

СРАВНИТЕЛЬНЫЙ АНАЛИЗ СВОБОДНО РАСПРОСТРАНЯЕМОГО ПРОГРАММНОГО ИНСТРУМЕНТАРИЯ 3D-РЕКОНСТРУКЦИИ ОБЪЕКТОВ ИСТОРИКО-КУЛЬТУРНОГО НАСЛЕДИЯ

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Рассматривается применение программных средств по 3D-моделированию для реконструкции объектов историко-культурного наследия, примеры этих средств, их возможности, производится сравнительный анализ, показываются плюсы и недостатки.

Ключевые слова: 3D-моделирование, программное обеспечение, компьютерная графика, программное средство.

3D modeling software is now used in various spheres of everyday life, industry, entertainment, etc. The most important area for 3D modeling technology is the reconstruction of various objects of historical and cultural legacy.

3D modeling is the process of creating a three-dimensional model of an object. Its purpose is to create the necessary three-dimensional image of the object using special software tools. A large number of such tools is provided, they can be either paid (a license or subscription is required), or free.

Software tools for 3D modeling are widely used for reconstruction of objects of historical and cultural legacy, they make it possible to re-create the original image of the object using photographs, historical materials and other sources, thereby helping to completely show the building. 3D models can be used to create virtual collections, interactive guides and various resources, as they enrich their completeness and multimedia.

Various companies and organizations use a plenty of computer graphics software. To choose the appropriate software tool for 3D modeling, it is necessary to conduct a comparative analysis of software products existing on the market.

For comparison, the following software tools were selected: *Sketch Up* (by *Trimble Navigation*), *Blender* (by *Blender Foundation*), *Autodesk* 3*ds Max* (by *Autodesk*), *Maya* (by *Autodesk*), *Houdini* (by *Side Effects Software*).

Sketch Up is a software for modeling relatively simple 3D objects – buildings, furniture, interior. It is developed by *Trimble Navigation*. There are two versions of the program – free for non-commercial use with limited functionality of *Sketch Up Make* (primarily regarding exporting to other formats), and commercial version *Sketch Up Pro*[1].

Blender is a professional free and open source program for creating 3D computer graphics, including modeling, sculpting, animation, simulation, rendering, post-processing and editing of video with sound, node composition, as well as creating 2D animations. It is very popular among all free 3*D* editors due to its rapid stable development and technical support [2].

Autodesk 3ds Max is a professional three-dimensional software for modeling, animation, and visualization. It is used for game development and design. This program is currently being developed and published by *Autodesk*.

The program is available by subscription for commercial purposes from one month to three years. Students and teachers can get a three-year subscription for free, but with such a license, the program can only be used for training [3].

Maya is a three-dimensional graphics editor available on Windows, mac OS and Linux. *Maya* has the full functionality of 3D animation, modeling and visualization. The program is used to create animations, environments, motion graphics, virtual reality and characters. It is widely used in cinematography, television and game development.

Houdini is a professional software package for working with 3D graphics. The main difference of this package is that it is a visual programming environment [4].

One of the main criteria for selecting programs was free access. Based on the needs for 3D reconstruction of historical and cultural objects, the criterion for comparing software products was the presence of:

1. Russian-language version.
2. Free access.
3. Video tutorials.
4. Built-in sets of design elements.
5. Ability to customize the toolbar.
6. Ability to create animations.
7. The ability to create customized materials, textures, etc.

According to these criteria, a comparative analysis was carried out. The results are shown in Table.

Benchmarking analysis of software products

Criteria	Sketch Up	Blender	Autodesk 3ds Max	Maya	Houdini
Russian-language version	+	+	+	+	–
Presence of free access	+	+	3 years trial version for students	Free for students	+
Video tutorials	+	+	+	+	Available, but not sufficient
Built-in databases with design elements	+	–	Available, but a full set of elements is only in the paid version	In the student version, the set is limited	–
Presence of customized toolbar	+	+	–	+	–
Animation creation	+	+	+	+	+
Creation of customized materials, textures, etc.	–	+	+	–	–

A comparative analysis showed that *Autodesk 3ds Max*, *Maya* and *Houdini* software products are partially suitable for the reconstructing historical and cultural objects, as some of them contain an insufficient or limited set of built-in design elements, or do not allow you to customize the toolbar and create your own materials and textures, which is very important, therefore the *Blender* and *Sketch Up* software tools are more suitable for the user. The *Blender* has a huge set of tools, allows the user to create customized textures, materials and colors, work with the adjustment of light sources, etc. But this program is difficult to learn and use because of such wide functionality. Therefore, if modeling complex objects with the detailed animations is not required, then the *Sketch Up* is more suitable for a user. Other software tools can be used as auxiliary.

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УДК 395

THE RESEARCH OF THE PECULIARITIES OF THE TRADITIONS IN THE ROYAL FAMILY OF THE WINDSOR DYNASTY

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The article discusses the peculiarities of some traditions in the royal family of the Windsor dynasty. The authors draw our attention to the fact that the Windsors are the ruling royal dynasty in the United Kingdom of Great Britain and Northern Ireland that dates back to 1901, when Edward VII, the son of Queen Victoria (from the Hanover dynasty) and Prince Albert, the representative of the German house of Saxe-Coburg-Gotha, ascended the throne. One of the main traditions is analyzed – Garden Parties – as an important way for The Queen to speak to a broad range of people from all walks of life, all of whom have made a positive impact in their community. The examples of specific significant events occurring during such parties are also mentioned.

Keywords: Windsor dynasty, traditions, royal family, Buckingham Palace, Holywoodhouse palace, tea tent, garden parties.

ИССЛЕДОВАНИЕ ОСОБЕННОСТЕЙ ТРАДИЦИЙ В КОРОЛЕВСКОЙ СЕМЬЕ ВИНДЗОРСКОЙ ДИНАСТИИ

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Рассматриваются особенности некоторых традиций в королевской семье Виндзорской династии. Авторы заостряют внимание на том факте, что Виндзоры — правящая королевская династия в Соединенном Королевстве Великобритании и Северной Ирландии, которое берет свое начало с 1901 года, когда на престол вступил Эдуард VII, сын королевы Виктории (из Ганноверской династии) и принца Альберта, представителя германского дома Саксен-Кобург-Гота. Анализируется одна из главных традиций – «Вечеринки в саду», как один из важных способов для королевы пообщаться с широким кругом людей из всех слоев общества, каждый из которых оказал положительное влияние на его развитие. Также приводятся примеры конкретных значимых событий, происходящих во время таких вечеринок.

Ключевые слова: династия Виндзоров, традиции, королевская семья, Букингемский дворец, дворец Холивудхаус, чайная палатка, садовые вечеринки.

The article discusses the peculiarities of some traditions in the royal family of the Windsor dynasty. The aim of the article is to conduct a research of the peculiarities of the Garden Parties – as an important way for The Queen to speak to a broad range of people from all walks of life, all of whom have made a positive impact in their community.

The authors explain that every year, Windsor invites more than 30,000 members of the public to their garden parties – three of which are held at Buckingham Palace, and one at Holyrood. It is estimated that during such festivities, 27,000 cups of tea, 20,000 sandwiches and 20,000 pieces of cake are prepared for guests.

The article informs that Garden parties began to be organized in the 1860s, during the reign of Queen Victoria. Such a meeting of the upper classes was a kind of social therapy for the queen, who lost her husband, Prince Albert, in 1861. One of these parties is captured in 1897 painting dedicated to the anniversary of these meetings in the open air. The painting depicts Queen Victoria and Alexandra, the Princess of Wales, who ride back to the palace in a horse-drawn carriage, while the Prince of Wales communicates with "respected members of the London community" [3].

Already in 1891, The New York Times published a message about a garden party organized by the Prince and Princess of Wales in honor of the Emperor and Empress of Germany.

Fig. 1. Royal Garden Party at Buckingham Palace in 1911

Held at Marlborough House, this party brought together all the colors of society: among those present were Queen Victoria, Prince and Princess of Monaco, Princess Alexandra of Anhalt, Dukes of Edinburgh, Dukes of Connaught. "The well-kept and artistically trimmed gardens of the Marlborough House for this occasion were turned into a brilliant, tastefully decorated summer camp with emerald lawns, on which tents and tents flaunted here and there. Everywhere among the magnificent flower beds and fountains, happy representatives of the British and German aristocracy laughed, talked unhurriedly, laughed in the shady arbors" [2].

Fig. 2. Lauritz Tuxen's painting "A Party
in the Garden of Buckingham Palace, June 28, 1897"

The authors draw our attention to the fact that across the country, a long-established network of sponsors is used to invite guests, including Lord Lieutenants, societies and associations, government departments, local authorities, services, the church and other faiths. At the same time, it should be emphasized that only people who have shown themselves actively in charity and have made a significant contribution to the development of local communities can receive an invitation.

Each invitee is allowed to take with him a relative, girlfriend or friend, etc., but it is impossible to buy such an invitation. Each invitee should be dressed in accordance with certain rules: men – in ordinary suits or tailcoats, women – in an elegant dress with a hat or a facilitator. The military was allowed to be in their uniform.

The article describes the details of the event. On the day of the Garden Party, the gates of the Palace are open from about 15:00. The party officially begins when the Queen and Duke of Edinburgh, accompanied by other members of the royal family, enter the garden at 16:00, when the national anthem is performed by one of the two military groups present.

While the groups continue to play the music of their choice, the Queen and the Duke of Edinburgh bypass the guests on the "paths". Each of them goes their own way, and random presentations are made so that everyone has an equal opportunity to speak with Her Majesty and other Royal Family Members. Then the queen arrives at the Royal Tea Tent, where she meets regular guests.Guests can eat, drink and stroll through the beautiful palace gardens. The summer garden reception ends around 6:00 p.m. when Queen Elizabeth II and the Royal Family leave the event and the orchestra playing the National Anthem indicates the end of the receptions [1].

The authors consider some peculiarities of such parties. For instance, a garden party is also held every year for the Not Forgotten Association, a war veteran charitable organization typically hosted by the head of The Princess Royal.

The Queen also gives permission to hold additional parties in the garden, for example, to celebrate the 50th anniversary of the award ceremony of the Duke of Edinburgh in 2006 and the 100th anniversary of the territorial army in 2008. In 2006, in honor of the Queen's 80th birthday, the gardens were turned into scenes from children's books for the Children's Day at the Palace. In 2015, garden parties were held to mark the 100th anniversary of the Women's Institute and the United Kingdom Charity.

Thus, the parties at Buckingham Palace, organized by the Queen, play an important role in maintaining communication between the public and members of the Royal Family.

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TECHNOLOGICAL DEVELOPMENT OF GROUND SPACE INFRASTRUCTURE

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The article is devoted to the study of the technological development of ground space infrastructure in Russia, as well as the consideration of ground complexes for the control of space vehicles. The main directions of work on the development of the ground automated control complex are formulated.

Keywords: technological development, ground-based space infrastructure, spacecraft, ground control software.

ТЕХНОЛОГИЧЕСКОЕ РАЗВИТИЕ НАЗЕМНОЙ КОСМИЧЕСКОЙ ИНФРАСТРУКТУРЫ

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Статья посвящена исследованию технологического развития наземной космической инфраструктуры в России, а также рассмотрению наземных комплексов управления космическими аппаратами. Сформулированы основные направления работ по развитию наземного автоматизированного комплекса управления.

Ключевые слова: технологическое развитие, наземная космическая инфраструктура, космический аппарат, наземный комплекс управления.

The development of space technology and the development of complex space systems have resulted in a significant increase in the number of spacecrafts being operational at the same time. The introduction of more complex spacecrafts, sharply increases the requirements for the efficiency of the solution of management tasks. For these purposes, ground control software, whose development is not on the ground, are designed. New algorithms of spacecraft control are constantly being implemented, hardware part is being improved, and new, improved software is being developed.

Ground control software are a set of ground-based information and measurement and computing facilities with the required mathematical support. Ground control software provide the management of the spacecraft.

Ground control software should address the following major challenges [1]:

Firstly, in terms of the spacecraft command and control software:

− formation of one-time commands, command and program information and conditions of their issuance during communication sessions;

− collection and preparation of initial data for planning of operation of onboard systems, calculation and formation of programs of management of spacecraft;

− planning of operation of onboard systems, formation of control programs;

− issuance of one-time commands and command and program information for spacecraft;

− Control of the spacecraft in the session by issuing, if necessary, one-time commands directly from the Manned Spacecraft Control Center and extraordinary one-time commands from the ground station of the command and measurement system according to the instructions from the Manned Spacecraft Control Center;

− calculation of the planned cyclic graph of the flight of the spacecraft.

Secondly, in terms of information and telemetry support for spacecraft control:

− reception of all types of control information transmitted from the spacecraft (information of general control, telemetry information);

− processing of control information;

− monitoring of the execution of spacecraft planned tasks;

− assessment of the state of systems, devices and elements of the spacecraft design in the performance of functional tasks;

− diagnostics of failures in the operation of onboard equipment and issuing recommendations for the management of spacecraft in abnormal situations;

− preparation of initial technological data for the control of spacecraft;

− accumulation, systematization, cataloguing, storage of current and reference information on spacecraft and elements of the Manned Spacecraft Control Center.

Thirdly, in terms of navigation and ballistic support for spacecraft control:

− measurement of the current navigation parameters of the spacecraft;

− prediction of motion parameters and orbit elements according to measurements of current navigation parameters of the spacecraft;

− calculation of ballistic information to ensure the operation of the ground control software funds and the means of interacting organizations.

− In addition, ground-based spacecraft control systems should provide [2]:

− the formation and storage of the local time scale (time scale of ground control systems);

− protection against unauthorized issuance of one-time commands and control programs on the spacecraft and against unauthorized access to information circulating in the ground-based control complex, ensuring the imitation resistance of messages transmitted to the spacecraft;

− organization of information exchange between elements of the ground control complex.

The main elements of ground-based control systems:

a) Manned Spacecraft Control Center:

The main element of ground-based control systems is the Manned Spacecraft Control Center, from which round-the-clock automated control of spacecraft and ground-based control systems is carried out.

The main functional tasks of the Manned Spacecraft Control Center:

− planning the work of onboard spacecraft systems and ground-based control systems;

− calculation, formation of command and program information and its transmission to the ground station of the command and measurement system;

− collection, processing, display and documentation of all types of management information;

− monitoring the operation of on-board systems, analyzing the results of the flight program according to telemetry information received from the board;

− monitoring the operation of technical equipment of ground-based control systems in the process of preparing and conducting control sessions;

− solution of navigation and ballistic tasks.

b) Communication and data transmission system:

Communication and data transmission system – designed to ensure the transfer of information between elements of ground-based control systems in the required amount.

− the communication and data transmission system includes:

− automated switching centers;

− modems;

− channel-forming and subscriber equipment;

− cable, wire, fiber optic, radio relay and satellite communication channels;

− means of interfacing various communication subsystems.

c) Command control information system:

The Command control information system is designed to measure the current navigation parameters of the spacecraft (range, radial speed and angular coordinates), receive telemetric information from the spacecraft, as well as to organize the control channel of the spacecraft.

Based on its purpose, the Command control information system performs the following functions, thereby providing an interface between the spacecraft and the Manned Spacecraft Control Center[3]:

− reception of technological, command and program information and target designations from the Manned Spacecraft Control Center via the Communication and Data Transmission System for conducting communication sessions with the spacecraft;

− measuring current navigation parameters, pre-processing information and issuing it to the Manned Spacecraft Control Center;

− receiving telemetric information from the spacecraft, its preliminary processing and transmission to the Manned Spacecraft Control Center;

− issuance to the spacecraft, during a communication session, one-time commands and arrays of command and program information, etc.

The command and measurement system consists of hardware and software and is the main connecting link between the Manned Spacecraft Control Center and the spacecraft, which provides spacecraft control, as well as transmits data on the forward and reverse channels of the radio line and the communication and data transmission systems.

Independent access of Russia to space is one of the main national priorities for the development of Russian cosmonautics and is ensured by the development of the Russian system of launch vehicles and ground-based space infrastructure, including cosmodromes and a ground-based automated spacecraft control complex. For technological development, one should adhere to the project "Strategies for the development of space activities of Russia until 2030 and for the future", developed under the guidance of Yu.N. Koptev, in which the strategy for the development of ground-based spacecraft control systems was formulated.

The development of the ground-based automated spacecraft control complex is aimed at creating conditions for the efficient use of existing infrastructure, as well as the development of international cooperation for controlling spacecraft in flight in the entire range of tasks. The main areas of work on the development of a ground-based automated control complex include:

− until 2020, the full development of existing controls for the Russian orbital constellation, transfer of the management of the ISS program facilities to the global relay circuit;

− after 2020, the development of technologies for creating high-performance antenna systems to support and reserve existing large-sized antennas, the introduction of control of automatic spacecraft and booster units through a global relay circuit;

− until 2030, the creation of the Manned Spacecraft Control Center for manned long-range spacecraft, the construction of a new Center for Long-Range Space Communication in the south of the European part of Russia, the construction of multi-element antenna systems of ultra-high efficiency, the creation of the foreign Russian Center for Long-Range Space Communication in the western hemisphere;

− after 2030, further improvement of the system characteristics of the ground-based automated control complex to ensure advanced research of deep space objects.

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METHODS OF DISTRIBUTING PROBABLE PLACES OF FINDING AN OBJECT IN A TASKED SECTOR

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The paper discusses methods for distributing probabilistic locations of an object in search problems. A brief description of the methods and their characteristics is given. The issues associated with probability of search objects detecting while moving both the object and the detection device with variable speeds.

Keywords: probability of detection, finding process, random variable, object position, index of probabilities.

МЕТОДЫ РАСПРЕДЕЛЕНИЯ ВЕРОЯТНЫХ МЕСТ НАХОЖДЕНИЯ ОБЪЕКТА В ЗАДАННОМ СЕКТОРЕ

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Рассматриваются методы распределения вероятностных мест нахождения объекта в задачах поиска. Приведено краткое описание методов и их характеристик. Рассмотрены вопросы, связанные с вероятностью обнаружения объектов поиска при одновременном перемещении, как самого объекта, так и устройства обнаружения с изменяющимися скоростями.

Ключевые слова: вероятность обнаружения, процесс нахождения, случайная величина, положение объекта, показатель вероятностей.

The task of searching and finding search objects is an interesting and relevant task, since the issues of detection are related to ensuring the safety of industrial enterprises, defense and energy facilities, transport nodes, various places of mass accumulation of people, etc. Modern security systems, in addition to access control, video surveillance, perimeter security, should include capabilities to detect a variety of unmanned aerial vehicles, such as drones, quadrocopters, and multicopters. The search for a typical object can be carried out both visually and using mathematical calculations. Visual search is performed by given squares. In mathematical calculations, the probability indicator of the search and rescue group is used. As a result of applying various techniques, the quality of finding an object in the studied sector is improved [3].

By finding something of a different nature the researcher means the process of purposefully checking a certain area of space for the detection of objects in it. Detection is understood as obtaining information about the position of an object by establishing direct energy contact with the object. Detection can be done in many ways – radar, acoustic, optical, and others.

However, finding should be understood as a random process, the course of which will depend on a number of different factors, so the outcome of the finding for each case cannot be predicted. But one can make a reasonable assumption about the average expected result of finding. For a quantitative description of the finding process, the apparatus of probability theory is used.

If continuous checks are carried out during the search, the assessment of the basic probability over time dt is one of the main criteria for evaluating the effectiveness of surveillance tools for detecting objects [1]. At the same time, the size of the elementary probability is the base density of the number of detections, that is, the intensity of the detection stream (search intensity).

Moreover, limited by the maximum detection range, it is often called the possible detection area, which is a random variable, and under constant conditions takes different values. This is usually a circle or sector, and object detection may or may not occur in this area. This method is called "Distribution of the range of the detection means during the search".

In the method "Distribution of kinematic characteristics of the search object", the search is performed to detect an object of a certain category, the Vo velocity of which is within certain limits, and thus, it is considered known. The values characterizing the position and movement of the search object with respect to the observer are generally considered random and independent of each other. Each of the given values is characterized by their own distribution. In practice, the most common are the uniform and normal distributions of the possible locations of search objects.

In many cases, the active zone of the search object (area Sp) is reliably known, and the position and direction of its movement are unknown. In addition, none of the possible routes or locations could be preferred. In this case, the most appropriate assumption is the assumption that the position of the object is a uniform distribution of the location of the object in the Sp region, and that its motion is uniformly distributed in the range from 0 to 2π [4].

The normal distribution of probable locations of the search object corresponds to the case when the search actions are organized based on the location of the object at a certain point in time after which the data flow for one reason or another has ceased. We give an example in which a certain search object is shown at a certain moment in time. (Fig. 1).

Geometric explanation of the distribution of the probabilistic locations
of the search object, after its initial discovery

In this example, it is necessary to organize search activities using discovery devices to rediscover a search object using the location of the search object 's initial discovery.

There are cases when the courses of the search object are not equally probable in the range from 0 to 360 ° (2π), but are evenly distributed in the sector (K2 – K1). Knowing that the Rayleigh distribution describes the distribution of the length of a random vector whose projections onto the coordinate axes obey the normal law, it can be assumed that the error in determining the velocity vector of the search object is a random quantity obeying the normal circular law.

Thus, the probabilistic characteristics of the process of searching and detecting an extended object were considered and analyzed. The process of searching for an object in continuous and

discrete time was not observed, since cases of uniform and normal distribution of probable places of a search object are most often encountered in practice. The basis for the distribution of the probable location of an object in the sector will be the indicators of the tests performed, the detection methods presented, a quantitative assessment and the effectiveness of a particular method [5].

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USING SOCIAL MINING TO ANALYZE THE STATE OF PUBLIC OPINION

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In this article the use of web mining and social mining technologies is considered as a key factor for analyzing the state of public opinion

Keywords: personal information, analysis, machine learning, social mining

ПРИМЕНЕНИЕ SOCIAL MINING ДЛЯ АНАЛИЗА СОСТОЯНИЯ ОБЩЕСТВЕННОГО МНЕНИЯ

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Рассмотрено применение web-mining и social mining технологий для анализа состояния общественного мнения.

Ключевые слова: персональная информация, анализ, машинное обучение, social mining.

Nowadays, the development of post-industrial society dictates new rules for the relationship between society and government. Due to the the development of Internet communication, ways of expressing public opinion are also progressing, which have become the impetus of changing decisions in the political sphere [1]. A new field of influence and confrontation is being formed, which is a form of protest expression that causes interest as an object of information influence among political rivals of our state.

Independent and autonomous development of the country has always awakened a negative interest among our political rivals. Under these circumstances, we need to decide how to respond to the challenges that the world's competing powers are offering us to face. And, finally, we have to make a choice: whether continue to surrender our positions to the success of foreign information intervention, or to oppose them and create a real basis for our geopolitical initiatives.

It is a well-known fact that social networks have become the main way of communication among the most active strata of society. Social networks in the modern world are not just a means of communication, but a way of expressing an active position, formation of effective public opinion, and influence political decisions of those who make them. With the development of information technology, as well as the Internet, the relationship between people has moved to a new level. Electronic portals have appeared that can reflect certain aspects of a person's activity in society, save and accumulate information.

Personification of offers allows you to make a social network more efficient and attractive to the end user. A personalized appeal to network users, highlighting their real needs, customization of

content and services are one of the main components in the process of attracting and retaining users. Using the analysis of user interest circles to determine the most suitable groups and users of social networks is not the only task of social mining technologies, more and more web mining and social mining technologies are beginning to be used to resolve all kinds of conflict situations [2].

Web mining and social mining technologies are increasingly being used to resolve conflict situations [2]. The main aim of using the algorithms is to collect the necessary information about users' interactions between each other, their interests and behavior. Analysis of history of user's behavior in a network helps to identify the most frequented resources, the time of their visit, interesting subjects, content, etc. All this information gives us an opportunity to specify the user's profile of the network and find the missing data. Identifying information about users is a rather simple task on the condition that all necessary information was filled in correctly. Personal information about last and first names, age and date of birth, and place of residence significantly simplify the collection of information about social groups of users of social networks. However, it is a common situation when this information is not filled in, or specially filled in incorrectly. In order to provide a personalized representation of information about guest or falsely registered users, it is necessary to collect and enrich information about them as much as possible using other sources of information. The process of extracting information from user profiles includes five main steps: extracting information from the Internet, extracting user profile data, preprocessing information, processing using neural networks and data mining, and interpreting the results (see Figure).

The process of extracting information from user profiles.

If there is no personal data for a certain category of users and their preferences, interests, and social circle is not known reliably, this information will be received by analyzing cookies and server log files [3]. Analysis of the content of cookies and logs can determine the user's interests, region of residence, time of visiting resources, and so on, which in turn helps to form an approximate portrait of the user. Though, it is important to understand that information about users and guests of the network is approximate [4].

These algorithms improve the personalized selection of interesting information for a person, helps to find new groups of communication, new interesting people. Nevertheless, there are situations when different users' groups are formed for the purpose of a terrorist attack. By analyzing this information, these programs or special services may block social network accounts or respond with physical methods to find actual criminals or people who threaten the security of the country.

Certainly, the using of such services will make the social network more effective and attractive for users. It will be much easier to find exactly what you need among thousands of articles and discussions, without wasting time studying unnecessary information. As a result, it will increase user loyalty, and therefore the value of the network as a whole. Such mechanisms will increase the effectiveness of various promotions and newsletters within the social network. Last but not least, these algorithms monitor users of social networks, predicting possible outbreaks of protest movements or negative behavior against the political power of our country [5].

Based on the foregoing, it can be concluded, that the social network's intellectual analysis is a powerful and important tool that provides information for optimizing its work, allows successful marketing companies to increase visitor loyalty, and provides security support both between users and within modern state.

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PROBLEMS AND PROSPECTS FOR THE COMMERCIALIZATION OF THE RESULTS OF INTELLECTUAL ACTIVITY

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The article discusses the problems existing in Russia and the prospects for the results of intellectual activity in educational institutions. In addition, examples of key commercialization methods are provided.

Keywords: university, intellectual activity, commercialization, production, small innovative enterprises.

ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ КОММЕРЦИАЛИЗАЦИИ РЕЗУЛЬТАТОВ ИНТЕЛЛЕКТУАЛЬНОЙ ДЕЯТЕЛЬНОСТИ

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Рассматриваются существующие в России проблемы и перспективы результатов интеллектуальной деятельности в учебных заведениях. Кроме того приводятся примеры основных способов коммерциализации.

Ключевые слова: университет, интеллектуальная деятельность, коммерциализация, производство, малые инновационные предприятия.

The main mission of universities around the world is primarily to educate students and train high-quality specialists. In addition to performing this function in developed countries, the model of commercializing the results of research activities is increasingly being used, since commercialization is understood as the type of profit making in which all the participants benefit. In order to get more profit from the idea, small innovative enterprises work on the basis of universities, which are responsible for creating an invention or utility model and creating a finished product.

The main subjects of market relations in the commercialization of intellectual property in the process of innovation are:
− government and control bodies;
− an enterprise that creates and uses new technologies;
− authors (creators) of new technologies in the form of results of intellectual activity;
− investors or sponsors participating through financing in the production cycle;
− "competitor" manufacturers that produce competitive products (services) based on their own developments or other similar intellectual property objects;

− manufacturers – "pirates", carrying out illegal use of objects of intellectual activity of the enterprise and producing fake products. On the market the problems arise in the relations between market entities during the commercialization of intellectual property, the difference and similarity of their interests are most clearly and sharply manifested [1].

The analysis of foreign experience in the sphere of stimulating innovation and research activities shows that the main source of innovation is organizations engaged in scientific and technical development, development work and research activities in general, which allows us to consider them as innovative. These innovative organizations ensure the sustainable development of the scientific and technical sphere and play a huge role in the socio-economic development of the state, economy, relevant industries and economic sectors.

The most difficult and least developed in practice are financial relations in market conditions and problems of regulation of relations in connection with the creation, legal protection and use of intellectual property, as well as problems associated with the inventory, documentation, valuation and accounting of intellectual property in quality of the property of the enterprise. In order to remove or at least reduce the severity of these problems, compliance with the rules for managing intellectual property and the conditions for its correct commercialization are required. They can be applied to intellectual activity at all levels: from school to research centers.

The main ways of commercializing intellectual activity are considered to be:

− leasing;
− technology transfer through joint ventures;
− industrial cooperation;
− franchising;
− technical assistance;
− engineering.

In Russia, engineering (design and practical work) and leasing (rental of rights and technologies) are most common [2].

Nowadays, the main ways of using intellectual property are defined: application in own production; transfer of rights to use; capital contribution. Qualified lawyers and appraisers are needed in this case. The process of commercialization of intellectual property requires an integrated approach, efforts and knowledge of many specialists.

As a rule, the staff of modern enterprises does not have the necessary team of specialists. Therefore, most likely, it will be necessary to attract them from the outside, but the problem of the quality of services remains. A way out could be the existence of a regional innovation center, staffed by experienced specialists in such various fields as law, patent protection, valuation, marketing, taxation, economics and finance.

Summing up the above, it can be noted that there are much more problems with the commercialization of the results of intellectual activity than opportunities and prospects. There are many opportunities for Russian scientists to create and promote their ideas, but in order to create a finished product or service, it is necessary to withstand great competition and correctly formalize intellectual property in law.

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MULTIMEDIA FEATURES OF A WEB-BASED RECOMMENDATION SYSTEM IN ESTABLISHING A RETAIL START-UP

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The article considers the possibilities of multimedia in establishing a retail start-up.

Keywords: multimedia, multimedia features.

МУЛЬТИМЕДИЙНЫЕ ВОЗМОЖНОСТИ РЕКОМЕНДАТЕЛЬНОЙ ВЕБ-СИСТЕМЫ ПО РЕАЛИЗАЦИИ СТАРТАПА В СФЕРЕ ТОРГОВЛИ

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Рассматривается возможность применения мультимедиа средств для рекомендательной веб-системы по реализации стартапа в сфере торговли.

Ключевые слова: мультимедиа, мультимедийные возможности.

At present, multimedia – technologies are a rapidly developing area of information technologies. The significant number of large and small firms, technical universities and studios are actively working in this direction.

The main features of these technologies are:

1) integration of multi – component information environment(text, sound, graphics, photo, video) into the homogeneous digital representation;

2) providing safe (coping integrity) and durable storing (guarantee period for decades);

3) the simplicity of information processing (from ordinary operations to creative ones).

Multimedia is the combination of modern information technologies. It allows to integrate text, sound, video image, graphics, animation and digitized still images.

Multimedia technologies are a set of modern audio, tele, visual and virtual communication tools. They are used in the organizing, planning and management processes of all activities.

Nowadays, the relevance of the multimedia product development is increasing.

In the diversity of education programs the following will be used in our recommendation system for start –up realization:

1) demonstration programs are used for illustrating material in form of video and audio clips with the application of a hypertext system. They can be used effectively in presenting some new information. Such programs optimize the education process and make it more successful by involving all kinds of sensory perception of a student in the entertaining multimedia context;

2) reference and information programs. It is possible to have access to different repositories of information and many databases. The example of reference and information program is an electronic encyclopedias, dictionaries, handbooks and so on. Electronic encyclopedias are based on hypertext links. They have additional opportunities to optimize students' research work, namely:

− allow to carry out research by keywords;

− contain convenient navigation system based on hyperlinks;

− contains the ability to include audio and video clips [1].

Creating and implementing such technologies will require PC, appropriate software and also the tools of multimedia project design for the big screens [2].

A certain way of transmitting the information is used in multimedia programs:

1. Interaction of various information blocks (text, graphics, video fragments) by means of hyperlinks. Hyperlinks are presented as a formed graphic image. A few hyperlinks can be located on a screen at the same time, and each of them determines its own route.

2. Due to the dialogue between user and source in which the user can choose the information he is interested in, the speed and sequence of its transmission [3].

The recommendation systems are the complex of algorithms, programs and services aimed in prediction of interesting objects for a user having the information about his profile or other data.

The goals of recommendation systems are simple and clear. They offer clients those products or services that will be interesting for them with high probability.

The recommendation systems are classified by the method of selecting the material necessary for the user.

Three basic approaches are mainly applied: collaborative filtering, content-based filtering, knowledge – based systems.

1. Collaborative filtering is one of the easiest and most effective. This three – step process begins with gathering user information. Then a matrix is built to calculate associations and, finally, a very reliable recommendation is made. There are two main varieties of this method: based on the users engaged in the search, and based on the elements that make up a particular category.

2. Content-based filtering. In content recommendation systems, recommendations are formulated based on attributes assigned to each element.

3. Knowledge –based systems. In knowledge – based systems, recommendations are not offered based on ratings, but on the basis of similarities between user requirements and a product description, or depending on the restrictions set by the user when specifying the desired product. Therefore, this type of system is unique, because it allows the client to explicitly indicate what he wants [4].

To build recommendations, such a system can use various data about the current visitor, their main groups – in the Figure.

Start-up or start-up company is a kind of business oriented on income generation by implementation of a fundamentally new idea. Start-up in a trade sphere includes the placement of a new product in the market, the emergency of a new sales service and all new things what can appear to improve the trade.

The recommendation system will play the main role in start-up realization in the trade sphere in such questions as:

1) the methods of promoting goods;

2) the opportunity to share experience due to a forum;

3) the ability to write the sale good texts;

4) struggle against objections.

Due to the multimedia capacity, we will have the possibility to enable it so to present interactivity, visual appeal and well-structured information.

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ANALYSIS OF CRYPTOGRAPHIC SECURITY TOOLS AND METHODS

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This article discusses the basic concepts of cryptography and methods of cryptographic protection in various fields. It describes how important cryptography is today and how this science will develop in the future. A theoretical understanding of the existence of an absolutely stable cipher is presented. The questions concerning modern problems in cryptography are considered. Examples of various situations showing how much an attacker's knowledge of a particular information affects the reliability of cipher are given.

Keywords: cryptographic protection, absolutely stable cipher.

АНАЛИЗ СРЕДСТВ И МЕТОДОВ КРИПТОГРАФИЧЕСКОЙ ЗАЩИТЫ ИНФОРМАЦИИ

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Рассматриваются основные понятия криптографии и методы криптографической защиты в различных сферах. Рассказывается о том, как важна криптография на сегодняшний день и как эта наука будет развиваться в дальнейшем. Представлено теоретическое представление о существовании абсолютно устойчивого шифра, а также рассмотрены вопросы, касающиеся современных проблем в криптографии. Приведены и анализированы примеры различных ситуаций, в которых отображается, как сильно влияют знание злоумышленником той или иной информации на надежность данного шифра.

Ключевые слова: криптографической защиты, абсолютно устойчивого шифра.

The main task of cryptography is the secret dissemination of information. This task applies only to information that requires protection. In this case, the information is considered hidden, secret, protected, and private. Cryptographic methods of protection are special methods of information re-adjustment which result in the information content being hidden [1]. The leading types of cryptographic protection are considered to be encryption and encoding of protected data, which are shown in Figure 1.

There are the following types of encryption: substitution, permutation, gamming, and analytical conversion of encrypted data. To encrypt and decrypt data in information systems, any cryptographic tool uses a particular cipher. It is necessary to understand which objects of the initial text are being cryptographically rearranged: individual bytes, bits, or blocks [5]. For example, in an Enigma cipher, operations are performed by byte.

Cryptography uses information rearrangement techniques that will not allow the enemy to extract it from intercepted messages. The case of the situation in which the cryptography

(encryption) task appears is shown in Figure 2. In the present example, **P** is an illegal user who seeks to intercept messages transmitted over a communication channel and tries to extract interesting and useful information from them. This simple scheme can be considered a model of normal situation in which cryptographic methods of information protection are used [2; 5].

Fig. 1. Encryption and Decryption of Information

Fig. 2. Cryptography Task

In this case, it is not the protected information itself that is transmitted on the communication channel, but the result of its re-adjustment with the help of a cipher, and for an illegal user there is a difficult task of opening the cipher. Opening or breaking the cipher is the process of obtaining protected information from the encrypted message without knowing the applied cipher [5].

Creating a reliable cipher is quite time-consuming, so it is better to increase the lifetime of this cipher and use it to encrypt as many messages as possible [4].

Recently, the security of protected information has become determined primarily by the key. For encryption and decryption the sender and recipient use the same key, which they agreed to use before the interaction began. Let's consider the symmetric methodology and specific examples in which this methodology is applied:

– Kerberos created to authenticate access to resources on the network (not to verify data).

– ATM Banking Networks.

These systems are usually considered unique developments of the banks that own them and are not sold. They also use a symmetrical methodology.

One of the modern problems of cryptography is the lack of further prospects. According to experts, the supposed future of modern cryptography lies in quantum computing associated with the emergence of serious quantum computers with which it will be possible to solve most problems much faster.

The existence of an absolutely stable and reliable cipher is possible. Claude Shannon was one of those who first formally proved the existence of such a cipher. He also put forward a mandatory condition for absolute strength of the cipher: in order for the cipher to be absolutely stable, it is necessary that the uncertainty of the encryption algorithm is not less than the uncertainty of the encrypted message [2; 5].

The uncertainty of the encryption algorithm is defined in the same way as the uncertainty of the message. The strength of ciphers is based on secrecy, that is, on the uncertainty for an illegal user of the decryption algorithm – if this were not the case, anyone would have the ability to decrypt the encrypted data. The less the attacker knows about the cipher, the less likely it is that the message will be successfully decrypted [5].

I will give the following example for an explanation of the aforesaid: let the short 16-bit encryption having the following contents be intercepted: 1 0 0 1 1 1 0 1 1 1 0 1 0 1 0 1

To make it simple, assume that the original message is the same length. If the attacker does not have any priori information about the encrypted message, each of the 2^{12} original variants is equally probable for him, and thus the probability to determine correctly the original message by simple guessing is 2^{-12}. Suppose now that the attacker is a priori aware that the encryption is an overlay of the same 4-bit mask on each 4-bit message group by a bitwise exclusive or operation. Obviously, it is possible to $16 = 2^4$ different bit mask variants, respectively, it is possible to 16 different values of the source text:

Mask source text
0000 100101110101
0001 100001100100
0010 101101010110
1111 011010001010

Thus, now the probability to guess correctly the source text is 1/16 – familiarity with the peculiarities of the used encryption method increased it by 256 times. Hence, we can conclude that the more uncertainty in the encryption transformation for an outsider exists, the further it stands from the acceleration of the cipher, the more reliable the cipher is. A cipher is completely uncertain to the attacker.

From all of the above, it follows that the current challenges for the modern cryptography are increasing the stability and reducing the size of data blocks.

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IMITATION MODELING AT OPTIMIZATION OF TRANSPORT NETWORKS

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The paper considers simulation optimization of traffic light control to improve intersection throughput. An experiment was conducted; for this, reliable data on the work of a traffic light were collected with the help of which a simulation model of the intersection was built.

Keywords: simulation models, Markov process, transport network, discrete event modeling, algorithm.

ИМИТАЦИОННОЕ МОДЕЛИРОВАНИЕ
ПРИ ОПТИМИЗАЦИИ ТРАНСПОРТНЫХ СЕТЕЙ

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Рассматривается имитационная оптимизация светофорного регулирования для улучшения пропускной способности перекрестка. Проведен эксперимент, для этого собраны достоверные данные работы светофора с помощью которых была построена имитационная модель перекрестка.

Ключевые слова: имитационные модели, Марковский процесс, транспортная сеть, дискретно-событийное моделирование, алгоритм.

Currently, the problem of road congestion for most large cities is one of the central ones, with an increase in cars traffic congestion appears, because of this the number of accidents increases. Of course, you can optimize traffic by building new interchanges, but it will be costly. If you conduct experiments on real roads, this can lead to accidents and difficulty driving. It is possible to optimize traffic control along with the construction of new and expansion of existing road junctions. Optimization of traffic light regulation is an ongoing process, attention to which is growing in proportion to the world level of motorization. The severity of the transport problem requires a systematic approach to solving it.

The following methods are used in the formulation of the problem of optimal control of the traffic light cycle: adaptive regulation of the cycle, joint consideration of several intersections, study of stable operating modes. To solve the existing problem, it is necessary to expand the base of the applied methods for analyzing the road situation, including through the creation of simulation models of traffic flows. It is possible to improve the situation on sections of the road network – due to imitation optimization of traffic light regulation. This area is economically viable; it takes a little time to implement it. When studying the movement of traffic flows, modeling is very promising,

allowing you to create a simulation model that is adequate to the real traffic situation for a given set of initial parameters and find the optimal mode of traffic light on the simulation model.

To develop multi–agent systems, specialized software is used that contains tools for describing agent behavior and environmental conditions, monitoring and controlling the simulation model processes, as well as their interaction. The range of capabilities of such programs is determined by the degree of interaction with the system developer. For example, for educational purposes, where the capabilities of such software are limited, but the simplicity of the simulation implementation compensates for this drawback. For specialized needs, programs with advanced functionality, but with limited capabilities in administering this product, are provided.

When analyzing the urban transport system, many factors must be considered: streets, highways, bike paths, public transport routes, etc. The ability to realistically predict traffic demand is critical to road infrastructure planning. In this regard, in recent decades, agent-based models for the development of the city have been actively used. In the literature, one can find many agent-based models of urban transport system planning at various geographical scales and with varying degrees of detail of agent behavior. These models have proven effective in modeling the entire diversity of the urban environment. Simulation models make it possible to build mathematical models that are able to describe the behavior of participants in the traffic flow and reproduce the parameters of its movement (for example, to improve the organization of movement, etc.).

A Markov process, a process without aftereffect is a random process, the evolution of which after any given value of the time parameter t does not depend on the evolution preceding t, provided that the value of the process at this moment is fixed (in short: the "future" and "past" of the process are independent apart from the known "present".

A transport networks a set of transport routes of a certain territory connecting transport hubs and settlements. Transport routes vary in function, throughput, load, and flow rate.

Agent-based modeling is a reliable tool for analyzing alternative urban development scenarios. It is difficult to model such a system by traditional methods due to the complexity of the real world and the presence of interdependencies between systems. Basic approaches: Discrete event simulation and agent-based modeling. In discrete-event modeling, a process is described as a sequence of separate discrete events; modeling takes place at an average level of abstraction. With an agent-based approach, the behavior of each individual agent is modeled and relationships between them are established.

Discrete event modeling is the most developed and has a wide range of applications – from mass service and logistics to production and transportation systems. This type of simulation is the most obvious for the implementation of production processes [2]. Discrete event modeling is characteristic of systems for servicing object flows: pedestrians, museum visitors, cars in front of a traffic light, etc. It is these systems that are called queuing systems.

Agent-based models are based on three main ideas:
– object orientation;
– agent learning (or their evolution);
– complexity of calculations.

Agent-based model consists of agents dynamically interacting according to certain rules. The environment in which they interact can be quite complex.

To compile the model, data are required on the intersection: traffic congestion, traffic data.

About the optimization experiment (Fig. 1).

The type of parameters "discrete" is set; the minimum and maximum values of the phase lengths of traffic lights are selected from 10 to 90, with a fixed step per unit, since a smaller step is not advisable. And the "fixed" parameter for the traffic light regulating the movement of pedestrians is 21s.

Start
↓
Materials study
↓
Data collection
↓
The experiments
↓
Application of the obtained data
↓
the end

Several optimization experiments were carried out with different intensities of car traffic. But for all traffic intensities, the optimal modes of switching traffic lights do not differ significantly (Fig. 2).

Fig. 1. Simulation of the intersection

Fig. 2. The result of the optimization experiment

After carrying out optimization experiments, the obtained data was substituted into the simulation model and simulation was started. After changing the mode of operation of traffic lights, traffic jams at the intersection became less. In the experiments that were done, the average travel time and maximum travel time are almost the same. Conclusion: this mode works best traffic for all modes of movement studied.

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ANALYSIS OF PUBLIC TRANSPORT TRAFFIC ROUTES

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This article discusses the information system for the analysis of public transport routes and the impact of passenger traffic, as well as the results of the development of the program analyzes the transport network of the city.

Keywords: passenger traffic, public transport, route.

АНАЛИЗ МАРШРУТОВ ДВИЖЕНИЯ ОБЩЕСТВЕННОГО ТРАНСПОРТА

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Рассмотрена информационная система для анализа маршрутов движения общественного транспорта и влияние на него пассажиропотока, а также представлены результаты разработки программы анализы транспортной сети города.

Ключевые слова: пассажиропоток, общественный транспорт, маршрут.

The high population growth rate of cities every year covers an increasing number of countries, the number of urban residents is constantly growing, which in turn is accompanied by an expansion of the boundaries of cities and an increase in their area, and with this, the need for a high-quality and well-organized urban transport network. In particular, urban passenger transport routes that can fully satisfy the needs of city residents, such as: fast and convenient movement through the territory of the population point, the opportunity to get to any part of the city by spending the minimum amount of resources, strict adherence to the schedule and the minimum waiting time at the stopping point.

The traffic stream consists of individual cars with different dynamic characteristics and driven by drivers of different qualifications, that is, it is not homogeneous [1].

Analysis of the routes of public transport is a multi-stage process of collecting data and making calculations. Route assessment includes a large number of criteria, all of them are an important part of the analysis, however, among them we can distinguish such criteria as passenger flow.

Passenger traffic – a set of individual characteristics that allow us to generally assess the movements of passengers [2]. Passenger traffic plays an important role in the analysis of the transport network of the city, since it is the residents of the city who create the need for public transport.

The developed system of analyzing public transport routes allows to simplify the process of calculating and analyzing criteria. The result of the work was a program for analyzing public transport routes, the working area of this program is presented in Fig. 1 [3].

This Figure presents the operator workspace. This work area reflects routes and their characteristics. The operator, in turn, can correct these parameters if it detects an error in the calculations, since the program calculates all the parameters on the basis of the data entered into it and to avoid errors when entering incorrect data, the operator selectively recalculates one or more criteria.

These calculations are based on the collection of information on passenger flow and the work area for filling these data is presented in Fig. 2.

Fig. 1. Characteristics of the route

Fig. 2. Area filling in passenger traffic data.

In this work area, the employee captures the necessary data for further calculations. Also in this window the option of sampling by such parameters as date, time, bus number and stop name is implemented. In turn, this allows the operator to collect information, for example, for a day or for a certain period of time or at a specific stop, it allows to analyze the movement of passengers on a specific section of the route or the entire route, in the future it allows to conduct a qualitative analysis of the route.

Now the development perspective is the introduction of cameras with face recognition in rolling stock for the automated process of collecting information about passenger flow, this step will eliminate the human factor from the calculation of passenger flow, which in turn will eliminate such errors as incorrect data entry and incorrect calculation of criteria, it is also planned in the distant future to use trained machine intelligence to calculate in real time the most efficient route of movement.

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SIGNAL MODULATION AND ENCODING IN SATELLITE COMMUNICATION SYSTEMS

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This article provides an overview of digital signal modulation and encoding techniques used in satellite communication systems. The described techniques are used to process a signal at the ground station before transmitting data via the communication channel between the spacecraft and the ground station.

Keywords: digital signal processing, satellite communication systems, phase shift keying, interference immunity encoding.

МОДУЛЯЦИЯ И КОДИРОВАНИЕ СИГНАЛА В СПУТНИКОВЫХ СИСТЕМАХ СВЯЗИ

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Представлен обзор методов цифровой модуляции и кодирования сигналов, используемых в спутниковых системах связи. Приведенные методы применяются для обработки сигнала на земной станции перед трансляцией информации по каналу связи между космическим аппаратом и земной станцией.

Ключевые слова: цифровая обработка сигналов, спутниковые системы связи, фазовая манипуляция, помехоустойчивое кодирование.

An intensive development of satellite communication systems results from the global coverage area and the ability to provide communications for hard-to-reach areas of the Earth. These systems use wireless communication channels for data transmission. In these channels the transmitted signal is affected by interference, both internal interference that arises in the communication system paths and equipment components, and external interference that is caused by external sources of interference. This leads to the fact that the received data is most likely to contain errors. However, for the tasks performed in satellite communications, only a small fraction of errors in the processed discrete data is possible. Digital signal processing, which includes the conversion of an analog signal to a digital signal that is less prone to distortion, the best modulation and interference immunity encoding techniques can increase the throughput capacity and the signal-to-noise ratio, given the low energy performance of these systems [1].

The signals in satellite communication systems are quite stable in the troposphere when it is calm, but in case of tropospheric disturbances it is not advisable to use signals with complex types

of modulation (digital modulation is also called shift keying). The most suitable example is the Quadrature Phase Shift Keying (QPSK). Scheme of modulator is presented in Figure 1. However, further development led to the use of multi-position phase shift keying, as it is more immune to non-linear distortions peculiar to satellite system repeaters. For example, the Eight Phase Shift Keying (8-PSK) is used in the DVB-S2 satellite broadcasting standard. In addition to the multi-position phase shift keying, the ISDB family of standards for digital satellite broadcasting uses the Quadrature Amplitude Shift Keying (QASK) to increase the spectral efficiency of a satellite signal [3].

Fig. 1. Scheme of QPSK modulator

The examples of implementation of the interference immunity code used in satellite communication networks are as follows: a fairly powerful cascade code that is most often used to correct error packets (the inner code is a binary BCH code with error correction, and the outer code is a non-binary Reed-Solomon code), and a cascade scheme, in which the outer code is the Reed-Solomon code, and the inner code is the convolutional code (Figure 2), usually decoded using the optimal Viterbi algorithm. In addition, the turbo codes are used that are formed by parallel cascading of two or more components of systematic codes. The use of cyclic LDPC codes is provided for by the DVB-S2 standard for digital satellite television broadcasting; their feature is the provision of a high degree of error correction with a very easy and fast decoding algorithm.

Fig. 2. Scheme of convolutional coder

All the above encoding techniques are static from the point of view of the time invariance of the code parameters. A feature of any communication channel, including the satellite communication channel, is the continuous change of the channel parameters, in particular, the signal-to-noise ratio, which leads to the following problem: in case the signal-to-noise ratio is high the selected encoding technique is inefficient, since it contains an excessive amount of overhead information (check bits), and in case the signal-to-noise ratio is low it is the other way around: the selected number of check bits is not enough to correct a large number of bit errors. All this proves the need to use the adaptive modulation and encoding algorithms in satellite communication systems that adapt to the changing parameters of the communication channel [2].

At present time the radio resource allocation does not ensure operation without interference, therefore, effective interference protection techniques are needed, namely, management, energy efficient and signaling techniques. The interference management technique involves such an arrangement of signal sources and frequency ranges at which they will not cause mutual interference. However, this principle has now exhausted itself. The energy efficient interference protection technique involves increasing the transmitter power to a level that is guaranteed to exceed all interference. The signaling technique is based on digital signal processing and allows reducing the impact of interference at the level of 20...30 dB. This technique is based on the use of pseudo-random, multi-frequency and wideband noise-like signals, and also includes interference immunity encoding techniques.

The described techniques of digital signal processing used in satellite communication systems can increase throughput capacity, protect signals from interference for high-quality data transmission, efficiently use frequency bands, and increase the signal-to-noise ratio. This techniques is presented in Figure 3. However, satellite communications do not provide constant channel parameters and it is possible to increase the quality of transmitted data through adaptive digital signal processing algorithms. It means that the digital signal processing in the considered area has not fully been employed.

Fig. 3. Techniques of digital signal processing

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THE INFLUENCE OF NEGATIVE AERODYNAMIC EFFECTS ON FLIGHT SAFETY

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The study of the influence of negative aerodynamic characteristics on the design of an aircraft is an urgent task today. Every day passenger air transportation is actively gaining momentum, and these aerodynamic phenomena directly affect the safety of flights, because they have a significant impact on the strength, integrity and performance of the airframe.

Keywords: aerodynamic, reliability, operation, helicopter, airplane, components, buffeting, flutter.

ВЛИЯНИЯ ОТРИЦАТЕЛЬНЫХ АЭРОДИНАМИЧЕСКИХ ЯВЛЕНИЙ НА БЕЗОПАСНОСТЬ ПОЛЕТОВ

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Изучение влияния отрицательных аэродинамических характеристик на конструкцию самолета является актуальной задачей на сегодняшний день. С каждым днем пассажирские авиаперевозки активно набирают темп, а данные аэродинамические явления напрямую влияют на безопасность полетов, так как они оказывают существенное влияния на прочность, целостность и работоспособность планера ЛА.

Ключевые слова: аэродинамика, надежность, эксплуатация, вертолет, самолет, компоненты, бафтинг, флаттер.

The negative aerodynamic effects significantly affect the strength of a plane, and therefore flight safety. The loss of static or dynamic stability of a construction leads to disruption, and the resulting reverse of ailerons and rudders leads to inverse controllability of an aircraft, which is unacceptable during the flight.

When any airframe unit is deformed under the influence of aerodynamic, elastic and inertial forces, the aerodynamic loads acting on it change, leading to additional deformations of the structure. Vibrations of the structure in flight occur in the process of its deformation. If elastic, aerodynamic and inertial forces act on the structure, then dynamic aero elastic effect will arise.

Of the dynamic aero elastic phenomena characterized by the interaction of aerodynamic, elastic and inertial forces and manifested in the form of dangerous vibrations and vibrations of the structure, we note the vibrations of aircraft parts caused by wind gusts in a turbulent atmosphere, often having a cyclic nature, called "buffeting" and "flutter".

Buffeting is a kind of vibration of any part of an aircraft (most often in the tail) under the influence of periodically changing aerodynamic forces which arise from the flow of this part of an aircraft. They swirls disruptions from the front of the wing, various superstructures on the fuselage, with the released landing gear, open brake flaps and cargo hatches.

Buffeting of the plumage occurs due to periodic strikes on it by the jet behind the wing and manifests itself in the form of "swinging", i. e. increasing the amplitude of the oscillation of the plumage. If a construction process failed to bring the tail out of the slipstream, to ensure the strength of an aircraft, then, the buffeting is necessary to increase the flexural rigidity of the fuselage and tail, which inevitably is associated with an increase in the mass of the structure.

Vibration of the structure under the influence of cyclic gusts of turbulent atmosphere and buffeting arise and are supported by an external periodically changing exciting force, i.e. they are forced vibrations.

Measures to combat buffeting are to improve the aerodynamic shape of the aircraft, reduce the interference effect of units at their joints, removal of the horizontal tail from the zone of the jet, and most importantly – to prevent those flight modes in which it is not possible to completely prevent buffeting.

Flutter is self-excited at a certain speed of flight (critical speed of the flutter) undamped oscillations, for the emergence and development of which it is not required to influence the design of periodic exciting forces.

Wing flutter can occur under the influence of any force (aileron deflection, wind gust), which caused the deflection of the wing due to its bending from the original (neutral) position, for example, upwards. Striving under the action of elastic forces to return to the starting position, the wing will begin to move down not plane-parallel, but with a twist due to the mismatch of the positions of the center of pressure, in which the lifting force is applied and the center of mass, in which inertial and mass forces are applied with the center of stiffness, relative to which the wing is twisting.

At the airspeed of an aircraft corresponding to the critical speed of the flutter, the inflow of energy supporting these oscillations and transmitted by the lift force from the air flow to the wing structure begins to exceed the energy dissipation in the oscillating structure. As a result, the frequency and amplitude of oscillations increase dramatically and there is an instantaneous explosive destruction of the structure.

Types of flutter are very diverse and are associated with deformations and deviations of almost all bearing and control surfaces of an aircraft.

Depending on the combination of possible movements of the structure (degrees of freedom) of the elastic aircraft, there are flexural-torsional, flexural-aileron, torsional-aileron flutter of the wing; flexural-steering flutter of the horizontal tail, characterized by a bend of the fuselage and a symmetrical deviation of the elevators.

Constructive measures to prevent flutter include measures to increase the torsional stiffness of the wing, as well as measures to prevent or reduce the interaction of aerodynamic and inertial forces by reducing the moments of these forces, i. e., the convergence or distance of the characteristic points of the wing-the center of mass, the center of stiffness. Such measures also include the installation of anti-flutter loads in the nose of the wing tip. A positive role in the fight against flutter is played by the installation of engines on the wing with the removal of nacelles with engines forward in relation to the wing chord. The use of triangular and swept wings with a large narrowing, in which the bend is accompanied by a twisting of the wing to reduce the angle of attack, allows you to reduce the range of changes in the additional aerodynamic forces arising in the process of oscillations, and thereby move the value of the critical rate of occurrence of the flutter towards higher speeds.

Scientists of the Central Aerohydrodynamic Institute named after Professor N. E. Zhukovsky (TSAGI) have developed new ways to combat aircraft shaking at transonic speeds. For five years, an active method of suppressing wave resistance was experimentally studied, consisting in the tangential blowing of a jet of compressed air from a slit nozzle to the upper surface of the wing. In

the wind tunnel of TSAGI, as a result of experiments, the optimal parameters of such a control system were determined: the position of the nozzle, the intensity of blowing in the simulated conditions of transonic flight at Mach numbers from 0.72 to 0.82.

At the same time, research was carried out on a kind of know-how of the Institute scientists, a passive method of influencing the transonic flow with the help of special jet vortex generators. Vortices, which are formed by passing air from special holes located on the wing before and after the jump of the seal, stabilize its position, thereby weakening the phenomenon of buffeting. One of the main advantages of this method is that it does not require additional energy costs. The developed flow control techniques at transonic cruising speeds will form the basis of the concepts of promising aircraft to significantly improve their aerodynamic quality.

Thus, the study of the influence of negative aerodynamic characteristics on the design of an aircraft is an urgent task today. Every day passenger air transportation is actively gaining momentum, and these aerodynamic phenomena directly affect the safety of flights, because they have a significant impact on the strength, integrity and performance of the airframe.

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Post Graduates & Young Scientists' Research

APPROACHES TO IDENTIFY FACTORS OF INNOVATIVE DEVELOPMENT OF ATOMIC INDUSTRY ENTERPRISES IN RUSSIA

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The specific features of the nuclear industry have a significant impact on the innovative development of its enterprises. Global industry and other global processes form serious external and internal challenges and threats in the field of innovative development. The authors of the article analyzed the existing approaches to the study of factors of innovative development of an enterprise and proposed an author's approach to the classification of factors of innovative development of enterprises in the nuclear industry.

Keywords: innovation, factors of innovative development, nuclear industry.

ПОДХОДЫ К ВЫЯВЛЕНИЮ ФАКТОРОВ ИННОВАЦИОННОГО РАЗВИТИЯ ПРЕДПРИЯТИЙ АТОМНОЙ ОТРАСЛИ РОССИИ

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Специфические особенности атомной отрасли оказывают существенное влияние на инновационное развитие её предприятий. Глобальные отраслевые и иные мировые процессы формируют серьезные внешние и внутренние вызовы и угрозы в сфере инновационного развития. Авторами статьи проанализированы существующие подходы к исследованию факторов инновационного развития предприятия и предложен авторский подход к классификации факторов инновационного развития предприятий в атомной отрасли.

Ключевые слова: инновации, факторы инновационного развития, атомная отрасль.

Today, the creation of a competitive innovative economy in Russia is one of the priorities of the government. Modern conditions of technological development of the world economy and other world trends pose serious challenges to the innovative and socio-economic development of our

country. This has a special impact on developed high-tech and knowledge-intensive industries that are participants in global competition, the innovative development of which is one of the key conditions for the technological leadership of the nuclear industry in Russia.

One of such branches of high-tech and competitive in the world market sectors of Russia is the nuclear industry, which is one of the most important sectors of the economy. The innovative development of the industry includes the modernization of technologies and the technological re-equipment of technological capacities aimed at solving a key problem – improving the competitiveness of products of goods and services [1].

About 400 enterprises and organizations of the nuclear industry of Russia are merged into the Russian state holding – State Atomic Energy Corporation Rosatom. The company has competencies in all segments of the nuclear fuel cycle, from uranium mining to decommissioning of nuclear facilities [1]. In recent years, the company has taken a course towards creating products for non-energy markets and diversifying its business.

Innovative development depends on a number of factors, that is, causes, conditions or parameters, the effect of which affects the nature, structure, orientation and intensity of innovative processes. To build an effective system for managing innovative activities of nuclear industry enterprises, it is important to understand the factors affecting innovative development.

World processes, features of the development of modern society, the conditions for the development of nuclear energy in the country and the world form serious challenges for the innovative development of the nuclear industry as one of the high-tech industries. Prospects, trends and the nature of development of the nuclear industry in Russia depend on many world and regional factors. Participation in global competition, as well as the complexity and specifics of the production of nuclear energy enterprises and industry, determine a complex set of factors for the innovative development of the industry.

The selection and analysis of factors affecting innovative development, largely depends on the object of study, the extent of consideration of innovative processes and the choice of classification features. In the scientific literature there are many different approaches to the classification of factors, their detail and analysis in general. At the same time, the identification approaches and principles for classifying the factors of innovative development in the works of research authors in a wide variety of fields overlap in many respects. The grouping of factors is considered by many authors from the side of impact on the object – internal and external; by exposure level – macro-, meso- and micro-factors; positive (stimulating) and negative (inhibitory); as well as in various areas of life [2–4]. Often when considering innovative processes, a system of factors is analyzed in various directions, classified by level or in matrix form.

As part of a study of the factors of innovative development of the nuclear industry in Russia, the authors of this article analyzed existing approaches to identifying factors of innovative development and their classification, which showed that most authors analyze factors in the areas of society. In addition to the classification of factors in various directions, a number of authors consider factors by level. Some authors note that taking into account industry specifics is essential when developing factors, which reveals a unique combination of internal and external factors.

The complex industry structure, the territorial dispersion of enterprises throughout the country, a wide range of activities and industries, and a number of other features of the country's industry determine the presence of a wide range of factors that influence its innovative development.

In the framework of the study of factors affecting the innovative development of the nuclear industry of Russia and taking into account the analysis of existing approaches to the study of factors of innovative development, the authors of this article developed the principle of their grouping for the nuclear industry, a model of which is presented in in Figures 1 and 2.

The analysis showed that for such high-tech and global industries as the nuclear industry, in studying the factors of innovative development, it is necessary to take into account sectoral and global aspects. Given the strong influence of global processes on the development of the nuclear industry of Russia, the specifics of nuclear production, Russian industry characteristics, trends in the technological and innovative development of the country and the nuclear industry, as well

as a number of other economic, political, social, scientific and technological factors, factors of innovative development of the nuclear industry of Russia can be considered at the global (global and state – Figure 1) and corporate (industry – Figure 2) levels.

Fig. 1. The principle of grouping factors of innovative development
of the nuclear industry (global and state)

Figure 2. The principle of grouping factors of innovative development
of the nuclear industry (corporate)

The selected principle of grouping of factors of innovative development takes into account specific features and trends of the nuclear industry, including the specifics of production, corporate governance and global trends.

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VULNERABILITY OF MODERN IPS/IDS SYSTEMS

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Intrusion Detection/ Prevention System (IDS/IPS) allows you to respond to attacks by cybercriminals using known vulnerabilities, as well as to detect malicious activity within the network of an organization. In this paper, protection classes and confidence levels for similar systems by IS regulators are described. A short list of the main attacks aimed at unauthorized penetration into the network, theft of information and compromise of encryption keys of especially significant objects of the information infrastructure of the organization has been formed. The use of integrated solutions can break dubious connections and automatically configure a firewall that will block further attacks, as well as inform the security service of a company about the invasion of its personal space.

Keywords: attacks, encryption keys, unauthorized access, data transfer, IDPS systems.

УЯЗВИМОСТИ СОВРЕМЕННЫХ IPS/IDS СИСТЕМ

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Система обнаружения и предотвращения вторжений (IDS/IPS – Intrusion Detection/ Prevention System) позволяет реагировать на атаки нарушителей информационной безопасности, использующих известные уязвимости, а также распознавать вредоносную активность внутри сети организации. Описаны классы защиты и уровни доверия к подобным системам со стороны регуляторов по информационной безопасности. Сформирован краткий перечень основных атак направленных на неавторизованное проникновение в сеть, кражу информации и компрометацию ключей шифрования особо значимых объектов информационной инфраструктуры организации. Применение комплексных решений может обрывать сомнительные соединения и автоматически настраивать межсетевой экран, который осуществит блокировку дальнейших атак, а также проинформируют службу безопасности компании о вторжении в ее личное пространство.

Ключевые слова: атаки, ключи шифрования, несанкционированный доступ, передача данных, IDPS системы.

Introduction. The increase of the number of problems related to information security (hereinafter referred to as information security) has led to the fact that intrusion detection and/ or prevention systems very quickly became a key component of any network security strategy of an organization. To conceal information from unauthorized access in the conditions of exchange of

data packets [1] and information constituting any of the types of secrets (judicial commercial, banking, medical, state), including personal data, in accordance with the norms of the Russian legislation, as well as legal entities with the status "the owner" of such information or endowed with the functions of "trust management" and organized in any of the legal forms that are legitimate on the territory of the Russian Federation and abroad, it is necessary to implement a set of organizational, technical and legal measures to protect data.

The main part: The systems certified by Federal Service for Technical and Export Control and Federal Security Service of the Russian Federation allow:

1. According to the Federal Service for Technical and Export Control, to divide the systems into six protection classes by IDPS (Intrusion Detection and Prevention System). They differ in the level of information systems and the information being processed (personal data, confidential information, state secret).

2. According to the methods of the Federal Security Service of the Russian Federation, to correlate the types of attack detection devices, divide them into four classes – from G to A, and each subsequent class should include all the functions of the previous classes [2].

At present, in theory and in practice, there are a huge number of attacks on the automated control systems of organizations, when listing and describing the features of each of them, you can get some kind of reference system administrator. In the general concept, any of the existing types of attacks provides unauthorized access to data (hereinafter – UAD). The main methods of UAD are presented in Figure.

The main methods of unauthorized access to communication systems

A special category includes information constituting a state secret. Organizational, technical and legal measures are divided into:

– uniform requirements for the treatment of information carriers (production, reception, transfer, accounting and storage);

– licensing certain types of activities;

– special regime of activity (regime of secrecy) of enterprises, institutions and organizations;

– special procedure for access and admission of citizens;

– technical protection (including cryptographic information protection);

– consequences and legal liability of people having access to information constituting a state secret [4; 5].

It is known that more than 80 % of threats aimed at compromising encryption keys are committed within enterprises by their own employees and officials. The duties of this category of citizens include the implementation of conditions and mechanisms for the preservation of data constituting state and commercial secrets, as well as personal data of employees of the organization, obtained through special dedicated communication channels using cryptographic means of protecting information from unauthorized access included in IPS/IDS systems [3; 4; 6].

Under the compromise of ciphers or their constituent elements, the fact of establishing that the current key documents became known to third parties who do not have access to them, including theft, copying, loss of storage media, as well as the disappearance of officials admitted to information constituting the state a secret. In particular, there are a fairly large number of hacker attacks on information systems, for example: fishing, used to obtain user information (login, password, etc.); UDP storm, forcing 2 open ports to respond to each other, reducing system performance until one of the packets disappears; sniffing, using software to listen to dial-up connections; Smurf, allows the substitution of IP addresses; Mac address spoofing exploiting software vulnerabilities and errors; IP – hijack, allows you to "crash" into the network and act as an intermediary when transferring data between network subscribers; various types of injections (SQL injection, PHP injection, script injection (aka XSS Cross Site Scripting), XPath injection), a separate class of attacks called Man-in-the-Middle [4; 7].

Conclusion: Thus, the presented work shows the critical aspects that arise during the operation of modern cryptographic encryption systems, their possible compromise and, as a result, the loss of data obtained through closed communication channels. The object of this study is to choose a comprehensive solution that allows you to separate network segments, analyze internal and external traffic, identify and analyze suspicious network activity, stop attempts to penetrate into isolated network segments, and include cryptographic information protection tools. Such a comprehensive solution will allow to solve problems of various degrees of complexity – from providing secure Internet access to company employees to combining enterprise branches into a single secure network with intrusion detection and prevention system, as well as cryptographic protection of critical data.

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FEATURES OF RATIONING OF INTELLECTUAL LABOR

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The article considers the regulation of labor as a systemic and most effective method of managing a modern enterprise. A comparative analysis of research work and engineering work is presented. The factors affecting labor standards and inverse relationship are considered.

Keywords: Rationing of labor, research work, labor of a design engineer.

ОСОБЕННОСТИ НОРМИРОВАНИЯ ИНТЕЛЛЕКТУАЛЬНОГО ТРУДА

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Рассматривается нормирование труда, как системный и наиболее эффективный метод управления современным предприятием. Представлен сравнительный анализ научно-исследовательского труда и инженерно-конструкторского труда. Рассмотрены факторы, влияющие на нормирование труда и обратная зависимость.

Ключевые слова: нормирование труда, научно-исследовательский труд, труд инженера-конструктора.

The key developments in this area were made by scientists from the soviet period, mainly in the 60–80s of the last century. The transition period in the domestic economy, which began in the 90s of the last century, led to a lack of interest in this issue and, as a consequence, to the destruction of the rationing system [1].

Recently this theme has become interesting again, when enterprises, including enterprises of the space and rocket complex, were in the midst of an economic crisis, faced with sanctions from Western countries and were forced to: select high-quality personnel at a lower price, form the most efficient the concept of personnel management in crisis conditions, to optimize personnel costs [2].

Mostly research in the field of rationing intellectual work is theoretical in nature and is aimed at the scientific justification of methodological approaches to rationing intellectual labor. But the practical side of the issue and the definition of specific norms remain insufficiently developed today.

The aim of this work is to establish the concept of intellectual work, what factors must be taken into account when normalizing it, whether the employee himself is involved in the standardization process, and whether it is necessary and possible to normalize intellectual labor. At the same time, it is necessary to take into account the features of the space-rocket enterprise, and also to determine if there are differences in approaches to rationing intellectual labor for fundamental, applied research and development.

Accumulating the opinion of various scientists, it can be determined that research work is a worthwhile activity aimed at obtaining and applying new knowledge, creating scientific and scientific-technical results [4].

Engineering activity includes the development, design and construction of new equipment and technology, invention, engineering research and calculations, engineering maintenance of current production, operation of equipment and technology, quality control of products, compliance with standards, technological discipline, norms and standards of environmental protection safety measures, fire fighting equipment, development and implementation of long-term plans for the assessment and implementation of scientific and technological achievements in practice et al [5].

Comparative characteristics of the labor of a design engineer and research work

Labor of a design engineer	Research work
AIM OF LABOR	
Creation of engineering and technology in production based on scientific knowledge	Creation of new scientific knowledge
LABOR CHARACTER	
Innovative	
Creative	
Irregular	
PERSONAL QUALITIES	
Dependence is, but not essential	Significant dependence
WORKING TIME	
Regulated	The "irregular" creation workflow
RESULT	
The result should always be positive, because its absence disrupts the deadlines for the manufacture of the spacecraft	High risk of getting a negative result due to novelty. The result can be never applied anywhere and never

Despite the similarity of research and engineering activities, there are significant differences between them. A design engineer is a practical profession, aimed at creating technology and technology, at materializing, "materializing" scientific knowledge in production. The scientist pursues cognitive goals: knowledge of the laws and laws of the world, technology, technology and engineering, its main result is new scientific knowledge.

It is important to note that research activity is not the main one for an engineer [3]. The activity of a design engineer is creative, involves innovative solutions and actions related to the creation of a new one. However, in practice, an engineer has to deal with routine, mechanical, and far from creative work.

A modern engineer is not just a technical specialist who solves narrow professional tasks. Solving narrow professional tasks, an engineer actively influences society, man, nature [6]. In engineering and technical creativity, the process of creating a new technical object does not go from a scientific idea to technology, but from a technical idea to a technical solution, and from it to a new technical object.

A universal measure of the amount of labor is working time. Therefore, labor standards are established by determining the amount of working time necessary to perform certain work, which must be performed per unit of time.

If for research work "the productivity of officially spent working time does not reflect the actual time spent on the scientist's mental work", because "Solution" can "come" suddenly and not at all in the workplace" [4], then for the intellectual work of an engineer in the rocket and space industry, working hours are strictly regulated.

The normative complexity of creating an innovative product is the basis for determining the timing, developing a schedule of work, determining the amount of financing, calculating the contract price, evaluating the effectiveness of an innovative project [7]. Thus, labor rationing is a process without which no modern enterprise can do.

The introduction of rationing of intellectual labor at the enterprise is a transformation of the usual way of working, which naturally collides with the resistance of "normalized" subjects. In order to ensure effective implementation, it is necessary to take scientifically based measures to increase the awareness of all subjects of organizational activity in the need for reorganization [8].

The procedure for setting labor standards in an enterprise is influenced by many factors. But the rationing of labor itself influences an increase in labor productivity, a decrease in labor intensity and, as a result, competitiveness, development of capacities and modernization of equipment, optimization of the number of employees, and, as a result, an increase in wages and an increase in the efficiency of labor utilization. Therefore, it is appropriate to talk about labor standards as a system. After all, efficiency is achieved only with a systematic approach. This approach to management allows you to reconcile the interests of the system with the interests of specific employees, leveling the contradictions between them [9].

We found that both the labor of a design engineer and research work are intellectual work, but each of them has its own characteristics that must be taken into account in the normalization process. The intellectual work of the design engineer can and should be normalized, since this procedure allows avoiding disputes regarding loading, labor intensity and overall productivity of the rocket and space enterprise divisions and makes rationing of intellectual work "transparent" for partners, customers, and understandable for all workers. The latter is especially important, because the employee, knowing for what, how much, time, and with what efforts he will have to work and what kind of payment he will receive, is actively involved in the process of mastering new job sites or his own development, advanced training, etc. Do not neglect the active involvement of the employee himself in the standardization process, explaining in detail and clearly the consequences of the procedure, which will allow to level the resistance of the "normalized" subjects.

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VOCATIONAL STUDENTS' ATTITUDES TO CAREER

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In the current situation of modernization of secondary vocational education in Russia, the study of ideas about the career of students in educational institutions of secondary vocational education is being updated. The article presents the survey data and the results of the study. It should be noted that the idea of a career is controversial, but the importance of education is an important aspect of this study.

Keywords: secondary vocational education, students, representation, professional self-determination, career.

ПРЕДСТАВЛЕНИЕ УЧАЩИХСЯ СРЕДНЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ О КАРЬЕРЕ

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В современной ситуации модернизации среднего профессионального образования в России актуальным является изучение представлений о карьере студентов образовательных учреждений среднего профессионального образования. Представлены данные опроса и результаты исследования. Необходимо отметить, что представления о карьере являются противоречивыми, однако важным аспектом этого исследования выступает значимость получаемого образования.

Ключевые слова: среднее профессиональное образование, студенты, представление, профессиональное самоопределение, карьера.

Today in the hectic world graduates are supposed to have the skills of the new century. In this context the graduates must have critical thinking, determination, discipline as well as be able to make career choice. Future profession will strongly influence both professional development and personality.

Modern youth get loads of information daily including various opinions and values. This way, adolescents have an opportunity to open up the way for life choices. Uncertainties really matter when there are of opportunities and prospects, however it is difficult to make up one's mind what career path to choose [3], which is associated with the need for a conscious voluntary rejection of some of the prospects and habitual behavior to make the choice more specific. Career researchers call this period as the preliminary stage which includes "studying at school, getting secondary and higher education that lasts up to turning 25" . This stage corresponds to the "stage of exploration or

research" in D. Super's terminology. At this stage young people try themselves in various types of activities, change several types of work searching for the best one which will meet their capabilities and satisfy needs [1].

Indeed, the problem of career self-determination of young people is not new, but due to drastic changes in the field of professional activity it is a promising branch in modern psychology now. In foreign psychology this problem is more studied. D. E. Super, E. Schein, L. S. Gottfredson, R. A. Noe and many others devoted their research to career issues. In Russian psychology E. A. Mogilevkina, A. S. Novgorodova, K. A. Abulkhanova-Slavskoy, N. S. Pryazhnikova studied the problem of career self-determination. Nowadays, most researches focus on study career attitudes of professionals, school senior students and university students, while secondary vocational students' attitudes is more understudied.

The anonymous survey among students of secondary professional institutions was carried out in order to study issues of career self-determination in the context of individual basic values. The survey was necessary to identify their opinions on essentially relevant issues at the beginning of the career, as well as to determine the position and level of understanding of career success and failure.

Results and their analysis Students' attitudes to their future career was studied with a specially created questionnaire. The questions are open-ended, which allows to identify the conscious and unconscious mindset of a person, shows his/ her attitude to parents, family, life goals, etc. [4].

The survey was anonymous, 42 people participated in the survey. Students of the Krasnoyarsk College of Industrial Service – 52.4 % and Krasnoyarsk Construction College – 47.6 %. From them 57.1 % are males and 42.9 % are females.

The purpose of the survey is to study the students' opinions from their own point of view, from their peers' point of view, from the parents' opinion admitting their perception of career success or failure.

The data is divided into five groups according to generalized criteria. The first group includes those who associate career success with prosperity ("Material values"); the second group is for those who associate career success with diligence and hard work ("Professional Values"); the third group includes students' if they think a successful career is followed with getting a decent education ("Educational Values"). The fourth group includes answers where students describe a successful career as a job that is enjoyable, pleasant, and interesting – ("Spiritual Values") and the fifth group includes those who hesitated with the answer ("Not sure").

Data is presented in certain figures: 45.3 % of respondents associate a successful career with spiritual values. In their answers they indicate the following options: "to find something to do with one's liking," "interesting work." 19.0 % associate a successful career with a good education; another 19.0 % believe that a successful career is nothing without diligence and hard work; 16.7 % are about high salary, while no one of the respondents hesitated to answer. The data shows that students associate career success with spiritual values, it is important for them to enjoy what they do, the work should be interesting. It is also important to emphasize that good education and professional values take a high position in the understanding of students. According to their answer, they less associate career success with financial benefits.

The data *"My peers think a successful career is"* shows: 28.6 % of the respondents believe that their peers associate the career success with a well-paid job; 9.5 % say that a successful career is hard work; 11.9 % believe that education is an important part of a successful career; 21.4 % think that a successful career must be interesting; a sufficient proportion of nonresponses is 28.6 %. Data of this group shows that the majority of respondents think that peers associate career success with a well-paid job, gaining job satisfaction is of the second priority and only a quarter of the answers associate career success with having an education.

The data for the question *"What a successful career is according to my parents"*, is given in the following figures: 21.4 % believe that in their parents' consideration a career is the possibility of promotion and wealth; another 21.4 % say that parents associate a successful career with a decent

education; 16.7 % think that for parents a successful career is that they would like to work, it should bring satisfaction, the same number of respondents (16.7 %) believe that a successful career demands hard work. Almost a quarter of the respondents were not sure, we can assume that the respondents do not discuss the topic of career and career success with their parents.

Findings clearly show that for the majority of respondents, career success is primarily in interest in activities and satisfaction with results. In the students' perception their peers think a successful career is high incomes. From the perspective of their parents, students consider a successful career with a decent education which is supposed to be a boost for self-realization.

Data survey analysis reveals vocational students' attitudes to what a successful and an unsuccessful career is like.

For 28.6 %, the reasons for an unsuccessful career are a lack of interest, "dislike of work", "you don't like it"; 26.2 % think that an unsuccessful career is low salary; the same number of respondents associated career failure with poor education (19 %) and the same number of respondents (19 %) indicated that an unsuccessful career was associated with a reluctance to work on low-level jobs, with poor staff and poor working conditions; 7.1 % found it difficult to answer the question.

Results reveal that an unsuccessful career for students, as a successful one, is associated with getting satisfaction and interest in the activity you are engaged.

The answers about their peers' opinion: 31.0 % believe that their peers associate an unsuccessful career with low salary; 23.8 % stated that the failure was a lack of interest in work; for 11.9 %, career failure is the absence or poor education; 7.1 % associate career failure with work difficulties and poor working conditions, nonresponses are 26.3 %. As the data shows respondents believe that their peers primarily associate unsuccessful career with low salary.

Regarding respondents' perception about their parents' opinion about unsuccessful career, the majority of respondents (33.5 %) were not sure (as well as on the question of the parents' presentation of a successful career). 21.4 % of respondents indicate that, in the opinion of parents, the lack of interest in work, frustration with the results of work is unsuccessful; 19.0 % believe that parents associate an unsuccessful career with a low-paid job; another 19.0 % believe that an unsuccessful career is the lack of a good education and 7.1 % indicated unfavorable working conditions and poor relationships with the team. Observing the data, it was found that career non-success for parents is frustration with work results and lack of interest in activities.

Conclusion. All data considered, we can draw the following conclusions:

1. Students associate career success with a system of personal value orientations within the basis of spiritual values, it is important for them to enjoy what they do. The work should be interesting and bring self-worth. In their opinion, this is what a successful career actually is. Good education and professional values are essential for students. Prosperity and high salary is not of paramount importance for students.

2. The majority of respondents think that peers associate career success with a high-pay work, gaining job satisfaction is not of the paramount importance, while only a quarter of the responds stand for a good education to be successful.

3. A successful career from the parents' point of view includes career promotion, wealth and getting a good education. Almost a quarter of the respondents were not sure, we can assume that the respondents do not discuss the topic of career and career success with their parents.

4. An unsuccessful career for students, primarily, is associated with a lack of interest and satisfaction in the activities they are engaged.

5. Students believe that their peers associate unsuccessful careers with low pay.

6. According to the respondents the non-successful career for parents is frustration with the results of work and lack of interest in activities.

All things considered, we can conclude that being well-paid in matters of understanding the career occupies only one of the priority parts and is not the dominant factor in the students' self-awareness.

Personal values of self-understanding of the studied group and the revealed desire for self-development within the basis of universal and spiritual values have priority prospects and do not lose their dominant positions against the background of the desire for prosperity.

The fact which must be concerned, it is poor family relationship and often the complete absence of receiving positive work experience to be shared with younger generation from the family.

The career non-success is associated with a lack of interest and motivation for self-development, which leads to frustration, low pay and a common reason is mostly caused by wrong career path choice.

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3-HYDRAZINYLQUINOXALIN-2(1H)-ONE WITH 2-HYDROXYIMINO-1-PHENYLBUTANE-1,3-DIONE INTERACTION

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We obtained new derivatives of quinoxaline by the interaction of 3-hydrazinylquinoxalin-2(1H)-one with 2-hydroxyimino-1-phenylbutane-1,3-dione. The structures of the synthesized compounds are established by modern physical and physicochemical methods.

Keywords: quinoxaline, isonitrosodiketone, 4-nitrosopyrazole, cyclocondensation, hydrazone.

ВЗАИМОДЕЙСТВИЕ 3-ГИДРАЗИНИЛХИНОКСАЛИН-2(1H)-ОНА С 2-ГИДРОКСИИМИНО-1-ФЕНИЛБУТАН-1,3-ДИОНОМ

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Взаимодействием 3-гидразинилхиноксалин-2(1H)-она с 2-гидроксиимино-1-фенилбутан-1,3-дионом получены ранее неизвестные соединения ряда хиноксалина. Строение синтезированных соединений доказано с помощью современных физических и физико-химических методов.

Ключевые слова: хиноксалин, изонитрозодикетон, 4-нитрозопиразол, циклоконденсация, гидразон.

Quinoxaline derivatives attract sustained interest of chemists since many of them have high biological activity and are used to generate drugs. Some substances containing a quinoxaline fragment are used in medicine as an antibacterial drug I [1] and as pesticides II-III [2] (Figure 1) in agriculture.

In this connection, scientists intensively study methods of preparations of hydrazinylquinoxalines, their biological activity, and cyclic analogs. Article [3] describes condensation reaction of ethyl 3-oxo-3-phenylpropanoate with 2-hydrazinyl-3-phenylquinoxaline leading to pyrazolone *IV* (Figure 1); appropriate 4-nitroso- and 4-azopyrazolones were synthesized by their nitrosation and diazo-coupling. These compounds showed antibacterial and antifungal activity. It is known, cyclocondensation of 1,3-diketones or β-ketoesters with 3-hydrazinylquinoxalin-2(1H)-one yielded pyrazole *V* and pyrazolone *VI* (Figure 1), which have antibacterial activity [4].

Also, aromatic heterocyclic compounds with a similar structure could modify the properties of a polymer if they contain active functional groups, we hope. This allows them to be used in rocket technology and rocket solid-fuel.

Thus, the development of methods to synthesize new functionalized quinoxalylpyrazole derivatives is an important purpose.

Fig. 1. Biologically active derivatives of quinoxaline

In a previous paper [5] we reported the interaction 3-hydrazinylquinoxalin-2(1H)-one *VII* with 3-hydroxyimino-2,4-pentanedione leading to the appropriate 4-nitrosopyrazole. The condensation of 3-hydrazinylquinoxalin-2(1H)-one *VII* with 2-hydroxyimino-1-phenylbutane-1,3-dione *VIII* has not investigated yet. Investigation of this reaction will synthesize a wider number of promising quinoxaline compounds.

We have synthesized the starting 3-hydrazinylquinoxalin-2(1H)-one [6] and 2-(hydroxyimino)-1-phenylbutane-1,3-dione [7] according to the existing methods to achieve this purpose.

We first showed that 2-(hydroxyimino)-1-phenylbutane-1,3-dione with 3-hydrazinylquinoxalin-2(1H)-one are successfully condense in glacial acetic acid at 60 °C with the formation of a previously unknown 3-[2-(3-hydroxyimino-4-oxo-4-phenylbutan-2-ylidene)hydrazinyl]quinoxalin-2(1H)-one *IX* in high yield (Figure 2). The cyclization of hydrazone intermediate IX to 4-nitrosopyrazole X occurs under higher temperature, at 118 °C. The isolated cyclocondensation product is a blue crystalline substance soluble in ethanol and dimethyl sulfoxide. The results of UV-vis, IR, ^{1}H NMR spectroscopy and chromato-mass spectrometry confirmed the obtained compound structures.

Fig. 2. Condensation reaction of 3-hydrazinylquinoxalin-2(1H)-one
with 2-hydroxyimino-1-phenylbutane-1,3-dione

Thus, investigating cyclocondensation, we have synthesized a previously unknown quinoxalylpyrazole series of compounds involving a nitroso group in the pyrazole ring. High

activity of a nitroso group will allow investigating the modifying properties of the previously unknown compound *X* in the rocket solid-fuel.

Experimental Section

3-[2-(3-hydroxyimino-4-oxo-4-phenylbutan-2-ylidene)hydrazinyl]quinoxalin-2(1H)-one (IX). 3-hydrazinylquinoxalin-2(1H)-one (0.4 g, 2.27 mmol) with 2-hydroxyimino-1-phenylbutane-1,3-dione (0.43 g, 2.27 mmol) was stirred at 60 °C for 1 h in glacial acetic acid (7 ml). The yellow precipitate of *IX* was filtered off, washed with acetic acid and water. The product appeared to be yellow crystals, soluble in ethanol and tetrahydrofuran, and its yield was 0,745 g (95 %). Mp = 170–173 °C (dec.); UV-Vis, λ_{max}, nm: 447, 517; IR: $\tilde{v}$ = 3350, 3050, 1681, 1606, 1566, 1413, 1246, 1100, 965, 756, 703 см$^{-1}$; MS (70 eV): m/z (%): 349 (40) [M]$^{+}$, 348 (100).

3-(3-methyl-4-nitroso-5-phenyl-1H-pyrazol-1-yl)quinoxalin-2(1H)-one (X). A suspension of hydrazone IX (0.1 g, 0.29 mmol) in glacial acetic acid (2 ml) was boiled for 60 min, the resulting green solution was poured into cold water and salted out with sodium chloride. The resulting precipitate was filtered off and washed with water. The crude product was purified on a silica gel column, in the toluene — acetonitrile (9: 1) system. The product appeared to be blue crystals, soluble in ethanol and dimethyl sulfoxide, and its isolated yield was 0.03 g (32 %). ^{1}H NMR (DMSO-d6), δ, ppm: 2.23 (s, 3H, CH3), 7.41 − 7.58 (m, 5H, Ph), 7.70 − 7.88 (m, 4H, Quinox.), 13.11 (s, 1H, NH); UV-Vis, (ethanol): λ_{max} (ε) = 698 nm (53) (N = O).

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THE METHOD FOR MEASURING THE SHIELDING COEFFICIENT OF RADIOFREQUENCY CONNECTORS OF A COMMUNICATION MODULE WITHOUT DISMANTLING

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The factor of shielding effectiveness of high-frequency connections is one of the most important characteristics of radiofrequency (RF) design. Shielding effectiveness cannot be controlled in terms of space, therefore, it is important to have an effective method for assessing RF connections. The article describes an original method for testing RF connections communication module – electromagnetic coupling.

Keywords: electromagnetic shielding, electromagnetic compatibility, radio measurements, satellite payload, testing.

МЕТОДИКА ИЗМЕРЕНИЯ КОЭФФИЦИЕНТА ЭКРАНИРОВАНИЯ ВЧ-СОЕДИНИТЕЛЕЙ МПН БЕЗ ДЕМОНТАЖА

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Одной из наиболее важных характеристик ВЧ проектирования является коэффициент эффективности экранирования ВЧ соединений. Эффективность экранирования в условиях космического пространства невозможно контролировать, поэтому при создании космических аппаратов важно иметь метод эффективной оценки ВЧ соединений. Настоящая работа описывает оригинальную методику проверки ВЧ соединений модуля полезной нагрузки космического аппарата на эффективность экранирования, то есть на электрогерметичность.

Ключевые слова: электрогерметичность, электромагнитная совместимость, радио-измерения, космические аппараты, испытания.

Electrical tightness means the stability of RF connections to external noise, i.e. interference with the equipment of spacecraft, and the own influence of the generated spurious electromagnetic radiation of the RF compounds on the equipment.

The efficiency assessment is performed in two stages: the susceptibility to external influences and own impact on the equipment.

The tests for electrical tightness are performed at the stage of autonomous tests, since after docking with the service system module there is no access to waveguide paths and cable network.

Before testing, it is necessary to measure the level of the spectral components of interference. This procedure will make sure that the equipment is in good working condition and that the levels of industrial noise at the test site correspond to the required value. It is important to calibrate and calculate (based on the values obtained) the gain of technological coaxial waveguide transitions as well.

Checking the output section for radio emission (RE) is the first stage. The essence of the radio emission tests is to determine the intension of the electromagnetic field within the communication module in the area after the power amplifier at low gain, which maximizes the energy of the transmittable signal. The maximum interference power level is the amount of power leakage from the RF connections communication module equipment, which is calculated for the central output frequencies.

The next step is to check for radio susceptibility (RS). The measurements are taken at a high gain level to ensure maximum sensitivity to external noise. External interference is fed with coaxial-waveguide transition with an offset relative to the carrier of 100 kHz, the relative magnitude of interference signal is measured at the output relay. The determining characteristic for evaluating the electrical susceptibility is generator power level required to create the necessary level of external interference. This value characterizes the resistance to external interference.

The method of testing RF compounds for electrical tightness allows us to determine the screening coefficient of RF paths.

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MODEL OF A POWER PLANT FOR A REMOTE-CONTROLLED UNDERWATER ROBOT

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Most underwater robots use electric motors as their power plant. But when studying the rivers of Siberia, which are characterized by a rapid flow, the power capacity and energy intensity of an underwater installation in electric motors may be insufficient. This article describes the design of a power plant using an internal combustion engine, which will help solve this problem.

Keywords: underwater robot, internal combustion engine, Stirling engine, Miller–Atkinson cycle.

МОДЕЛЬ СИЛОВОЙ УСТАНОВКИ ДЛЯ ТЕЛЕУПРАВЛЯЕМОГО ПОДВОДНОГО РОБОТА

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В качестве силовой установки в большинстве подводных роботов используются электродвигатели, но при исследовании рек Сибири, которые характеризуются быстрым течением, энерговооруженность и энергоёмкость подводной установки на электромоторах может оказаться недостаточной. Описывается конструкция силовой установки с использованием двигателя внутреннего сгорания, которая поможет решить эту проблему.

Ключевые слова: подводный робот, двигатель внутреннего сгорания, двигатель Стирлинга, цикл Миллера–Аткинсона.

Underwater research of the Yenisei riverbed and its tributaries using underwater remote-controlled devices can reveal the nature of the bottom sediments, detect dangerous objects in the fairway, sunken ships and vehicles. In addition, underwater robots are used to inspect the condition of the outer skin of river vessels, their steering feathers and propellers without using a dry dock. But, unfortunately, such work cannot be performed in most of the water area of the Yenisei River, because the usual design of mass-produced devices [1] does not allow them to move at a speed of more than 1 m/sec. In addition, underwater robots, as a rule, have an open body in the form of the basket, in which a strong current forms eddy currents of water that interfere with the stabilization of the device and, under certain conditions, can even turn it over. The speed of the Yenisei River in summer is from 2 to 2.5 m/s in the upper destinations, in the area of the Kazachinsky threshold – from 5 to 7 m/s. The maximum flow values are observed during the flood period, which is of interest to researchers. And only in the basin below the confluence of the Yenisei River and Podkamennaya Tunguska, the river flow decelerates to 0.2 ... 0.25 m/sec [2].

Calculations show that even with the maximum streamlined body and the weight of electric batteries up to 15 kg, the underwater vehicle will not be able to maintain drift in one place for more than 20 minutes, in a flow of 5 m/sec. This time is clearly not enough for full-scale research.

A more powerful source of mechanical energy could be an internal combustion engine. In the conditions of limited internal volume of the underwater vehicle, it would be more appropriate to use a Miller-Attkinson engine with a high fuel efficiency index and a low exhaust temperature [3].

The illustration shows a diagram 1 of the power plant for the underwater robot.

The fuel for the Miller–Attkinson 5 internal combustion engine comes from the fuel tank 4. Since oxygen is required for engine operation, its supply is safest to store in the form of hydrogen peroxide in the tank 7, which gets into the Kipp apparatus 10, undergoes catalytic decomposition according to the following formula:

Power plant for the underwater robot

$$2\,H_2O_2 = 2\,H_2O + O_2 \qquad (1)$$

The resulting oxygen has a high reactivity, so before it is fed to the carburetor of the engine 8, it must be mixed with the air in the mixer 6. The engine 5 generates useful mechanical energy by transmitting it to the shaft 9. The exhaust from the engine enters reactor 2, where the following chemical reactions occur:

$$CaO + H_2O = Ca(OH)_2 \qquad (2)$$

$$Ca(OH)_2 + CO_2 = CaCO_3 + H_2O \qquad (3)$$

Since these reactions are exothermic, the released thermal energy can be utilized using the Stirling engine 3 [4] and generator 1, which can give the resulting electricity needed to power the onboard network of the underwater vehicle.

This solution, with the use of internal combustion engines on the Miller – Atkinson cycle, was previously used only for cars with a hybrid installation. However, due to the higher fuel efficiency and low fuel and oxygen consumption, they can be successfully used both in underwater uninhabited vehicles and in other closed systems, such as mines.

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ESTABLISHMENT PROCESS OF KNOWLEDGE MANAGEMENT

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This paper is about establishing a knowledge management process using the example of an Austrian company called "Count IT Group". A focus of this paper also lies on the socialization and finding incentive systems for knowledge management. Because without these two factors, there will never be a successful establishment of knowledge management.

Keywords: models and methods of knowledge management, SECI-Model, roadmap for knowledge management process, incentive systems, socialization of knowledge.

With the invention and the distribution of the World Wide Web, the amount of information increased enormously. In the 21st century, people are constantly confronted with this information overflow. Because of the amount of information, the brain does not have the capacity and possibility to store all information permanently [1,2]. In addition, there are difficulties to distinguish relevant from non-relevant information [3]. The larger companies become, the more important it becomes to store their information permanently, as this is a key criterion for success. This knowledge consists of individual and collective knowledge and is called organizational knowledge base. According to North, information only becomes a competitive advantage when it climbs the knowledge ladder (Figure 1). Owning knowledge can therefore decide on success or failure.

Fig. 1. Knowledge ladder (North et al.)

In order to establish this success factor in the company in the long-term, knowledge management has to be used effectively. Knowledge management is defined differently depending on the source, but essentially refers to a process for acquisition, developing, transferring, appropriating, enhancing and securing knowledge [4].

However, knowledge management is not only used to master the information overload and to secure and increase competitiveness, but also to increase employee satisfaction. As this indirectly increases customer satisfaction and subsequently leads to a strengthening of customer loyalty. Through the targeted use of knowledge management, the reuse of knowledge can also be achieved, which increases the efficiency of a company [4,5]. But knowledge management has no or reduced benefits if it is used incorrectly. For this reason, the introduction process of knowledge management has to be sufficiently planned and structured.

Furthermore, there are numerous barriers that could obstruct the introduction of knowledge management. These can occur at all levels of knowledge management. According to Bullinger et al., these levels are called human, organization and technology. At the human level, barriers such as lack of acceptance, willingness and motivation of the persons in the company can arise. At the organizational level, the low commitment of management and the incorrect anchoring of knowledge management in the corporate culture often pose a problem. In the technology dimension, wrong technology decisions can negatively influence usability, quality of the sources and benefit of using the system.

The successful planning of an establishing process can be achieved with the help of various methods [5]. For example, the knowledge building blocks of Probst et al. are used very frequently in practice (Figure 2). The SECI model of Nonaka and Takeuchi explains how knowledge can be generated and disseminated within the company.

Fig. 2. Knowledge building blocks (Probst et al.)

With the help of concrete methods, these models can be implemented and integrated into planning. For example, lessons learned, best practices, knowledge maps, knowledge management portfolios, communities of practice and balance scorecards are used. Each of these methods is used for different knowledge management tasks [6].

It is equally substantial to achieve the socialization of the knowledge and create incentive systems. Without the collaboration of the employees as individuals and as a community, knowledge management cannot be used successfully.

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DESIGNING THE MECHANISM OF DISCLOSURE
OF AN UMBRELLA REFLECTOR WITH A RIGID CENTRAL PART

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The article describes the analysis of basic constructions of mechanisms of opening umbrella reflectors with a rigid central part, the choice of the standard design of a disclosed opening mechanism, and the design of the mechanism for opening a reflector.

Keywords: spacecraft, antenna systems, deployable umbrella reflector, disclosure mechanism.

ПРОЕКТИРОВАНИЕ МЕХАНИЗМА РАСКРЫТИЯ ЗОНТИЧНОГО РЕФЛЕКТОРА
С ЖЕСТКОЙ ЦЕНТРАЛЬНОЙ ЧАСТЬЮ

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Описывается анализ основных конструкций механизмов раскрытия зонтичных рефлекторов с жесткой центральной частью, выбор типовой конструкции разрабатываемого механизма раскрытия, разработка конструкции механизма раскрытия рефлектора.

Ключевые слова: космический аппарат, антенные системы, трансформируемый зонтичный рефлектор, механизм раскрытия.

Recently, there has been high interest in transformable mesh reflectors with a rigid central part. This is due to the fact that the presence of a rigid central part allows you to set more stringent accuracy requirements to a reflector and thereby obtain a more accurate reflective surface of a reflector. However, the presence of a rigid central part leads to the fact that the actuators of a control drive must be located at each spoke and united by an annular connection [1]. Such an arrangement of actuators of the control drive may lead to asynchronous opening of a reflector. Today, the development of the mechanism of the disclosure of a reflector with high degree of synchronism of opening is a very urgent task [2].

Conducting a review and patent search for the construction of the mechanisms of disclosure of umbrella reflectors with a rigid central part made it possible to determine: basic concepts, kinematic schemes, and the main parameters of disclosure mechanisms developed to date [3].

As a prototype for the developed mechanism of disclosure of a reflector with a rigid central part, it was decided to use the concept of the mechanism with a double gear ring and lever assemblies.

a   *b*

Fig. 1. Parametric and solid model of a disclosure mechanism

In order to ensure the moment arriving at each spoke at the end of the opening, the value of which directly depends on the moment of resistance during tension of the net-cloth and to determine the values of key parameters, the parametric kinematic scheme of the developed mechanism was made (Figure 1, *a*).

In the developed parametric model, three positions of the mechanism were considered:

– transportation position (purple lines in Figure 1, *a*);
– intermediate position (blue lines in Figure 1, *a*);
– working position (green lines in Figure 1, *a*).

This parametric model, in addition to changing the configurations of the mechanism, by setting various parameters, is able to conduct the force calculation of the resulting configurations.

Using a parametric kinematic model allowed us to determine the optimal values of the key parameters of the mechanism:

– rod length = 125 mm;
– shoulder length = 60 mm;
– angle of rotation of spokes = 76°.

These values of the key parameters make it possible to obtain the moment arriving at the spoke at the end of the opening of about 2.6 kg · m, with drive torque of 2.1 kg · m.

A parametric model of the disclosure mechanism can be used as a universal tool for designing similar mechanisms with other values of key parameters.

The design of the disclosure mechanism was carried out in a computer-aided design system. The created 3D solid-state model of the designed mechanism of the disclosure of the reflector with a rigid central part is shown in Figure 1, *b*.

In the chosen concept, at the design stage, the lever assemblies were modernized, which involved the use of spherical joints: ring-rod, rod-spoke. This allowed us to reduce the number of rods to two and thereby obtain more reliable and accurate design. The transport and operating positions of the lever assembly are shown in Figure 2, a and Figure 2, *b*, respectively.

The designed mechanism of the disclosure of a reflector with a rigid central part, throughout the entire opening, creates a rigid connection between the drive and the spokes, and has a small number of adjustment points as well, which makes it possible to obtain a mechanism with the high degree of synchronization of opening.

The disclosure of the reflector is as follows. The electromechanical drive starts to rotate the rings, the lever mechanisms connected to the rings transfer the spokes from the transport position to the working one.

<center>a</center>
<center>b</center>

Fig. 2. Transport and working position of rods

Thus, as a result of the work done, the analysis of analogues was carried out, on the basis of which the operating principle and design features of the developed mechanism of the disclosure of an umbrella reflector were determined. Next, the parametric model of the mechanism of the disclosure of the reflector was developed in order to determine the optimal values of key parameters, after which the solid-state model of the mechanism of the disclosure of the reflector was designed.

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FORMATION OF ABOVEGROUND PHYTOMASS OF PINUS SIBIRICA OF FIRST CLASS AGE ON PLANTATION

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The article presents the results of the study of the endogenous variability of a 39-year-old Pinus Sibirica of local (Divnogorsk) origin, grown on the site of plantation crops "Izvestkovaya" of the suburban zone of Krasnoyarsk. The formation of the aboveground phytomass of the model tree was studied taking into account its fractional distribution.

Keywords: Pinus Sibirica, plantation crops, phytomass, variability.

ФОРМИРОВАНИЕ НАДЗЕМНОЙ ФИТОМАССЫ СОСНЫ КЕДРОВОЙ СИБИРСКОЙ ПЕРВОГО КЛАССА ВОЗРАСТА НА ПЛАНТАЦИИ

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Приведены результаты исследования эндогенной изменчивости 39-летней сосны кедровой сибирской местного (дивногорского) происхождения, выращенной на участке плантационных культур «Известковый» пригородной зоны Красноярска. Изучено формирование надземной фитомассы модельного дерева с учетом его фракционного распределения.

Ключевые слова: сосна кедровая сибирская, плантационные культуры, фитомасса, изменчивость.

Recently, it has become increasingly important to create highly productive target plantations of an ecological orientation near large cities to improve the environmental situation, reduce the harmful effects of dust, gas, phytotoxicants, reduce noise and other factors.

Artificial plantations, in contrast to the natural forest, are characterized by more active binding of atmospheric carbon, especially in the first classes of age [1].

Global climate change, an increase in the concentration of carbon dioxide in the atmosphere, etc., are changing the patterns of growth of tree species. The tables of the course of growth, developed on the basis of the analysis of the growth of stands during previous centuries, are less and less in line with modern realities [3].

The studied plantation crops were created at the Experimental Forestry Enterprise of SibSU named after M. F. Reshetnev in 1989 according to the scheme of 3.5×3.5 m. Ten-year-old seedlings were used as planting material. At the time of the research, Pinus Sibirica trees reached 39 years of biological age. The phytomass structure was studied according to the method of V.A. Usoltsev et al. [4]. The assessment of the level of variability of attributes was determined on a scale of

S. A. Mamaev [2]. The endogenous variability of the number and total mass of branches in the whorl on the model tree NP-14 was studied.

It was established that the number of branches in the whorl of the studied model varied from 1993 to 2017 from 4 to 14 pcs. The mass of the covered middle branch in the whorl varied depending on the vertical arrangement in the crown from 0.1 to 4.9 kg in a freshly cut state. The mass of all explored branches in the whorl varied from 0.7 to 53.9 kg. The mass of the annual segments of the trunk (in height) in the freshly cut state varied from 1993 to 2017 from 0.6 to 15.9 kg with a length of trunk growth from 35 to 67 cm.

The trunk of the model tree was conditionally divided into three parts: upper, middle and lower. In the lower part of the trunk, the average increase in height was 46.8 ± 3.13 cm, in the middle – 51.2 ± 4.38 cm, in the upper – 49.2 ± 2.60 cm.

The annual growth of phytomass is determined to a large extent by the height and diameter of the tree trunk and crown. In the upper part of the tree, about 35 % of the above-ground phytomass accounts for the share of trunk wood, 65 % of the covered branches, of which about two-thirds are the mass of needles. The mass of annual segments of the trunk in a freshly cut state is characterized by a very high level of variability in the upper part of the crown.

In the middle and lower parts of the tree, the ratio of phytomass fractions varies. In the middle part of the crown, most of the phytomass falls on the mass of branches, in the lower part – on the mass of the trunk.

When distributing the mass of the crown along the vertical profile of the tree, it was found that in one whorl of the upper part of the crown, on average, about 57 % account for the needles, 43 % – for shoots. In the middle part of the crown, the percentage of phytomass of needles is reduced to 50 %. In the lower part of the crown, the number of needles in whorls remains at about the same level, but decreases in percentage terms – up to 40.5 % in the total phytomass of the lower part of the crown.

As a result of the studies, it was found that the aboveground phytomass of Pinus Sibirica per tree in a freshly felled state at the age of 39 is about 716 kg, including 68.6 % for the covered branches and for the trunk weight – 31.4 % of aboveground phytomass. When calculating the indicators of ecological productivity of plantation crops, it was found that, the above-ground phytomass of crowns of 39-year-old Pinus Sibirica will be about 405 tons, stem wood – 186 tons per unit area with planting density of 825 pcs / ha.

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GENETIC PROGRAMMING ALGORITHM FOR THE DYNAMIC SYSTEMS IDENTIFICATION

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The genetic programming algorithm is an effective tool for solving a symbolic regression problem. The article considers application of this method to the solution to the dynamic identification problem in the form of a differential equation. The testing results of the proposed approach are presented for the dynamic systems identification of the order from 1 to 5 with several input influences.

Keywords: dynamic systems, identification, differential equation, genetic programming.

АЛГОРИТМ ГЕНЕТИЧЕСКОГО ПРОГРАММИРОВАНИЯ ДЛЯ ИДЕНТИФИКАЦИИ ДИНАМИЧЕСКИХ СИСТЕМ

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Алгоритм генетического программирования является эффективным инструментом для решения задачи символьной регрессии. Предлагается применить данный метод к решению задачи идентификации динамических в виде дифференциального уравнения. Представлены результаты тестирования предложенного подхода при идентификации динамических систем порядка с 1 по 5, при нескольких входных воздействиях.

Ключевые слова: динамические системы, идентификация, дифференциальное уравнение, генетическое программирование.

Nowadays, the problem of building models of dynamic processes remains important [1]. Despite the fact that a great number of diverse approaches have been developed, scientists today are developing methods that minimize initial restrictions on the model. It is worth noting that one of the most preferred ways to describe dynamic systems is to represent them in the form of a differential equation [2].

The problem of building model of a dynamic system from the numerical data of its inputs and outputs can be considered as a problem of symbolic regression. This problem is solved by such an effective evolutionary method as genetic programming (GP) [3].

Consider the statement of the identification problem using the sample data. Let be a sample of volume $n\{y_i,t_i\}$, $i = 1, 2, ..., n$, where y_i is the measurement of the dynamic system output at time t_i. The control action, which is an input of the dynamic system, is known. The object is described by a differential equation with the known initial condition:

$$y^{(k)} = F(y^{(k-1)}, ..., y', y, x),$$
$$y(0) = y_0.$$

The order of the differential equation will be considered to be limited. It is necessary to build a symbolic model in the form of the differential equation that describes the relationship between the input and output of the system. The initial conditions will be considered to be known.

In this statement, the identification problem is reduced to the problem of symbolic regression.

The GP algorithm requires the representation of the individual in the form of a tree [3]. In this paper, a method for encoding a differential equation in the form of a tree is developed and described.

It is necessary to specify the maximum possible order of the differential equation K to form a tree. Therefore, we will seek for a solution to the identification problem as a differential equation of the order $k < K$, where $k \in N$:

$$\hat{y}^{(k)} = F(\hat{y}^{(k-1)}, ..., \hat{y}', \hat{y}, x).$$

The functional and terminal sets are redefined to using the GP algorithm. The terminal set includes a set of all input (x) and output (y) variables, a set of constants, derivatives $y', ..., y^{(k-1)}$. The functional set consists of the functions used by the algorithm to form the solution ($+, -, /, \sin, \cos$, etc.).

The root vertex of the tree contains not only an element of the functional set, but also the information about the maximum order of the derivative for the given individual. An example of a tree is shown in Figure 1.

Fig. 1. Example of the differential equation in the form of a tree

The evolutionary steps of the algorithm were also substantially modified for the GP algorithm operating with differential equations. A starting population is generated randomly from the given number of individuals at the initialization step. An order of the differential equation is not higher than the given value of K in the root node. An individual in the form of a tree is converted into a formula. Then the fitness value is calculated for it:

$$fitness = \frac{1}{1 + error},$$

$$error = \frac{1}{n} \sum_{i=1}^{n} \frac{\sqrt{(\hat{y}_i - y_i)^2}}{\max(y_i) - \min(y_i)},$$

where n is a sample size, $\hat{y}_i$ is a value of the individual at the i-th point, y_i is values from the original sample. The calculating derivative must be performed at the points of the initial sample in calculating an error of correspondence of the found solution to the true one. In this paper, the output estimation of the differential equation $\hat{y}_i$ from the points of the initial sample x_i was performed using the fourth-order Runge–Kutta method. The specific feature of the mutation in the proposed

approach is a possible change in the root node containing the maximum order of the differential equation. In case of a change (mutation) of the maximum order of the differential equation, the order of the derivative must also be changed.

We can consider the results obtained by the proposed approach in solving test problems and a graph of the model correspondence to the known differential equation as an example (Figure 2).

$$y''' = -y' + \frac{1}{\cos(u(t))}$$

$$u(t) = e^{\sin(t) + \cos(0,5t)}$$

Fig. 2. Model correspondence of the output graph
to the true values of the object output

Table shows the averaged accuracy values of the obtained model for the systems identification of various orders [4].

**Results of evaluating the effectiveness of the GP algorithm for solving the identification problem
of the differential equation (DE)**

Maximum order of the derivative	Error	Generation number
y'	0.015	59
y''	0.038	85
$y''' - y^{V}$	0.0006	76
DE with some inputs	0.0054	75

Often, a dynamic system is affected not by one, but several input dynamic influences at once. The test results of the proposed approach for the dynamic systems identification are also presented in Table.

Therefore, this paper proposes an approach based on GP algorithm that helps to obtain a model of a dynamic system of the arbitrary order and structure.

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SIMULATING SPACECRAFT TELEMETRY, COMMAND AND RANGING SUBSYSTEM

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In this article we consider the structural model of a telemetry, command and ranging subsystem (TCR) by means of queuing systems (QS). This model is generated using the "PLUS" language of the "GPSS WORLD" simulation system. The comprehensive study of the parameters of the TCR assembly project is performed. Various modifications of the TCR structures are simulated.

Keywords: telemetry, command and ranging subsystem, model, simulation system, queuing system.

МОДЕЛИРОВАНИЕ РАБОТЫ КОМАНДНО-ИЗМЕРИТЕЛЬНОЙ СИСТЕМЫ КОСМИЧЕСКОГО АППАРАТА

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Рассматривается структурная модель командно-измерительной системы (КИС) средствами систем массового обслуживания (СМО). Формируется модель на языке «PLUS» системы имитационного моделирования «GPSS WORLD». Производится комплексное исследование параметров проекта сборки КИС. Осуществляется моделирование различных модификаций структур КИС.

Ключевые слова: командно-измерительная система, модель, имитационное моделирование, система массового обслуживания.

Simulation of the TCR operation. Let us consider the logic of the TCR and model the operation of the TCR using the QS as it is shown in figure 1 [1].

In the TCR model, the blocks are identical, therefore, we will take a closer look at the first TPU block, shown in Figure 2.

OBDSM receives a signal from spacecraft (SC) in the form of a code (a sequence of transactions). SC is a source of the request. Next, the signal from the input stream is put in the queue of the first TPU block. The unit contains 3 sets – one main set and two backup sets. If the main unit does not work for some reason, the signal is sent to the second set. After passing the signal through the operating device, the signal is queued to the next block, etc. After passing the signal through the CWT block, the signal goes through the output stream of requests to the AFD – «request absorber». Next, the signal goes to the radio line.

The request for signal service is characterized by the moment when the signal appears at the entrance to the TCR, the status in relation to other requests, and parameters that determine the needs for temporary resources for service.

Fig. 1. TCR structure in the form of a scheme for QS:
"OBDSM" – on-board digital computing machine generating bytes of telemetry (TM) frame (single source); "TPU" – telemetry processing unit (three sets operating in parallel in a redundant mode); "E" – encoder (three sets operating in parallel in a redundant mode); "T" – transceiver (three sets operating in parallel in a redundant mode); "AS" – microwave adder-splitter (one set); "PA" – power amplifier (three sets operating in parallel in a redundant mode); "CWT1", "CWT2", "CWT3" – coaxial waveguide transition (three sets operating in parallel in a redundant mode); "AFD" – antenna-feeder device (completion of signal processing – transaction destruction)

Fig. 2. The structure of the TPU block means of QS

Constantly incoming requests for maintenance of the TCR work form a flow of requests – a set of requests distributed over time. The flow of applications can be uniform and non-uniform. The main parameter of the request flow is the time interval between the receipts of two adjacent requests. The flow of applications can be stationary or non-stationary (changing over time).

The transaction flow is considered as a random process characterized by the distribution function of the period of receipt of requests (for example, the simplest flow, the Erlang flow).

The TCR element where operations take place is called service device. At the time of performing operations, it is busy, otherwise it is free. If the first block is free, the request is accepted for service. Service of each request by a channel means that the request is delayed in it for a time equal to the service period. After servicing, the request leaves the first service block. Thus, the service device is characterized by the service time of the request. If the requests are received randomly, queues are formed.

Dynamic construction of the TCR model. This construction is due to the fact that the model may have a different structure. For example, using an external program developed as part of the study, you can set the topology of the TCR in graphical mode as shown in Figure 3 [2].

When you click on the "change TCR configuration" button, the program will automatically offer one of the options. After that, when you click the "generate" button, the model will generate the resulting configuration. This program at the modeling stage partially optimizes the process of modeling the TCR [3].

Thus, this article proposes and implements a program that allows you to implement the variable design of the TCR topology in graphical mode and automatically generate the

corresponding model code in the "PLUS" simulation language of the "GPSS WORLD" environment.

Fig. 3. Modified TCR structure in graphical mode

At the end of the simulation, it was necessary to compare the results of service channels and queues. The results of the reports are shown in tables 1 and 2.

Table 1

Information about the objects of type "device" Model 1

"FACILITY" Number of operating channels	"ENTRIES" Number of inputs	"UTIL." Utilization	"AVE.TIME" Average operating time
TPUK1	37439483	0.249	287.000
EK1	35140244	0.336	412.999
TK1	42897245	0.019	19.000
ASK	43200940	0.151	151.000
PAK1	43200940	0.015	15.000
CWTP1	43200940	0.055	55.000
CWTP2	43200940	0.055	55.000
CWTP3	43200940	0.055	54.999

Table 2

Information about the objects of type "device" Model 2

"FACILITY" Number of operating channels	"ENTRIES" Number of inputs	"UTIL." Utilization	"AVE.TIME" Average operating time
TPUK1	37439126	0.249	287.000
EK1	35757967	0.342	413.000
TK1	42910244	0.019	19.000
ASK	43200940	0.151	151.000
PAK1	43200940	0.015	15.000
CWTP1	43200940	0.055	55.000
CWTP2	43200940	0.055	55.001
CWTP3	43200940	0.055	55.000

Conclusion

Thus, when analyzing reports of variable TCR execution, it can be concluded that the first version of the TCR structure (Model 1) is preferable both in terms of cost and reliability. Each TCR

unit handles the flow of telemetry signals from the SC. In case of the failure of the main drive, there are two spare parts in each side, this is enough for the survivability of the SC.

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SOCIAL DESIGN IN THE PROCESS OF TRAINING A FUTURE DESIGNER

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The article reveals the concept of social design and its importance in design training. The definitions of "social engineering", "social design" are given. The problems of social design in the preparation of bachelors in design are also disclosed.

Keywords: socially oriented design, social design, design, training of social designers, social engineering.

СОЦИАЛЬНОЕ ПРОЕКТИРОВАНИЕ В ПРОЦЕССЕ ОБУЧЕНИЯ БУДУЩЕГО ДИЗАЙНЕРА

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Раскрывается понятие социального проектирования и его значение в дизайн обучении. Даются определения «социальное проектирование», «социальный дизайн». Также раскрывается проблематика социального проектирования в подготовке бакалавров по направлению дизайн.

Ключевые слова: социально ориентированный дизайн, социальный дизайн, дизайн, обучение социальных дизайнеров, социальная инженерия.

The main thing for the future designer is to understand the sociocultural essence of design in an industrial society. Victor Papanek in his book "Design for the Real World" talks about the era of mass production, when everything had to be planned and designed, design became the most effective means by which people create new tools, change the environment and as a result we change society and ourselves. This imposes a serious social and moral responsibility on the designer. In addition, it requires from the designer a greater understanding of the problems by the consumer, and from them, in turn, greater participation in the design process [7].

Design is a form of organization of art and design activities, the purpose of which is to create products of mass material and spiritual consumption. V. O. Pigulevsky writes in detail about the types of design: "The types of design are distinguished through professional areas:
– industrial design (product);
– graphic design (communicative);
– environment design (object and communicative);

– fashion or costume design.

If we consider the production and consumption cycle, it is enough to distinguish between product design and communicative (graphic design)" [3].

With the development of industry, design, in its basic understanding, was aimed at the development and promotion of social and household items. But with the development of universal need and a craving for aesthetics of design activity, in the XXI century a specific need for «social design» appeared. Obviously, these features began to be traced in the main types of design: industrial, environmental, graphic. A special development of these areas occurred at the junction of the past and current centuries, where the rapid development of industry and computer technology pushed the emergence of new trends in the development of design.

How does social design help us stay on the crest of life's challenges? Communicative and informational design enlighten us of a particular phenomenon in society. This unique alert and communication feature distinguishes design from other similar subject areas. Any visual object carries information that helps guide, educate, communicate, inform and more. This expresses the social function of design. A striking example of this is the Dobroshift project.

The Dobroshift project is dedicated to the day of cerebral palsy, which is celebrated on October 2. In Russia, an action was launched that day, in which Yandex, the Zenit football club, Sports.ru, the Lenta chain and the Russian Post network changed their logos to a font created by children diagnosed with cerebral palsy. Many other companies, as well as public figures and the media announced support for the action. Thus, information spread and more and more people learned about the problems of cerebral palsy. The mission of the project, according to its creators, is to tell a wide audience about how difficult it is for children with cerebral palsy to live and raise funds for individual programs for the rehabilitation of children and help their families. On the project website you can read the stories of all the children who participated in the work on the font, purchase products with the font, make a donation, and also download "Dobroshrift" [2]. And this is just one example out of many that shows how important the mission of socially responsible design is.

The previously mentioned Victor Papanek proposed several areas of socially responsible design that meets precisely human needs, and not the satisfaction of momentary or artificially created desires. His list is as follows:

– design for the third world countries.
– design of educational and training devices for people with development disorders, invalids and disabled.
– design for medicine, surgery, equipment of dental clinics and hospitals.
– design for experimental research.
– design of systems for maintaining human life in extreme conditions.
– a conceptual and innovative design that will allow us to reconsider attitudes to existing needs of people and offer fundamentally new solutions.

Modern scholars Victor Margolin and Sylvia Margolin also highlight areas of socially responsible design – sustainable design (also called "ecodesign", "green design" and "environmental design"), affordable housing, and the reorganization of state tax and immigration forms. They recognize that many products intended for the market also meet social needs, but at the same time claim that the market cannot take care of all social needs, as some of them belong to special groups of the population, but are not accessible to people with low incomes or unusual needs due to age, state of health or disability. They believe that many professionals share the goals of designers who want to do socially responsible work, and suggest that both designers and professionals help find ways to work together, unlike Victor Papanek's statements, in which he contrasts socially responsible designers with the market [8].

Future bachelors designers are trained in design through the development of universal competencies, but it is social design that allows them to master the competencies associated with individual groups of the population, and not just with the requests of manufacturers. Such competencies may include:

– be able to manage projects;

– design to suit individual circumstances of the project;

– design in a large team and with external members;

– create, develop and produce design objects in accordance with their goals and ideas;

– work with specific and real conditions in accordance with the brief;

– have developed empathy and increase social awareness.

Let's take a closer look at the concept of social engineering. Currently, social engineering is a special kind of scientific and practical activity that reconstructs or creates new objects valuable to society, and also forecasts the further development of these objects. A prognostic form of a person's awareness of his future in society is what social projection is.

According to the opinion of a group of scientists V. V. Seregin, E. A. Seregin, L. N. Shapovalova, "modern social engineering is a scientific-theoretical and, at the same time, substantive practical activity on creating projects for the development of social systems, institutions, social objects, their properties and relations on the basis of social foresight, forecasting and planning of special obviously necessary qualities and properties that are significant social need. The predicted, modeled and constructed qualities and properties of social objects make it possible to control social processes and are an expression of the new that characterizes the trends of modern social development. In accordance with this, social design is associated with innovation and the introduction of social innovation" [4].

According to P. I. Levko, "social designing is a scientifically based activity aimed at building a specific actual organization of social ties in various fields and at different levels of joint life. The result and the ultimate goal of social design is a social project – an ideal model expressed in the corresponding sign form (verbal description, flowcharts, graphs, matrices, networks of interactions) designed in accordance with given requirements" [5].

There are more and more social projects in the design environment. Poster actions in a design environment are quite common. Vivid examples of this can serve as the "Golden Bee" or "4th block" In the 21st century, social projects are carried out globally through design. A particular role here is given to communicative design, which belongs to one of the professional areas of design, which can be carried out in various directions, since all visual objects from these directions carry this or that information. Social projects during the training of students are one of the most effective tools for immersion in the profession. In this area, immersion in the problem, ingenuity, as often these projects have small budgets or their complete absence. But projects of this kind enrich, give meaning to an understanding of the profession of designer, which is something more than just technical knowledge, academic education. Mike Monteiro in his book "Design is Work" writes: "You are responsible for the work that you give the world. Choose projects carefully; do not take care of everything. Make the world a better place than it was before you. Improve things for people" [1].

The issues of "social design" are quite broad:

– the difference between product design and the socially oriented designers;

– lack of research in this area to determine the competencies of the "social designer";

– financing and support of "social design";

– training of designers of this orientation: features of training, priority disciplines, implementation of projects in society.

An analysis of the problem under study shows that the question of what competencies a socially oriented designer should have is relevant. Of course, designing is universal, but future "social designers" should have the competencies that will be necessary in working with certain groups of the population. Thus, they need more information about social needs, and how they are addressed in a professional environment. To do this, they need to go through practical training in hospitals, social services, nursing homes and other social-type organizations.

Thus, we can draw the following conclusions. The relevance of social design in the process of training designers is currently high, which confirms a large number of socially oriented projects, such as poster campaigns, design projects for different population groups, design objects. At the

same time, there are a number of problems in the formation of socially oriented designers that require study and practical solutions:

– the difference between product design and the socially oriented designers;

– lack of research in this area to determine the competencies of the "social designer";

– financing and support of "social design";

– training of designers of this orientation: features of training, priority disciplines, implementation of projects in society.

This indicates the prospects of this area of training. The design nature combines design and social design, which allows for the formation of interdisciplinary ties for the successful implementation of projects, as well as contributes to the formation of professional competencies of socially responsible designers.

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MULTIFUNCTIONAL COATING IN MODERN ROCKET AND SPACE TECHNOLOGY

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This article contains basic information about the multifunctional coatings used today in Aerospace Engineering. The concept is revealed. The main goal of using the coatings, mission and purpose are presented.

Keywords: multifunctional coating, gas dynamic spraying, protection against ionizing radiation, laser reflection.

МНОГОФУНКЦИОНАЛЬНОЕ ПОКРЫТИЕ В СОВРЕМЕННОЙ РАКЕТНО-КОСМИЧЕСКОЙ ТЕХНИКЕ

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Данная статья содержит основные сведения о многофункциональных покрытиях, используемых сегодня в аэрокосмической технике. Раскрыто понятие, представлена основная цель использования покрытия, миссия, назначение.

Ключевые слова: многофункциональное покрытие, газодинамическое напыление, защита от ионизирующего излучения, отражение лазерного влияния.

A multifunctional coating is a multilayer structure applied on the surface of a product to protect it from external influence (pressure, temperature, corrosion, erosion, vibration).

As a rule, such coatings have a boundary between their extreme layer and the surface of the protected product. That is, the size of the product increases by the thickness of the coating and accordingly the mass of the product increases as well.

The main objectives of the multifunctional coating are:

1) restoring the properties, overall dimensions, mass of a product surface, which were violated in operating conditions;

2) change in the initial physical, mechanical and chemical properties of the surface of a product, to ensure specified operating conditions.

The main mission of a multifunctional coating is the ability of a product being designed to fulfill its main task, subject to external irritation and at the same time to increase the durability of use.

In Aerospace Engineering, the main purpose of multifunctional (functionally gradient) coatings is thermal protection, protection against ionizing, electromagnetic and radio emission,

reflection of laser influence, aimed at influencing the control system, electrical equipment and product devices. The secondary functions of multifunctional coatings in rocket technology include increasing the strength and stiffness of individual external parts of a product, as well as protection against corrosion and erosion.

Fig. 1 shows the layout of an aircraft missile. It can be seen that all the rocket units are connected by a system of external protective wiring ducts with a special multifunctional coating applied on the outside, which is designed to protect against the external influence (electromagnetic and laser radiation) on the cable system and control unit.

Structure of medium-range aircraft missiles

The main way to obtain a multifunctional coating is spraying. That is, the technological process of coating formation by spraying liquid dispersed particles deposited during impact collision with the surface of the product [1]. The main advantage of this method is the ability to obtain thick uniform coatings, as well as the ability to control the application conditions and the quality of the applied material during the process.

Thus various spraying variations (gas-flame, cold gas-dynamic, plasma, high-speed ion-plasma magnetron, high-speed gas-flame spraying) are the main methods for producing multifunctional coatings in rocket and space technology.

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ALGORITHMS OF RECOGNIZING IMAGES AND TRACKING OBJECTS ON VIDEO

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Currently, surveillance systems are installed in all modern enterprises, shops and modern city streets. Processing information obtained from observation cameras will allow tracking various objects. Tracking objects requires recognition of images in the image.

Keywords: image recognition, tracking objects, video analysis.

АЛГОРИТМ РАСПОЗНАВАНИЯ ИЗОБРАЖЕНИЙ И ТРЕКИНГ-ОБЪЕКТОВ НА ВИДЕО

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В настоящее время камеры наблюдения устанавливаются на всех современных пред-приятиях, магазинах и современных городских улицах. Обработка информации, получаемой с камер наблюдений, позволит отслеживать различные объекты. Отслеживание объектов требует распознавания образов на изображении.

Ключевые слова: распознавание изображений, трекинг объектов, видеоанализ.

Recognition algorithms are used to detect an object in the image. The image recognition or classification algorithm takes a picture as input and displays what is contained in this image. The classification of images is carried out in several steps. In the first step, the input image is pre-processed to normalize contrast and brightness. Also in this step, the input image is cropped and scaled to a fixed size.

The second step is to simplify the image by extracting important information. Original image contains too much additional information that is not required for the classification. This step is called feature extraction. There is a fairly large number of signs used in computer vision – these are signs of Haar, HOG (Histogram of Oriented Gradients), SIFT (Scale-Invariant Feature Transform), SURF (Speeded Up Robust Feature) and others [1].

For the third step, the classification algorithm accepts a feature vector as input and outputs to which class the image belongs. Tracking is a search for an object in successive frames of a video. In some cases, object tracking can be performed using detection algorithms. For each object belonging to the class of interest, its vector representation is constructed as a descriptor. Next, on each frame, an object will be searched and its location highlighted with a rectangle [2].

The goal of tracking is to find the object in the current frame if it was successfully tracked in all previous frames. Since the object was tracked to the current frame, the parameters of the motion

model are known: the speed and direction of movement of the object are in the previous frames. Therefore, a new location of an object can be predicted based on its motion model and it will be very close to the real new position of the object [3]. In this case, the location of the object is first found using the detection algorithm, and then using the tracking algorithm to track the movement of the object.

The desire to increase the degree of security and control of protected objects leads to increase number of cameras in video surveillance systems. However, often cameras operating within the framework of one system remain independent: each provides its own information – analytics and statistics, which are not related to data from other cameras and do not allow to evaluate the overall picture [2].

Video analysis is an essential tool in systems with a large number of cameras. Among the most promising features in this case is tracking the movement of objects.

The simplest tracking implementation considers two frames and builds trajectories on them. First, movements are marked on the current and previous frame, then, analyzing the speed, direction of movement of the objects, as well as their sizes, the probabilities of the transition of objects from one point of the trajectory of the previous frame to another point of the current are calculated. The most probable movements are assigned to each object and add up to the trajectory [4].

Objects in the frame can move in different ways: their paths can intersect, they can disappear and reappear, and several objects can merge or change their direction of movement sharply. In these cases, the task of constructing an exact trajectory is complicated. The method of constructing a trajectory in two frames is not suitable to analyze such complex movements, because it gives a high error. To improve tracking accuracy, engineers can use the technology for analyzing frame sequences and continuous post-processing of the results [1; 4].

The program builds graphs: it analyzes the transitions of objects from one state to another. In order to understand which object corresponds to which movement, the speeds and directions of movement, position, color characteristics are also analyzed. As a result, a set of the most probable movements of the object is formed, which forms a trajectory. The difference between the methods is that when processing the sequence of frames, both the current position of the object and the history of its transitions are taken into account, which allows increase the accuracy in difficult situations of intersection of movement, disappearances and occurrences of the object [3].

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THE APPLICATION OF CLUSTERING IN LIFE

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The main definitions of clustering are given. The paper considers the division of clustering into categories, i. e., unsupervised learning. K-means algorithm as one of the most commonly used clustering algorithms is presented. The application of clustering is given.

Keywords: clustering, k-means algorithm, e-commerce.

What is clustering? Clustering is based on a group of samples of unknown category labels, and they are divided into several categories by some algorithm. This is an unsupervised learning.

Its main research is the logical or physical correlation between data. A cluster made up of clusters is a collection of data objects. These objects are similar to each other in the same cluster and different from those in other clusters. The analysis results can not only reveal the internal connections and differences between the data, but also provide an important basis for further data analysis and knowledge discovery [1]. The clustering effect of the clustering algorithm is shown in the Figure 1.

Fig. 1. The clustering effect
of the clustering algorithm

What is k-means method？K-means algorithm is one of the most commonly used clustering algorithms. Given a set of data points and the required number of clusters k, k is specified by the user, and the k-means algorithm repeatedly divides the data into k clusters according to a distance function.The k-means algorithm must know the size of the K value, that is, the number of clusters [2].

Advantages of the k-means algorithm:
− k-means algorithm is simple, fast and easy to understand;
− k-means algorithm is scalable and efficient;
− k-means algorithm clusters all data samples.

Disadvantages of k-means algorithm:
− k-means is sensitive to the initial cluster center;
− k-means needs to determine the number of clusters in advance;
− k-means is relatively sensitive to isolated points and noise points [3].

The clustering will vary depending on the K value chosen. So we need to choose the appropriate K value.

How do we decide on the number of clusters? The following demonstration selects different groups with different *K* values. As shown in Figure 2:

Fig. 2. Decide on the number of clusters

Here are some applications of clustering.

− Commercially, cluster analysis is used to find different customer groups, and to characterize different customer groups through purchase patterns. Cluster analysis is an effective tool for market segmentation. It can also be used to study consumer behavior, find new potential markets, select experimental markets, and serve as a pre-processing for multivariate analysis.

− Biologically, cluster analysis is used to classify animals and plants and to classify genes to gain an understanding of the inherent structure of the population.

− Geographically, clustering can help the database vendors observed on the earth tend to be similar.

− In the insurance industry, cluster analysis identifies a group of car insurance policy holders by a high average consumption, and at the same time identifies a city's real estate grouping based on residential type, value, and geographic location.

− In Internet applications, cluster analysis is used to classify documents online to repair information.

− In e-commerce, cluster analysis is also an important aspect in website construction data mining in e-commerce. By grouping customers with similar browsing behaviors and analyzing the common characteristics of customers, it can better help e-commerce. Of users know their customers and provide them with more appropriate services.

Market segmentation.

In the market segmentation field, different customers have different consumption characteristics when consuming the same type of goods or services. By studying these characteristics, companies can formulate different marketing combinations to obtain the largest consumer surplus. This is the customer detail. The main purpose of the sub. In the division of sales areas, only if the submarkets owned by the enterprise are reasonably divided into several large areas, can the marketing strategy and tactics in line with the characteristics of the area be effectively formulated. In the financial field, funds or stocks are classified to select classified investment risks.

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SELF-CONFIGURING GENETIC PROGRAMMING ALGORITHM TO DESIGN DECISION TREES

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Decision tree is a machine learning algorithm that is very effective in classification problems. Decision tree is a topical algorithm because of the good interpretability of the results of their work. However, decision tree has a drawback that standard algorithms do not allow obtaining an optimal structure of the decision tree. To overcome this drawback, it is proposed to use the genetic programming algorithm. This algorithm is one of the branches of evolutionary algorithms and has proven itself for the design of intelligent information technology. Genetic programming, in one of their implementations, searches for solutions in tree space, which is well suited for designing decision trees. Algorithms was tested on classification problems.

Keywords: decision tree, classification, genetic programming.

САМОНАСТРАИВАЮЩИЙСЯ АЛГОРИТМ ГЕНЕТИЧЕСКОГО ПРОГРАММИРОВАНИЯ ДЛЯ ПРОЕКТИРОВАНИЯ ДЕРЕВЬЕВ ПРИНЯТИЯ РЕШЕНИЙ

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Дерево решений – это алгоритм машинного обучения, который очень эффективен в задачах классификации. Дерево решений является актуальным алгоритмом из-за хорошей интерпретируемости результатов их работы. Однако дерево решений имеет тот недостаток, что стандартные алгоритмы не позволяют получить оптимальную структуру дерева решений. Для устранения этого недостатка предлагается использовать алгоритм генетического программирования. Этот алгоритм является одной из ветвей эволюционных алгоритмов и зарекомендовал себя для разработки интеллектуальных информационных технологий. Генетическое программирование, в одной из своих реализаций, ищет решения в древовидном пространстве, которое хорошо подходит для проектирования деревьев решений. Алгоритмы проверены на задачах классификации.

Ключевые слова: дерево решений, классификация, генетическое программирование.

At the moment, methods based on decision trees are one of the best algorithms for working with structured data [1]. Decision trees are one of the most effective classification methods that has been successfully applied in the practice of data mining [2–4]. The decision trees are widely used due to the intuitive form of the results, which is close to the expert's formal reasoning. Therefore, increasing the efficiency of decision trees is an actual area of data analysis.

Learning decision tree algorithms build an "almost optimal" tree, performing a local search in each node in the hope that the resulting tree will be as close as possible to the optimal one. Such algorithms are called "greedy" [5]. In addition, the decision tree should have a high degree of generalization, that is, the algorithm shouldn't just "remember" the belonging of the objects in the training set to classes, but reflect the dependencies between inputs and outputs [6]. Therefore, in this paper, we consider the possibility of using the genetic programming algorithm.

Genetic programming is an effective tool for computer-aided design of information technologies [7]. In one of the variants of genetic programming, individuals are represented in the form of binary trees; therefore, this algorithm is convenient for finding the optimal structure of a decision tree by searching in the space of trees.

The genetic programming algorithm does not perform a local optimum search in each node of the tree; it searches for the optimal structure from the set of all possible structures, performing a stochastic estimate of the gradient of the error function of the decision tree in the tree space.

A self-configuring genetic programming algorithm is used to automate the process of constructing decision trees; it designs decision trees without any imposed restrictions on their structure, in contrast to standard algorithms.

To design decision trees, the genetic programming algorithm needs to be modified. To modify the original algorithm, it's necessary to redefine the functional and terminal sets. For designing decision trees, the functional set includes threshold functions (predicates), and the terminal set includes class labels. Next, we clarify the stages of the genetic programming algorithm with the modifications necessary for the design of decision trees (see Figure).

Genetic programming algorithm for designing decision trees

The proposed approach is designed to increase efficiency in solving classification problems. For testing, eight real tasks were selected from the Machine Learning Repository:
1) car type recognition;
2) recognition of the type of urban landscape;
3) determination of the variety of iris;
4) diagnosis of Parkinson's disease;
5) image recognition by segment;
6) diagnosis of heart disease;
7) determining the type of soil from satellite images;
8) determination of biodegradable chemicals.

During the research, the efficiency of decision trees designed by genetic programming was compared with the results obtained by the decision tree in the RapidMiner data analysis system [7]. Table presents the accuracy of the classification on test problems. Accuracy refers to the proportion of correctly classified objects in the control sample.

The accuracy of the classification of trees

Task number	Classification accuracy	
	DT GP	DT RapidMiner
Task 1	**0.762**	0.739
Task 2	0.73	0.769
Task 3	**1**	0.978
Task 4	**0.771**	0.282
Task 5	0.835	**0.869**
Task 6	**0.864**	0.778
Task 7	0.819	**0.826**
Task 8	**0.851**	0.789

Designing decision trees using a genetic programming algorithm is effective, which is confirmed by tests. The genetic programming algorithm finds a decision tree structure that provides a solution better than standard decision tree learning algorithms. The application of the genetic programming algorithm for the design of intelligent information technology is an actual and effective area of data analysis.

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WAYS OF REMOVING BURRS ON AIRCRAFT PARTS

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The paper considers basic problems of removing sharp edges and burrs while manufacturing aircraft parts. The most promising methods of removing these defects are presented as well.

Keywords: edges, burrs, processing, parts.

НЕКОТОРЫЕ СПОСОБЫ УДАЛЕНИЯ ЗАУСЕНЦЕВ НА ДЕТАЛЯХ ЛЕТАТЕЛЬНЫХ АППАРАТОВ

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Рассмотрены основные проблемы удаления острых кромок и заусенцев при изготовлении деталей летательных аппаратов и представлены наиболее перспективные методы удаления этих дефектов.

Ключевые слова: кромки, заусенцы, обработка, детали.

Current trends in the development of space technologies form the demand for high-precision parts and assembly units that are part of rocket engines made of high-strength materials with special properties. In the manufacture of the parts and components of aircraft made of metals and alloys, a significant labor intensity (up to 25–35 % of the total labor intensity of manufacturing products) is represented by machining operations that lead to defects (sharp edges and burrs) [1]. Sharp edges are stress concentrators and it contributes to the destruction of parts themselves and rubbing surfaces.

The protrusions of micro-irregularities on the edges due to their low mechanical strength are destroyed in the initial period of operation. The cavities of micro-surfaces are the place of origin of microcracks that grow during operations and lead to the formation of chips.

The state of the cut-off edges in the spool and plunger pairs largely determines the reliability of fuel units and the stability of their technical characteristics. The problem of functionally necessary processing of the edges of parts (including spool, plunger, sleeve, labyrinth seals) is relevant for domestic and foreign engineering.

Deburring by machining requires the use of special cutting, abrasive, brush or hand tools. It is often economically unprofitable or technically impossible due to technological difficulties in accessing the processed area located in small-sized grooves, holes, especially in the case of intersecting holes.

In this regard, various alternative, relatively new and fairly effective electro physicochemical methods of metal processing are of interest, which significantly expand the possibilities of modern

production. These types and methods of processing materials include: ultrasonic and electrohydroimpulse processing, thermal energy and electrochemical method, as well as an electrocontact method for removing burrs and smoothing sharp edges.

The electrochemical method and the electrocontact method for deburring and smoothing sharp edges are technologies that have significant potential for development and these methods have all the features of key processing technologies in the field of deburring used in the manufacture of aircraft parts.

As a result of using the above technologies, a surface layer does not undergo structural changes, and its microhardness is the same that microhardness of a base metal. There are no residual stresses and they do not form microcracks or rivets.

The electric contact method for removing burrs and smoothing sharp edges is designed for processing long parts. This method has the property of self-regulation, i.e. when removing burrs, further removal of the material does not occur, which allows you to use this method without further control over their size [2].

The technical effect of the introduction of the electrochemical method and the electrocontact method for removing burrs and smoothing sharp edges is to reduce energy consumption, labor intensity of operations, reduce the complexity of design work during the technological preparation of new products, and increase the technological reliability of products.

The widespread introduction of electrochemical and electrocontact deburring technologies is being held back due to a number of unresolved scientific, technical and organizational problems. Technological processes and means of technological equipment for operations are not developed enough. Reference and methodological materials for their development, suitable for the use in shop conditions, are in very short supply. This leads to the increase of resource costs during the technological preparation of new products and low capital productivity.

In particular, the problems of implementing the electrochemical method are exacerbated by the fact that the significant amount of experimental material accumulated in the 70–90s of the last century in the field of high-speed anodic dissolution of metals and technological developments in this area were not properly generalized in the form of automated knowledge bases [3].

The above mentioned high-tech technologies for removing burrs and sharp edges should have priority development, thereby improving the organizational and technical forms of application of technologies, as well as creating specialized production units, primarily in manufacturing missile and aircraft parts.

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ORGANIZATION OF COGNITIVE ACTIVITY OF YOUNGER SCHOOLCHILDREN IN THE CONTEXT OF HEALTH-SAVING

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This article is devoted to the research of parameters of internal and external resources of students involved in cognitive activity from the point of view of health saving, comprehension of the problem of correlation and harmonization of positive intention of general education with opportunities of students.

Keywords: cognitive activity, health-saving, working capacity.

ОРГАНИЗАЦИЯ ПОЗНАВАТЕЛЬНОЙ ДЕЯТЕЛЬНОСТИ МЛАДШИХ ШКОЛЬНИКОВ В КОНТЕКСТЕ ЗДОРОВЬЕСБЕРЕЖЕНИЯ

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Данная статья посвящена исследованию параметров внутренних и внешних ресурсов обучающихся задействованных в познавательной деятельности с точки зрения здоровьесбережения, осмыслению проблемы корреляции и гармонизации позитивного намерения общего образования с возможностями обучающихся.

Ключевые слова: познавательная деятельность, здоровьесбережение, работоспособность.

Nowadays, in the age of progressive technological development, readiness to work with the flow of information is becoming one of the most topical skills. The diversity of invaluable information accumulated by mankind is still being transformed into new knowledge. New scientific approaches to the study of the phenomena of the world around us and the process of cognition itself, including an interdisciplinary toolkit of mastering health-saving technologies in the field of cognitive activity, are emerging.

Based on modern tendencies in the development of scientific knowledge, the organizers of the educational process are faced with a huge number of problematic questions. One of them, from the point of view of health-saving, is the contradiction between the growing amount of information that should be mastered by a growing person in the system of general education and his cognitive resource, which depends on the factors of the educational environment aimed at preserving the health of the child at all stages of his education and development. Especially careful organization of the educational process requires fragile, in terms of mental, physical and emotional reserves, cognitive resources of primary school students. Teachers are entrusted with the mission of laying a solid foundation for a continuous learning process that will last for many years to come.

Problems of overwork, fatigue, exhaustion, overvoltage, overload, reduced capacity for work, etc. are now increasingly being discovered in the context of health-saving. There is a misalignment between the all-round pedagogical stimulation and intensification of cognitive activity of younger schoolchildren in the conditions of modern educational rhythm, and serious limited internal resources of students. The cognitive activity of students in the educational process means their conscious activity directed to the cognition of the surrounding reality through such mental processes as perception, mindset, memory, attention and speech.

It should be noted that increased cognitive activity is primarily initiated by adult participants in the educational process. However, it should be taken into account that cognitive development begins with the internal motives of the student in this type of activity. At the beginning of school education it is necessary to transform the internal natural need for cognition into a subtle art of study, which requires high performance from students. For this reason, in the period of primary school age, a special responsibility is placed on all adult subjects of the education system to maintain an interest in learning in unity with the high performance of students, which is impossible without preserving and maintaining the health of students.

At infringement of conditions of health-saving in the course of activization and intensification of cognitive activity, the students inevitably face the problem of "mental exhaustion" that naturally leads to decrease in working capacity of schoolchildren. The limits of resources of cognitive activity are determined by internal (biological, physiological, age) and external (sociocultural, pedagogical) factors. Let's consider some parameters of the boundaries of internal and external resources of students on the example of the model "Matryoshka" in conditions of maintaining health-saving working capacity of primary schoolchildren (see Figure). The marked boundaries of the model are characterized by flexibility and mutual penetrability, which implies the variability of scale and range of application of cognitive technologies both on the level of the educational system as a whole and on the individual level. mutual penetrability

"Matryoshka" in conditions of maintaining health-saving
working capacity of primary schoolchildren

The "starting point" of cognitive activity in the figure below is the student's inner motives, namely "**The necessity of knowledge and self-knowledge**". In understanding the cognitive need, we will rely on the definitions of G. Caccioppo and R. Petty. The cognitive need for knowledge is expressed in a person's desire to seek and engage in activities that require mental effort, as well as in situations involving cognitive effort [2]. In the context of health-saving without constructive and positive maintenance of this cognitive activity component, the educational process for the learner is transformed into a heavy, violent, oppressive planting of knowledge. This component of the scheme is associated not only with the emotional component, but also with existential-sense. Based on the above, it is obvious that without conscious cognitive intention, without pleasure and satisfaction of inner cognitive desire, "zeal" – fatigue and other negative consequences that fall within the competence of health-saving pedagogy will be manifested earlier and more intensively.

Next level is "**Mental process resource**". One of the grounds for revealing the boundaries and possibilities of mental processes is the characterization of the nervous system. According

to I. P. Pavlov, all activity of the nervous system is based on interaction, collision, and correlation of two nervous processes: excitation and inhibition [3]. The interactions of these nervous processes may have different character and determine three main properties of the nervous system: strength, mobility, and balance [4]. Complementing the understanding of the resources of mental cognitive processes (perception, feeling, attention, mindset, imagination, speech, and memory) will be a general structural-functional model of the brain developed by A. R. Luria. According to this model, the brain can be divided into three main blocks, which have their own structure and role in mental functioning: energy block; block of receiving, reprocessing and saving exteroceptive (external) information; block of programming, regulation and control over conscious mental activity [5].

In the private and specific understanding of limitations, the resources of mental cognitive processes can be described by the following examples:

1) The amount of attention for adults is equal to the capacity of short memory and is 7±2 items of information [6]. For younger schoolchildren it does not exceed 3-4 symbols [7];

2) At the beginning of the learning process, attention spans from 7 to 12 minutes [7];

3) The younger schoolboy easily estimates the size of a subject and can correlate it with other subjects in space. At the same time, both at preschool age and in grades 1-2 grades, children often still confuse such spatial categories as "right and left" [7].

4) When combining the resources of verbal short-term memory and verbal pronunciation, the resources of one system are used, which affects the productivity of the task performed (immediately after reading out loud, there are difficulties with paraphrasing the meaning of the text) [6].

The third level is "**Resources for Physical Development**". The boundaries of the somatic potential of this level are described in detail by the sciences involved in solving the problems of health preservation of school-age children. Namely: school hygiene (preventive medicine); valeology (regularities and mechanisms of formation, preservation and strengthening of health); pedagogy of health (formation of necessity of motivational sphere of personality for building personal strategy of health care); sanology (teaching about the way to health and recovery) [1].

The fourth level is "**Pedagogical Resources**". It is external and beyond personal influence, has clear and rigid boundaries. For example, the resource is temporal. Working capacity and time are in direct correlation. The following disciplinary aspects are disclosed here.

1. Timetable parameters. Start of classes and their replacement; the duration of the lesson; small and big changes; day and week load (distribution of subjects according to the difficulty of the lessons during one day and by days of week); annual load taking into account seasonal dynamics (decrease of working capacity in the second half of the year, at the end of the academic year) [1].

2. The alternation of the educational process and rest (violations in the regime of the day: reduced time of night sleep, walks, increased time spent on self-training – training sessions in the gymnasium, preparation of lessons, additional sessions exceed 10 hours per day) [1].

Summing up the above, it should be noted that the organization of cognitive activities of young schoolchildren in the context of health-saving is a task that requires an interdisciplinary approach both at the level of adult education subjects and at the level of public institutions. Careful and rational attitude towards cognitive activities from early childhood contributes to the training of citizens capable of realizing intellectual resources in various fields of science and technology.

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LIQUID-PROPELLANT ROCKET ENGINE PUMP TEST AUTOMATION

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The paper gives an overall view on the problem of accuracy increasing in the testing process of liquid propellant rocket engine pumps. The author gives suggestions for improving the test process by automation. The paper contains some basic theoretical concepts as well.

Keywords: rocket engine, pump, the testing process, automation.

АВТОМАТИЗАЦИЯ ПРОЦЕССА ИСПЫТАНИЙ НАСОСОВ ЖИДКОСТНЫХ РАКЕТНЫХ ДВИГАТЕЛЕЙ

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Приведено общее описание проблемы повышения точности проведения испытаний насосов жидкостных ракетных двигателей. Автор формирует предложения по совершенствованию процесса испытаний путем автоматизации. Также в статье приводятся основные теоретические положения.

Ключевые слова: ракетный двигатель, насос, процесс испытаний, автоматизация.

A rocket engine (RE) is an engine that creates reactive force to move an aircraft. The reactive force, called thrust, is the multiplication of the mass flow rate and the speed of a working fluid.

In the liquid propellant rocket engines the process of working fluid creation and its acceleration is caused by burning some specific amount of fuel and oxidizer at a specific rate. To provide the most efficient working process, the required amount of fuel and oxidizer should be delivered to the combustion chamber under very high pressure. In modern liquid-propellant rocket engines the process of making the high (up to 25 Mpa) pressure takes place in a turbo-pump.

The turbo-pump is a unit, combining a turbine, which converts the energy of hot gases to the mechanical energy of a rotating shaft and centrifugal pumps, which increase the pressure of components by consuming mechanical energy. Every centrifugal pump has four main characteristics: the pump head – the amount of energy a pump has given to 1 kg of liquid, the mass flow rate – the amount of liquid passing through the certain area, efficiency – the difference between the amount of energy that is consumed by a pump and the amount that goes into the stream of liquid in the form of pressure, the critical cavitation reserve – the amount of energy that prevents the growth of cavitation inside centrifugal pumps. The development and maintenance of all these parameters have critical importance for liquid-propellant rocket engine performance, even insignificant changing occurring out of limits of tolerances may cause engine shutdown that leads to

a rocket failure. To reduce the possibility of getting pumps which are not capable of providing correct parameters there are pump tests.

The pump test is a process of obtaining data, illustrating the capability of pumps to provide required values under conditions as much as possible close to real. There is a strong dependence between the accuracy of the data and the reliability of an engine, therefore the work of improving the test process is an important task.

In general, the results of tests are affected by different factors. To achieve the demanded accuracy we need to decrease the affection of the systematic error by eliminating its main sources: an instrumental error and a subjective error. An instrumental error occurs due to inaccuracy of measuring equipment. The subjective error occurs because of the significant probability for humans to make mistakes. Today the testing process is highly dependent on workers. Humans are responsible for controlling the process by operating with valves, regulators etc., obtaining data, by reading indications and handling the results, using analytical and graphical methods. All these things bring to a very high value of the subjective error and therefore the systematic error.

Considering the foregoing, to decrease the value of a systematic error, the role of a human should be as small as possible. To match this statement, the process of liquid-propellant rocket engine pumps testing should be automotive.

To accomplish the automation of tests there should be considered the system which consists of software part and hardware part.

The software part is a computer program. The basement for the program is an algorithm which is able to control the process of testing, obtaining and handling data.

The testing process has two separate parts. In the first part the pump head characteristic is being obtained. During the process the algorithm should maintain the rotating speed of a pump at a specific level, changing the mass flow ratio stepwise (around 7 steps) by operating an electric gate valve. To control the rotating speed the algorithm needs to receive the information about its instantaneous value, compare it with the correct one and produce the control impulse if needed. The duration of every step and the value of the mass flow ratio are regulated by standards for every case, therefore the program has to allow an operator to insert required data. The result of the first part is a graphic, illustrating how the pump head changes according to different values of the mass flow ratio.

Fig. 1. The pump head characteristic

In the second part of the testing process the cavitation characteristic is being obtained. The cavitation characteristic is the relation between the minimum permissible value of the pump head and the minimum input pressure. The obtaining of the cavitation characteristic includes the process of stepwise changing of the input pressure up to the point where the pump head is below the permissible level. To control the process the algorithm should be able to set the required value of input pressure and maintain it until the related value of the pump head is registered. The process continues up to the point where the pump head is too low. The values of input pressure are given in standards, therefore the program has to allow an operator to insert required data. The process of the minimum permissible pump head registration takes place by comparing the real value of the parameter and the value that is set according to standard. At the very moment the value of the pump head has dropped below required minimum the algorithm should register the value of input pressure

and stop the test. The result of the second part is a graphic, illustrating the relations between the pump head and the input pressure.

Fig. 2. Cavitation characteristic

The hardware part is a system of mass flow ratio sensors, pressure sensors, thermometers, electric valves, electric gate valves and electric engines with controlling units. Considering the specificity of the testing process, the most important data come from pressure sensors. To minimize the systematic error, the automatic system should use the most accurate data. Besides, the signal the sensors transmit, has to be in a form that is acceptable for a computer to work with.

There are the basic requirements for pressure sensors to be used:

– The output signal should be electrical. To provide the required accuracy, the signal should be as proportional as possible to the pressure changing. Considering the changing speed of pressure during a test, an analog signal is the most suitable for the purpose.

– Sensors should be resistant to vibration, water hammers, high pressure, be stable.

– The data from sensors should have the least possible measuring error.

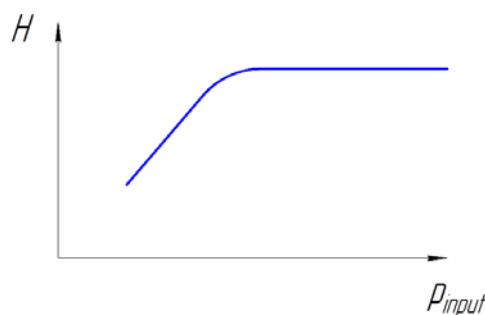The values, determining the measuring error are:

– Maximum measuring error, which is a difference between the actual characteristic and the ideal (completely repeating the pressure change).

– Non-linearity, which is a largest deviation of the actual characteristic and the ideal one.

– Hysteresis, which is the difference between the increasing and decreasing signals.

By comparing different types of pressure sensor technologies the most suitable type is piezoelectric sensors. This type of sensors has small maximum measuring error, fast response to the pressure changing. It is linear and very robust.

In conclusion it should be said that suggested technology of automotive liquid-propellant rocket engine pump test has the following advantages:

– The increasing of the result accuracy and, therefore, reliability of engines due to the decreasing of the systematic error in view of the subjective error exclusion and the accuracy growth of measuring equipment.

– The reduction of labor and time costs.

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GREEDY ALGORITHM IN COMBINATORIAL OPTIMIZATION TEST

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Combinatorial optimization is the problem of finding an optimal solution in a finite collection of feasible solutions, i. e., a solution that maximizes (or minimizes) an objective function under specified constraints. we study stochastic combinatorial optimization problems in a setting where any random variable can be tested (in the sense of observing its specific realization) prior to returning a feasible solution. Greedy algorithms always make the best choice in the current view. Greedy algorithm does not consider the overall optimization, and its choice is only the local optimization. Although greedy algorithm cannot get the global optimal solution for all problems, it can generate the global optimal solution for many problems. This paper gives two examples of greedy algorithms, such as knapsack problem.

Keywords: combinatorial optimization; greedy algorithm; knapsack problem; wobble sequence.

Most of the optimal solution problems can be divided into subproblems. The traversal of the solution space is regarded as the traversal of the subproblem tree, and the optimal solution can be obtained by traversing the whole tree in some form, which is not feasible in most cases. In some cases, even if the greedy algorithm cannot get the overall optimal solution, the final result is a good approximation of the optimal solution. We introduce two problems about greedy algorithm below 2.

Knapsack problem: there is a knapsack with a capacity of 35 pounds, and the following items are available.

Items, available, for a knapsack problem solving

Item	Weight	Price
Guitar	15	1500
Audio	30	3000
Laptop	20	2000
Display	29	2900
Pen	1	200

It is required to achieve the goal that the total value of the loaded backpack is the largest and the weight does not exceed.

It's easy to calculate so there are only three items. The actual situation may be thousands of them.

As above, the greedy algorithm is used. Because the total value is the largest, the most expensive one is loaded each time, and then the next most expensive one is loaded. The selection result is as follows [3]:

Choice: audio + pen, total value 3000 + 200 = 3200

Not the best solution: Guitar + laptop, total value 1500 + 2000 = 3500

Of course, sometimes the selection strategy is not very fixed, which may be as follows:

1) the value of each selection is the largest, and the final weight does not exceed:

choice: audio + pen, total value 3000 + 200 = 3200;

2) the largest weight is selected each time, and the final weight does not exceed (it may be preferred if the maximum weight is required):

choice: audio + pen, total value 3000 + 200 = 3200;

3) the highest unit value (price/ weight) is selected each time, and the final weight does not exceed:

choice: pen + display, total value 200 + 2999 = 3199.

The final result is not the optimal solution. In this case, greedy algorithm cannot get the optimal solution, only get the approximate optimal solution, which is one of the limitations of the algorithm.

Suppose an integer sequence, if the difference between two adjacent elements happens to be positive and negative alternately, then the sequence becomes a wobble sequence, and a sequence less than two elements is a wobble sequence directly. Give a random sequence, and find the length of the longest subsequence defined by the wobble sequence. For example:

Sequence [1, 7, 4, 9, 2, 5], difference of adjacent elements (6, − 3,5, − 7,3), this sequence is wobble sequence.

Sequence [1, 4, 7, 2, 5] difference (3,3, − 5,3) is not wobble sequence.

Thinking and analysis:

[1, 17, 5, 10, 13, 15, 10, 5, 16, 8], the whole sequence is not wobble sequence, but we observe the first six bits of the sequence: [1, 17, 5, 10, 13, 15]; 5, 10, 13 and 15 are ascending segments, among which three subsequences are wobble sequences: [1, 17, 5, 10, …]; [1, 17, 5, 13, …]; [1, 17, 5, 15, …].

When we don't know what the 7 of the original sequence is, we only look at the first six digits. The fourth digit of the wobble sub series selects a number from 10, 13 and 15. We should choose a number that makes the wobble sub series longer, so it should be 15. In this way, it is more likely to encounter a number smaller than others. According to this idea, we can summarize the law of greed.

When the sequence has a continuous increase (or decrease), in order to form a wobble sequence, we only need to keep this continuous increase (or decrease) of the first and last elements, which is more likely to make the latter element of the tail become the next element of the wobble sequence.

Element of a wobble sequence

Greedy algorithm and dynamic programming are essentially a pruning of the subproblem tree. Both algorithms require that the problem has a property of subproblem optimality (the solution of each subproblem that constitutes the optimal solution must be optimal for the subproblem itself)3. The dynamic programming method represents the general solution of this kind of problem. We construct the solution of the subproblem from the bottom to the top. For the root of each subtree, we find the value of each leaf below, and take the optimal value as its own value, and discard the other values. The greedy algorithm is a special case of the dynamic programming method. It can be proved that the root value of each subtree does not depend on the value of the leaf below, but only

on the current situation of the problem. In other words, you don't need to know all the subtrees of a node to find the value of that node. Because of this characteristic of greedy algorithm, it does not need to traverse the solution space tree from the bottom up, but only needs to start from the root, choose the optimal path, and go all the way to the end.

Starting from a certain initial solution of the problem, we can approach the given goal step by step to get a better solution as soon as possible. When a certain step in the algorithm can not be continued, the algorithm stops. The algorithm has problems:

There is no guarantee that the final solution is the best;

It cannot be used to find the maximum or minimum solution;

We can only find the range of feasible solutions that satisfy some constraints.

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FEATURES OF FORECASTING OF SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT OF THE REGION: FOREIGN AND DOMESTIC EXPERIENCE

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The article discusses the foreign and Russian experience in predicting scientific and technological development in the regions. The importance of the application of Foresight technology during the scientific and technological development of the region is noted. Examples of scientific and technological development in the subjects of the Russian Federation are given.

Keywords: Scientific and technological development of the region, foresight research, forecasting of scientific and technological development.

ОСОБЕННОСТИ ПРОГНОЗИРОВАНИЯ НАУЧНО-ТЕХНОЛОГИЧЕСКОГО РАЗВИТИЯ РЕГИОНА: ЗАРУБЕЖНЫЙ И ОТЕЧЕСТВЕННЫЙ ОПЫТ

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Рассмотрены зарубежный и Российский опыт прогнозирования научно-технологического развития в регионах. Отмечена важность применения технологии Форсайта при проведении научно-технологического развития региона. Приведены примеры проведения научно-технологического развития в субъектах РФ.

Ключевые слова: научно-технологическое развитие региона, форсайт-исследования, прогнозирование научно-технологического развития.

At the beginning of the XXI century, research in the field of scientific and technical forecasting began to revive in many European countries both nationally and at the European level. The technological Foresight was recognized as the most rational and effective form of conducting scientific and technological forecasting. Despite the existing differences in national approaches to conducting Foresight research, the general objectives for their implementation are as follows:

– assessment of the prospects of scientific and technological development in the economic and social context;

– assessment of the growth of a specific scientific and technical direction as well as;

– assessment of the existing prospects for technology and science.

It should be noted that today in the most developed countries of the world there is no single idea of Foresight, its single model. Each state interprets this term in accordance with its internal conditions and goals. Nevertheless, the most common and frequently used methods in all Foresight projects of the EU countries are: SWOT analysis, literature review, situation analysis, expert work and the so-called "brainstorming" [1; 2].

It should be considered that for Russia the concept of Foresight can be considered an innovation in views of the fact that here it was widely used only since 2005. Today, when Foresight research is one of the main tools of innovation policy in developed countries, this trend has begun to be traced in our country.

In the Russian Federation, the peak of interest in Foresight research falls on 2009. The largest of them are: forecast of scientific and technological development of the Russian Federation until 2025; forecast for the long-term scientific and technological development of the main sectors of the Russian economy for the period until 2030 [3].

As noted by V. P. Tretyak, N. V. Meshkova, V. A. Kozlov, in accordance with the current socio-economic level of development, the course towards modernization of the economy requires a special approach, previously not used in domestic practice that would allow determining areas where Russia could achieve a real socio-economic effect. Foresight research technology widely used today in the world has such capabilities.

It should be underlined that some elements of the use of Foresight were used in the USSR in the 1950s, in the defense industry. In the 1970s, the development of the "Comprehensive Program of Scientific and Technical Progress" was carried out. The Foresight elements are also used in the Strategic Research Center developed in 2000 by the Main Directions of the Socio-Economic Development of Russia until 2010. Next, we turn to specific examples of the use of Foresight technology when conducting scientific and technological forecasting in Russia.

On the initiative of the Ministry of Information Technologies and Communications of the Russian Federation the project called "Long-term technological forecast. Russian IT Foresight" was developed in 2006. The purpose of this project was to identify key priorities and prospects for the development of ICT in the Russian Federation for the next 10–15 years. During the implementation of the project, it was planned to organize an active, open dialogue during surveys, conferences, seminars and round tables. The project included several stages of implementation.

At the first stage, a quantitative survey method using special questionnaires was used. The experts were provided with a list of 74 technologies combined into 8 groups. Technologies were considered for such indicators as the forecast of the global market and technology volumes; temporary forecast of technology implementation (creation, development, and distribution) etc.

According to the results of the survey, analysis of quantitative research for each technological group, as well as SWOT analysis, discussions were held in the form of round tables. Thus, there was a formation of a consensus zone on the prospects of technology development. In total, 56 people took part in the round tables, most of which were representatives of business structures.

As a result of the study, such conclusions as were drawn:

– technologies for modeling and organizing content, technologies for conducting regulated processes on the Internet appear to be the highest priorities in the short and medium term development of Russia;

– the cooperation of the state, science and business, the development of human resources are the most important measures of state support for the development of the ICT sector;

– changes in the quality of life standards in the Russian Federation and the strengthening of the state's defense capability must be attributed to the positive consequences of the development of the industry;

– the prospect of Russia joining the top five countries in terms of ICT export and production volume is rather small [4].

In 2012, an attempt was made to form a regional Foresight in Bashkiria. The Republic became one of the first subjects of Russia to apply Foresight technology. The goal was the selection of scientific and technological priorities, the support of which will ensure sustainable economic growth and solve social problems in the medium and long term.

The task of the foresight project under consideration was the formation of a common vision of the prospects for innovative development among the main players that determine the socio-economic, scientific, technical and innovative policies of the region – representatives of executive authorities, business, science and education institutions, and industrial enterprises.

The procedure for selecting regional priorities for innovative development included the following methods:

– a survey of experts (to compile a list of the most important innovative products and services, the production of which can be launched over the next 10 years using domestic technological developments);

– conducting a SWOT analysis;

– critical technology method;

– focus groups (in order to reduce the number of regional priorities and develop measures aimed at their implementation).

As a result of Foresight, a list of priority areas for the development of science and technology was formulated and a list of critical technologies of the Republic of Bashkortostan was created.

The priority list includes seven areas of development of science, technology and technology: aviation and transport systems, living systems, the industry of nanosystems and materials, information and telecommunication systems, production systems, environmental management, energy and energy conservation [5]. The study showed that Bashkortostan has significant scientific, technological and innovative potential in all selected priority areas, which can be realized in the medium and long term [6].

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IDENTIFYING A REFRIGERATOR MODEL AND CHECKING
ITS COMPATIBILITY WITH A COMPRESSOR

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The aim of this project is to develop an installation checking the strength and durability of an object by constantly applying certain force and measuring pressure of this force according to the elasticity of an object.

Keywords: checking installation, strength of an object, durability of an object.

ИДЕНТИФИКАЦИЯ МОДЕЛИ ХОЛОДИЛЬНОГО ШКАФА И ПРОВЕРКА
ЕГО СОВМЕСТИМОСТИ С КОМПРЕССОРОМ

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Целью данного проекта является разработка установки, проверяющей прочность и износостойкость объекта путём регулярного приложения к нему определённой силы и зависимости проверки эластичности объекта от давления.

Ключевые слова: испытательный стенд, прочность объекта, износостойкость объекта.

The purpose of this work is to develop an installation for checking force on stocks of a product after mounting mechanical stops by arranging an alternating effort plus or minus 8 tons for moving motor blocks to predetermined swing angles [1].

The operating principle of the installation being developed:

Due to the creation of the alternating effort of 8 tons arranged by a numerical cylinder force checking is performed on the stocks with the help of an elastic element. For checking, the product is installed on the mounting ring on which the numerical cylinder is mounted.

The numerical cylinder consists of:

− Double-acting hydraulic cylinder which provides an effort for the rotation of an installed object (related to the axis of swing).

− Tensile compression force sensor. The signal from the sensor goes to the control system for motion regulation and visualization.

− The stem tip for the connection of the numerical cylinder to a product through an articulated bearing.

− The bracket of the numerical cylinder for the connection of the numerical cylinder to a product by using a spherical plain bearing.

The measuring module consists of:

− Angle sensor for measuring the main component of angular inclination.

− The flexible shaft for transmitting the rotation angle of a product boss to the angle sensor.

The hydro station is made to create the hydraulic pressure in the numerical cylinder.

The control cabinet consists of a controller [2] and other regulatory elements of the system's [3] parameters according to the signals received from the equipment.

Fig. 1. Installation construction

Fig. 2. Construction of a numerical cylinder

Conclusion. The described equipment can manage all the functions that it was supposed to make. With its help we can check the force that can be considered exceptional for the product that can guarantee product quality and its suitability to the system.

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INTRODUCTION TO NEURAL NETWORKS

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This paper discusses the introduction to neural networks. There is a historical background, review and analysis of modern solutions in the field of neural networks, namely, deep learning, semi-supervised learning and transfer learning.

Keywords: neural networks, deep learning, semi-supervised learning, transfer learning.

ВВЕДЕНИЕ В НЕЙРОННЫЕ СЕТИ

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Рассматривается исторический экскурс, а также обзор и анализ современных решений в области нейронных сетей, а именно, глубокое обучение, обучение с частичным привлечением учителя.

Ключевые слова: нейронные сети, глубокое обучение, обучение с частичным привлечением учителя, трансферное обучение.

For the first time, an artificial neural network, as a mathematical model of modern submission, was developed by F. Rosenblatt [1] in 1958. The research was based on scientific research of D. Hebb [22], W. McCulloch and W. Pitts [24]. Single-layer perceptron could only solve simple binary classification tasks but became the beginning of the popularity of artificial neural networks.

The information explosion and, therefore, recognition problem sophistication made progress of neural networks architecture complexity. There was a multilayer perceptron [3], self-organizing map [20; 22], Boltzmann machine [4; 21], feedback neural networks [22] and deep learning [23]. All those very different models were developed to solve more difficult various types of recognition problems like computer vision [25; 26], machine translation [27] or speech recognition but the results still were not impressive although these problems have not been solved with enough accuracy until nowadays [27].

In the middle of 2000th the research group with Yoshua Bengio, Geoffrey Hinton and Yann LeCun and the increase of computer performance gave a chance to develop more complex and powerful architectures of neural networks that are able to solve a wide range of tasks that could not be effectively solved before [4–9]. Efficiency in problem-solving has led to the use of deep learning almost everywhere in commercial and scientific recognition tasks [15–19].

But those methods have some challenges with their implementations. For example, there is a necessity for large scale training data sets. To make such a dataset is a high resource expense that

makes the cost of such datasets very expensive, for example [13] it is a very complex dataset for pain recognition, or there is a vanishing gradient problem [14; 15]. However, this domain is still popular nowadays [12].

The following milestone of the development of the neural network approach was to create ideas that could solve those problems. The tendency was to avoid the learning process of neural networks with a big amount of weights because of the complexity and duration of the process.

So, for example, GAN networks [31; 32], which operating principle is based on two antagonistic networks, one of which generates false samples, while the other tries to recognize false ones.

Another example is semi-supervised learning, which started in the 1960s. Many machine learning researchers have found that unmarked data, used in combination with a small amount of marked data, can significantly improve learning accuracy. That fact allowed renewing the popularity of semi-supervised learning [28–31].

Also, transfer learning is used to tackle a major problem: the unavailability of large sets of labeled data. by focusing on storing the knowledge gained from solving one problem and applying it to another, but the related problem [11, 33–34].

Thus, we could consider an evolution way of neural networks and the modern state in this field by using both classical and actual modern articles.

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EQUIPMENT FOR KNIFE BEATING OF FIBRE HIGH CONCENTRATION SEMI-PRODUCTS

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Different types of cellulose react differently to increasing slush concentration during beating process. A differentiated approach is therefore required to address the need for high concentration beating. This paper presents advantages and disadvantages of the equipment used for knife beating of fibrous semi-finished products in the papermaking.

Keywords: knife beating, fibrous semi-products, cellulose, high concentration beating, papermaking.

ОБОРУДОВАНИЕ ДЛЯ НОЖЕВОГО РАЗМОЛА ВОЛОКНИСТЫХ ПОЛУФАБРИКАТОВ ВЫСОКОЙ КОНЦЕНТРАЦИИ

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Установлено, что различные виды целлюлозы по разному реагируют на повышение концентрации массы при размоле. В связи с этим требуется дифференцированный подход к решению вопроса о необходимости применения размола при высокой концентрации. В данной работе представлены достоинства и недостатки оборудования используемого для ножевого размола волокнистых полуфабрикатов в целлюлозно-бумажной промышленности.

Ключевые слова: ножевой размол, волокнистые полуфабрикаты, целлюлоза, размол высокой концентрации, целлюлозно-бумажная промышленность.

In papermaking technology, the main role is played by the beating process of plant semi-finished products. For this purpose, paper mills use the following equipment: knife beating for fibrous semi-finished products as well as the equipment with knife-free operation on fibre. In the vast majority of cases, papermaking manufacturers use knife beating for this purpose. The main equipment for knife beating is a disk chipper and a jordan chipper. In recent years, there has been no consensus on the effectiveness of a jordan chipper and a disk chipper. However, due to the emergence of new products in papermaking (high-yield pulp, semi-chemical pulp) and groundwood production from chips, especially in wallboard production, it is impossible to avoid using a disk chipper. Such a large use of a disk chipper is due to a number of undeniable advantages of the disk chipper over the jordan chipper:

1. Lower specific power consumption due to lower hydraulic losses in the chipper, more uniform and higher slush quality.

2. Easier maintenance and repair.

3. Greater potential to increase the concentration in beating. As we will note below, the equipment has a favourable effect on most of the quality indicators of the finished product.

The use of a disk chipper is possible due to the rapid development of the production of semi-finished products of high yield. In the preparation of these semi-finished products, there is a need for mechanical splitting of the wood after chemical and thermochemical treatment first into strand fibers and then subsequent separation into separate fibers. For this treatment, rolls and jordan chipper proved unsuitable [1; 2].

At present, the disk chipper is also widely used for beating high-yield slush and semi-chemical pulp, but in contrast to low concentration slush (3–4 %) high concentration slush refining has its differences.

At low concentration during the beating process, the friction between the fibers is roughly equivalent to that of water and it is, therefore, insufficient to affect the properties of the fibers during the beating process. Thus, the main work should be done by beating surfaces. Since the water in the fiber suspension acts as a lubricant, the internal friction between the fibers must increase as the concentration increases, because the surfaces of the fibers can directly touch each other. As a result, a higher concentration leads to more uniform beating of slush with greater mechanical strength, and does not damage the fibers typically observed under low concentration beating of slush conditions [3; 4].

The Pulp Paper Industry Research Laboratory conducted studies related to high concentration refining fibrous materials. Interesting results were obtained by beating hardwood pulp. Tables 1 and 2 demonstrates a comparison of the mechanical strength properties of the pulp at a milling degree of $40°$SR with respect to the concentration of the pulp during grinding. It can be seen that as the concentration increases during beating from 6 to 30 %, the weight average length of the fiber constantly increases. The increase in freeness value during beating at high concentration is mainly due to the intensive internal and external fibrillation of the fibers, while at low concentration beating increases due to shortening of fibers. This is confirmed by the fact that the specific surface of the fibers during the beating process increases markedly with increasing concentration, so that the degree of water retention of the slush, as well as the value of the interfiber adhesion forces, increases, which is a clear advantage [4–6].

Table 1

Influence of slush concentration on properties paper pulp.

Concentration, %	6	30
Specific surface $\times 10^6$ cm^2/g	0,2	0,25
adhesion forces, kgf/mm^2	0,08	0,12
Degree of water retention, %	110	110
Breaking length, m	10000	7500
Weight average length of the fiber, dg	35	90

Together with the positive factors of the studies, the influence of certain factors on the beating process has not yet been investigated:

1. Design of a refiner bar of the disk chipper.

2. Rotation frequency of the disk chipper rotor.

The following were not fully taken into account:

1. Specific pressure in the beating process and change in slush pulp concentration.

2. Increase in slush temperature in the process of beating of slush.

To solve all these issues at the Department of Machines and Industrial Technologies at Reshetnev Siberian State University of Science and Technology, we developed a plant for high concentration slush refining.

Figure shows a scheme of a beating plant for high concentration slush refining. The beating plant consists of the following elements: beating zone *1*, containing two disks: one of which is

movable (rotor *2*), the second is a fixed stator *3*. Additive device *4* adjusts a gap between the rotor and stator knifes. Screw feeder *5* provides slush transfer to the beating zone. Rotation of rotor disk is performed by electric motor *6*. Slush is moved to the beating zone by screw feeder driven by electric motor *7* through worm reduction gear box *8*. Drive of disk chipper rotor and a screw feeder provide adjustment of their rotation speed by means of frequency converters. At the same time, driving the disk chipper rotor makes it possible to control power of drive of these elements.

Scheme of beating plant:
1 – beating zone; 2 – rotor; 3 – stator; 4 – additive device; 5 – screw feeder;
6 – electric motor of a rotor; 7 – electric motor of screw feeder drive;
8 – screw feeder drive worm reduction gear, 9 – container for slush pulp

In order to prevent heating of slush in the beating zone to a temperature above 50 ºC, a special device for slush cooling is provided.

Table 2

Technical characteristics of the beating plant

Diameter of disks, mm	200
Clearance between beating surfaces of discs, mm	0,1–1,5
Power of rotor rotation electric motor, kW	4
Rotor disk speed, RMP	500–2000
Power of screw feeder drive electric motor, kW	0,55
Gear ratio of worm reduction gear box	1:30
Screw feeder shaft speed, RPM	10–46
Concentration of the beating slush, %	1–15
Disc chipper productivity, m^3/h	7–15

We would also like to focus on the principle and operating procedure of the beating plant. Slush pulp of the required concentration from container 9 gets into the zone of screw feeder 5 by means of the latter, moves into zone of beating 1 of the disk chipper where the fibre material is directly beating. Adjustment of the gap between the rotor and stator knifes of the disk chipper is carried out due to axial movement of the stator disk using the mechanical additive device 4.

At the developed plant, we plan to carry out experimental studies affecting the main factors of the beating process, among which:
1. Change slush pulp concentration and rotor speed during beating;
2. Select optimal slush pulp feed mode via screw feeder;
3. Change specific pressure during beating;
4. Select a beating mill bar view

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УДК 674.81

INFLUENCE OF PRE-PRESSING MODES ON RESIDUAL DEFORMATIONS OF FIBER BOARDS

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This paper presents the results of experimental research aimed at studying the impact of cold pre-pressing on the stability of the shape of a wood-fiber board.

Keywords: thermal insulation boards, thermal conductivity, porosity, cold pre-pressing, strength.

ВЛИЯНИЕ РЕЖИМОВ ПОДПРЕССОВКИ НА ОСТАТОЧНЫЕ ДЕФОРМАЦИИ ВОЛОКНИСТЫХ ПЛИТ

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Приводятся результаты поисковых экспериментальных исследований, направленных на изучение влияния холодной подпрессовки на стабильность формы древесноволокнистой плиты.

Ключевые слова: теплоизоляционные плиты, теплопроводность, пористость, холодная подпрессовка, прочность.

Currently, the materials based on the environmentally safe natural components are of increasing interest. One of these materials is a heat-insulating fiberboard. The main raw material in production is technological chips [3]. Wood fiber boards are used in many industries, especially in construction. They are used for heat and sound insulation in wooden house construction. The main advantage of such plates is low thermal conductivity, high compressive strength and high vapor permeability.

Thermal conductivity is the main characteristic of the material's thermal protection properties. Low thermal conductivity is achieved by high porosity of the material. The uniform distribution of air pores in the material and their dimensions are important. The porosity of thermal insulation materials can reach 95 % [1]. However, we need to obtain the material with a structure with necessary physical and mechanical properties.

The strength of the structure is provided by the hydrogen bonds between the fibers and the adhesive that occur during the drying process. The energy of these bonds is small, so to give greater strength to the finished products, they are pre-pressed at the molding stage. To study these technological aspects, we conducted research aimed at exploring the impact of pre-pressing the plate on the size stability [2].

For the test, three samples were produced with a specified density of 125 kg/m^3 with a binder consumption of 40 %. Sample dimensions were 100×100×50.

When choosing the levels of variation in the amount of pressing force, we assumed that the pressure should not be excessive, since this leads to the increased absorption of the binder into the wood, which reduces the strength of the plates.

The results of the research are presented in Table.

Prepressing plates

Sample number	Pressure, MPa	Time (after removing the load), min	Thickness (before drying), mm	Thickness (after drying), mm	Δ, %
1	0,0838	5	45,23	49,63	8,86
2	0,0264	25	50,69	56,34	10,02
3	0,0342	3	51,62	58,56	11,85

As a result of the conducted research, we found that the thickness of the sample at number 1 after drying in the convective chamber had a minimum amount of compression, and samples of the material of the specified size were obtained, while the other two samples showed significant deformation. Therefore, we could propose to perform cold pre-pressing at the pressure of 0.08 MPa and with the duration of 5 minutes. This would prevent the material from decompressing in thickness and provide the necessary links between the fibers.

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THE EFFICIENCY INVESTIGATION OF GLOBAL SEARCH ALGORITHM AND ITS MODIFICATIONS

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The global search method can search the whole feasible set to find the minimum point. These methods only need to calculate the objective value of the function, and they do not need to derive the objective function. In some cases, the solutions generated by these methods can be used as "good" initial points of iterative methods such as gradient method and Newton method. But we are not satisfied with their efficiency, so we are looking for ways to optimize them.

Keywords: global search algorithm, efficiency, optimization, comparison, disadvantage.

First of all, it is necessary to understand several global search algorithms. Introduce two global search algorithms including differential evolution and particle swarm optimization as the examples.

The first one is differential evolution, also known as differential evolution algorithm and an efficient global optimization algorithm. It is a kind of evolutionary algorithm for solving optimization problems. It is an evolutionary algorithm based on real number coding.

Differential evolution algorithm is the fastest evolutionary algorithm. Its main idea is to select randomly the vector difference of two individuals from the population, and make the vector difference (Figure 1). The third random individual generates a new individual. A new individual is compared with the old individual in the corresponding population. If a new individual is better than an old individual, the new individual will replace the old one. If an old individual is better than a new individual, a new individual will be removed. Through constant comparison, an optimal solution is finally found [1].

Its main disadvantage is that with the increasing number of new individuals and the decreasing diversity of its population, it may converge to the local minima in advance, which may not meet the expectation, and make its performance worse in the evolution process.

In order to solve this problem, the optimization method is to improve its evolution mode and control parameters, or to use an algorithm together with other algorithms.

The second one is Particle Swarm Optimization (PSO) is a random search algorithm evolved by simulating the foraging behavior of birds [2]. A particle is used to simulate the above bird individuals. Each particle can be regarded as a search individual in the n-dimensional search space. The current position of the particle is a candidate solution to the corresponding optimization problem, and the flight process of the particle is the search process of the individual. The flight speed of the particle can be dynamically adjusted according to the historical optimal position of the particle and the historical optimal position of the population. The particle only has two attributes: speed and position. Speed represents the speed of movement, and position represents the direction of movement. The optimal solution that each particle searches individually is called individual extremum, and the optimal individual extremum in particle swarm is the current global optimal solution. Keep iterating to update speed and position. Finally, the optimal solution satisfying the termination condition is obtained (Figure 2).

PSO does not depend on the optimization problem itself. It has the advantages of prominence, evolution, memory and robustness. But PSO has some problems, such as premature convergence, dimension disaster, easy to fall into local extremum and so on. To solve these problems, we can adjust the parameters of PSO. For example, the acceleration coefficient is an important parameter, if we change this, maybe we can get a good result.
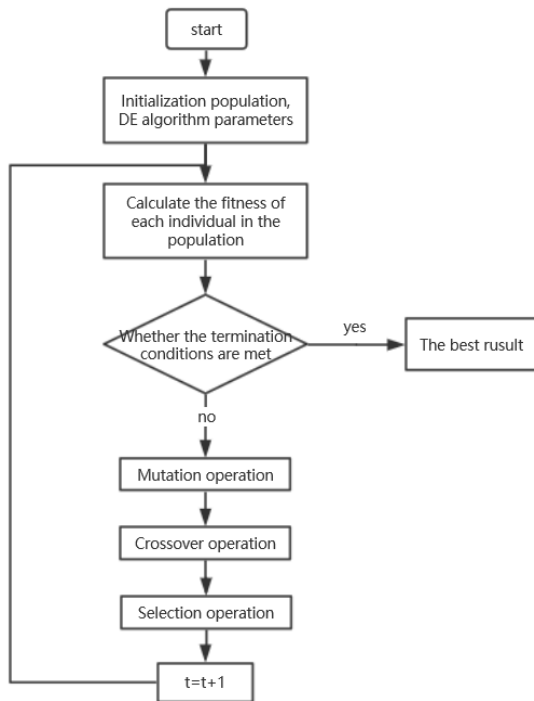

Fig. 1. Differential algorithm process

Fig. 2. Particle iteration diagram

So, the paper introduces two algorithms and methods for their modification. According to this paper, we have a preliminary understanding and optimization idea of the global search algorithm, which lays a good foundation for future research.

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УДК 336.64

PROJECT RISK ANALYSIS AND MODELING IN FINANCE

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The article considers finance as a very abstract definition because modern finance is the circulation of assets in the form of money or currency claims. The basic matter of finance is the operation of the capital market, the supply and pricing of capital assets. Due to that fact, it is connected with money. There could be a lot of project to take in generating the money. So, it is very important for us to analyze project risks.

Keywords: project risk, risk analysis, risk modeling, finance.

First of all, we consider risk analysis. It includes four parts [1]. They are as follows:

Risk Assessment. It could be core and basic.

To make a brief overview, risk analysis is an open and transparent process based on a scientific and structured approach. Risk assessment is necessary to quantify the possible degree of impact or loss caused by an event or thing. Risk assessment is the estimation of the threat, weakness, impact of information estimation from the point of view of the information security perspective [2].

Precautions and problems of risk assessment process.

Feasible approach to risk assessment. The risk assessment approaches are often used in practical work and it includes baseline assessment, detailed assessment and portfolio assessment.

General methods of risk assessment. They are risk factor analysis, fuzzy comprehensive evaluation method, internal control evaluation method, analytical review method, qualitative risk assessment method.

The second one is risk management.

Financial risk management refers to the practice of enterprises using financial instruments to manage the economic value of risk exposure: operational risk, credit risk and market risk, foreign exchange risk, shape risk, volatility risk, liquidity risk, inflation risk, business risk, legal risk, reputation risk, sector risk, etc [3].

How does risk management operate? One tends to consider of "risk" in predominantly negative terms. However, in the investment world, the risk is necessary and inseparable from the performance. Also, it is necessary to take into account the application and importance of risk management.

The third one is risk communication [4].

Here one should consider the definition of risk communication. It is defined as "the interaction of information and views among individuals, groups and institutions". It doesn't only transmit risk information, but it also includes the attention and response of all parties to risks.

Also, one should take into account basic objectives of risk communication, the process of risk mitigation and risk change.

There exist factors affecting risk communication. Risk communication from a separate perspective is carried out as a center. Through studying relevant factors, aiming at control points or ideal models, a scheme to improve the effect of risk communication is designed.

Also, it is necessary to overview basic strategies for risk communication [5].

Financial risk refers to the risks related to finance, such as financial market risk, financial product risk, financial institution risk, etc. The consequences of a financial institution's risks often

outweigh its own. The risks of financial institutions in the specific financial transactions may pose a threat to the survival of the financial institutions. They should be introduced in two important models in finance: mark to market portfolio theoretical models, such as JP Morgan's Credit Metrics and KMV's credit risk model based on Merton model and default mode models, such as CSFP's credit risk, model and Mc Kinsey's credit portfolio view portfolio method.

Credit risk, is also known as default risk; it refers to the possibility that the borrower, the securities issuer or the counter party is unwilling or unable to perform the conditions of the contract due to various reasons, which results in the loss of the bank, the investor or the counter party.

A Risk model simulates events that may occur in the real world. For project risk analysis, it is focused on events that can affect project objectives such as cost and schedule. The Project Risk Analysis Model (PRAM) uses Monte Carlo simulation to generate cost and schedule probability distributions from user input cost, schedule, risk and uncertainty information. It produces quantitative risk analysis outputs that provide actionable information to project managers and teams. The model runs thousands of simulations or "project realizations" that virtually execute the project under the influence of all input uncertainties and risks. For each realization some risks occur, some do not; some impacts are high and others are low. The output provides an estimated range of project cost and schedule outcomes. Few realizations reach the extreme limits of the distribution, most aggregate toward the middle.

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APPLICATION OF MONTE CARLO METHOD IN DEFINITE INTEGRAL

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Monte Carlo method is a widely used method to calculate the numerical solution of integrals. This paper uses a case analysis method to discuss the application of Monte Carlo method in integral calculation, and uses Matlab software to apply Monte Carlo method to the definite integral for example calculation. The analysis shows that the accuracy of the Monte Carlo method in the definite integral calculation depends only on the selection of the number of random simulations. The number of simulations gradually increases, the error gradually decreases, and the accuracy improves. The Monte Carlo method cannot guarantee the accuracy in the calculation of the fixed integral. Stability causes errors.

Keywords: Monte Carlo algorithm, error analysis, definite integral, stochastic simulation, Matlab software.

When there exist some complex definite integrals that cannot solve the original function, the calculation of definite integrals is difficult. In this case, Monte Carlo method provides a solution for similar integrals. The following calculations use Monte Carlo method to define integrals [1–3].

Calculation definite integral over interval $\int_0^1 f(x)dx$ and $0 \le f(x) \le 1$. Use computer uniformly distributed N for random numbers (x_i, y_i), $i = 1,2,...,N$, remember to satisfy the inequality $y_i \le f(x_i)$. Number of pairs μ_n, use frequency $\frac{\mu_n}{N}$ as points $\int_0^1 f(x)dx$ estimated value.

Calculate general definite integral $\int_a^b g(x)dx$: By using equation $y = \frac{x-a}{b-a}$. Make variable substitution into about y Integral of function between 0 and 1 $\int_a^b g(x)dx = (b-a)\int_0^1 g[a+(b-a)y]dy$. Further, if $c \le g(x) \le d$ change by function:

$$f(y) = \frac{g[a+(b-a)y]-c}{d-c}.$$

Make $0 \le f(y) \le 1$. Can be obtained:

$$\int_a^b g(x)dx = (b-a)(d-c)\int_0^1 f(y)dy + c(b-a).$$

Calculate using Monte Carlo $\int_0^1 f(y)dy$. And then get $\int_a^b g(x)dx$ Value.

Example 1. Calculate definite integral $\int_0^1 e^{-x^{\sin x}} dx$ (Matlab program calculates the integral value is 0.4549) solution $I_1 = \int_0^1 e^{-x^{\sin x}} dx$, $[0,1]$. Is the integration interval, and $e^{-x^{\sin x}}$ in $[0,1]$ Value between, remember k_1. To satisfy the inequality $y_i \le e^{-x^{\sin x}}$. Number-to-number. So $I_1 = \int_0^1 e^{-x^{\sin x}} dx \approx \frac{k_1}{N}$.

Number of simulations N. The value of the integral is worth the value of the integral, and the relationship between the integral value and the error is obtained.

Relationship between integral value and error

N	10^2	10^3	10^4	10^5	10^6
Integral value	0.4900	0.4480	0.4524	0.4545	0.4548
Error	7.7 %	1.5 %	0.5 %	0.09 %	0.02 %

Example 2. Calculating Definite Integral $\int_{-1}^{1} e^{2x} dx$. (Matlab program calculates the integral value is 3.6269) solution $I_2 = \int_{-1}^{1} e^{2x} dx$, $[-1,1]$. Is the integration interval, and e^{2x} in $[0, e^2]$. Value between, remember k_2. To satisfy the inequality $y_i \leq e^{-4+4x}$. Number-to-number. So

$$I_2 = \int_{-1}^{1} e^{2x} dx = (1+1))(e^2 - 0)\int_{0}^{1} e^{-4+4t} dt \approx 2e^2 \frac{k_2}{N}.$$

Number of simulations N. The value of the integral is worth the value of the integral, and the relationship between the integral value and the error is obtained.

Relationship between integral value and error

N	10^2	10^3	10^4	10^5	10^6
Integral value	4.1379	3.3694	3.6468	3.6132	3.6268
Error	14 %	7.1 %	0.5 %	0.4 %	0.0 %

According to Table 2 and Table 2, it can be obtained that the definite integrals with different given intervals above will change with the number of simulations. The value. N is different, the integration value is different, the number of simulations N The value of the value increases, the error between the integral value and the exact value gradually decreases, and the accuracy improves. For fixed integrals, the number of simulations N The value of is the key to the accuracy of the integration [4; 5].

By analyzing the definite integral example, we can get:

When the Monte Carlo method is used to calculate the definite integral, when the value of the random analog number is fixed, there is a certain error in the integral value obtained each time the computer runs the program, but the error is small, which can ensure the stability of the accuracy.

When the Monte Carlo method is used to calculate the definite integral, the value of the integral is different each time with the value of the number of simulations. When the value of the number of simulations is gradually increased, the error between the integral value and the precise value is gradually reduced increasing accuracy.

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УДК 004.02

EXPLORATION OF PARTICLE SWARM ALGORITHM IMPROVEMENT

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The paper considers the performance of the particle swarm optimization algorithm for quickly finding approximate solutions with better optimization features. At the same time, the shortcomings of being easily trapped in local optimums have also been discussed. Some advanced improvement methods have been proposed by famous scholars. The purpose of this article is to explore whether there exist any better ways to improve these improvements based on the known information.

Keywords: particle swarm optimization, swarm theory, global search, global search algorithm, optimization theory.

Particle swarm optimization algorithm is often applied by researchers for its fast search speed, high efficiency, and simple algorithm. At the same time, the shortcomings of standard PSO easily falling into local optimums have been explored by researchers. A lot of its modifications have been proposed [1; 2].

There are two main aspects:

1. Introduce various advanced theories to the PSO algorithm and study various improved PSO algorithms (such as chaos technology, neural network technology, adaptive technology).

2. Combine the PSO algorithm with other intelligent optimization algorithms to learn from each other and improve the performance of some aspects of the algorithm.

Here are a few examples of improvements in weight**s** [3**]**.

1. Consider PSO algorithm with linearly decreasing weight.

$$\omega = \omega_{max} - \frac{t*(\omega_{max} - \omega_{min})}{t_{max}}, \ \omega_{min} = 0.4, \ w_{max} = 0.9.$$

For functions: $f(x) = 100 \cdot (x_1^2 - x_2^2) + (1 - 2x_1 + x_1^2)$.

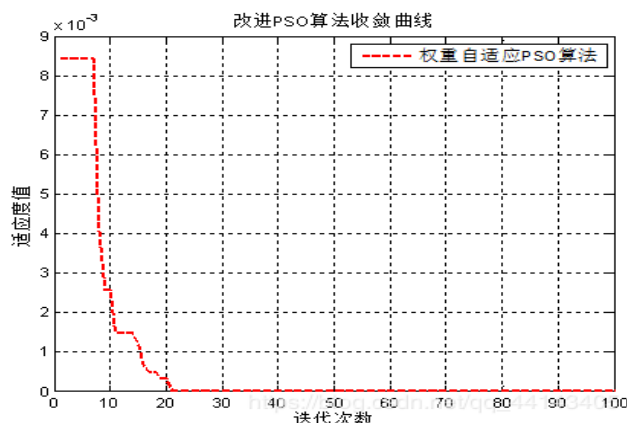
Fig. 1. Improved convergence curve 1

2. PSO algorithm with increasing shrinkage factor.

$$v_{i,j} = \varphi\{v_{i,j}(t) + c_1 r_1[p_{i,j} - x_{i,j}(t)] + c_2 r_2[p_{g,j} - x_{i,j}(t)]\},$$

$$C > 4, \quad C = c_1 + c_2, \quad \varphi = \frac{2}{|2\text{-}C\sqrt{C^2 - 4 \cdot C}|}.$$
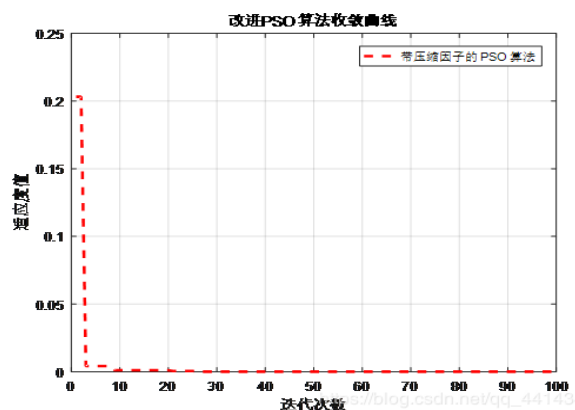

Fig. 2. Improved convergence curve 2

The compression factor is more effective in controlling and constraining the particle's flying speed than the inertia weight coefficient **w**, and it also enhances the local search ability of the algorithm [4].

In addition, there are many excellent optimization methods. Due to space limitations, these methods will not be described in this article.

The search performance of the PSO algorithm depends on the balance between its global search and local improvement capabilities, which largely depends on the parameter control of the algorithm, including N, $V_{\max}$, M, w, c_1, c_2, etc.

In addition, as the range and dimensions of variables increase, the search space expands geometrically, and the number of iterations increases accordingly. The more complex the optimization function, the larger the amount of calculation required and the more iterations.

The performance and efficiency of the algorithm are affected by the selected parameters, which is also a question worth optimizing. In practical applications, there is no universal method for selecting parameters, but only by experience. A large number of simulation experiments have found that the effect of parameters on the performance of the algorithm is regular.

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THE MULTI-TIME DISCLOSURE/ FOLDING MECHANICAL DEVICE OF A SOLAR BATTERY

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The paper presents the results of designing, manufacturing and testing the functioning of the mechanical device that solves such problems as placement and installation of a photo generating part on solar battery panels, fixing them on the body of spacecraft and their reusable transformation into the opening/ folded position with a given resource (if necessary).

Keywords: mechanical device, solar battery, space vehicle.

МЕХАНИЧЕСКОЕ УСТРОЙСТВО БАТАРЕИ СОЛНЕЧНОЙ МНОГОРАЗОВОГО РАСКРЫТИЯ/ СКЛАДЫВАНИЯ

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Представлены результаты проектирования, изготовления и испытания на функционирование механического устройства, решающего такие задачи как, размещение и монтаж фотогенерирующей части на панелях батареи солнечной, закрепление панелей на корпусе космического аппарата и многоразовая трансформация их в рабочее/сложенное положение при необходимости с заданным ресурсом.

Ключевые слова: механическое устройство, батарея солнечная, космический аппарат.

The mechanical devices of a solar battery are part of most spacecraft and it solves such problems as:
– placement and installation of a photo generating part on the panels of a solar battery;
– attachment of a solar battery to a spacecraft body;
– transformation of solar panels into a working position.
Today the tasks solved by spacecraft involve the use of single-acting devices, that means transferring solar panels from the transport position to the open one. The appearance of the promising projects of tugboats, tankers and other means of servicing spacecraft during the period of its active existence and necessity to change the orbit or any other similar operating conditions pose
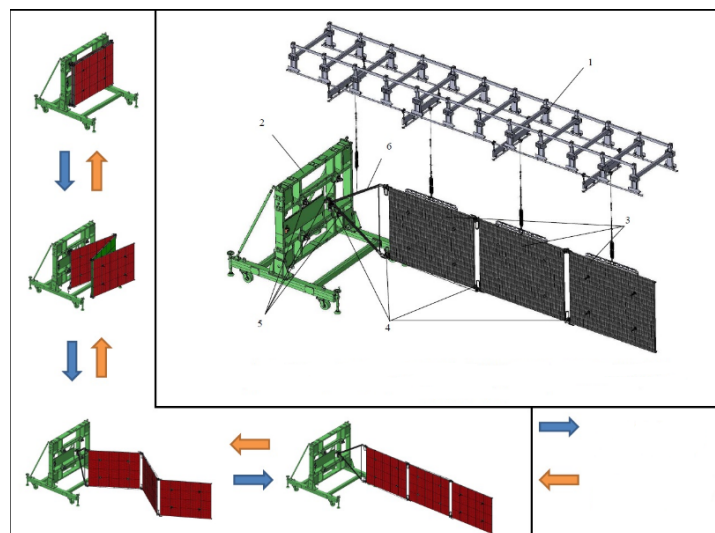
new requirements to spacecraft. One of these requirements is availability of the multi-time disclosure/folding mechanical device of a solar battery.

The task is to determine the promising design look of the multi-time disclosure/folding mechanical device of a solar battery.

The mechanical device has:

• solar battery panels (see Figure);

• rod (see Figure);

• mechanical fixation device on the spacecraft body (see Figure);

• disclosure/ folding mechanical device (root hinge, solar battery panels, electromechanical drive, synchronization system).

The panels and the rod are connected by the hinge. All the hinges are interconnected by a synchronization system. Each hinge has a spring actuator. It discloses and folds the mechanical device of a solar battery. The composition of the root hinge additionally includes an electromechanical drive, disclosing and folding mechanical device of a solar battery with the given speed due to the synchronization system. In the open position, the panels are held by the residual moment of the spring actuator and by the locking hooks installed in the corresponding hinges. In the transport position the panels are held by the locks. In the folded position they are held by the residual moment of the spring actuator, by the locking hooks installed in the root hinge and by the synchronization system.

General view of the mechanical device of reusable
disclosure/ folding and the logic of its functioning.

The multi-time disclosure/folding mechanical device of a solar battery solves the following technical problems:

− installing and fixing the deployment elements of a solar battery in the transport position at all stages of ground and standard operation until a signal is received for its release and disclosure;

− transferring the deployment elements of a solar battery wing from the transport position to the open position after receiving the signal for disclosure;

− transferring the deployment elements of a solar battery wing from the open position to the folded position after receiving the signal for folding;

− transferring the deployment elements of a solar battery wing from the folded position to the open position after receiving the signal for disclosure;

− keeping the deployment elements of a solar battery wing in the open position and ensuring the necessary dimensions, and stability during further operation for the entire design life;

− keeping the deployment elements of a solar battery wing in the folded position and ensuring the necessary dimensions, and stability during further operation for the entire design life.

During the operation, the mechanical device of a solar battery can take the following configurations:

− transport configuration: all the panels of the solar battery are folded and held on the spacecraft using a mechanical fixation device;

− opening configuration: all the panels of the solar battery are deployed and held on by the disclosure/ folding mechanical device;

− folded configuration: all the panels of the solar battery are folded and held on by the disclosure/ folding mechanical device.

The design of this construction was made on the basis of the technical requirements for the design and their analysis, namely:

− mechanical analysis;

− modal analysis;

− tension analysis;

− analysis of the dynamics of opening and folding;

− reliability analysis.

To confirm the functioning of the mechanical device of a solar battery, it was deployed/ folded using a weightless stand. As a result of the comparative analysis, it is revealed that at the moment the existing mechanical devices of a solar battery do not solve the problems of their multi-time disclosure and they are not suitable for providing this function in the given spacecraft operating conditions.

This article presents the mechanical device of a solar battery that solves such problems as placement and installation of the photogenerating part on the solar battery panels, fixing them on the body of spacecraft and their reusable transformation into the opening/ folded position if necessary, with a given resource. The implementation of the tasks allows specialists to use this design in advanced spacecraft.

At the moment, an application has been submitted and the patent for the invention has been received. The engineering model of this mechanical device is being manufactured and tested at JSC "ISS".

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