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У збірнику надруковано наукові праці Регіональної науково-практичної конференції молодих учених та студентів «Сучасні науково-технічні дослідження у контексті мовного простору», яка проводиться іноземними мовами 13–14 квітня 2017 року в Дніпровському національному університеті імені Олеся Гончара.

Для студентів, аспірантів, викладачів ВНЗів та наукових закладів.

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NEW ANALYTICAL SYSTEM FOR MONITORING
THE FLOCCULANT (PURO FLOCK 920) IN WATER

Nowadays flocculants are becoming increasingly popular in water cleaning. The methods of their control remain rather non-selective. Therefore, searching for analytical systems of monitoring the flocculants in water is important nowadays [1].

Spectrophotometrical investigation of properties of the polyelectrolyte PR 920 was carried out. Sulfophthalein dye bromophenol red (BFR) was used for preparation of the coloured system. The absorbance spectra of dye solutions changed in the presence of PR 920 (Fig. 1). Linear dependence of protolytic properties of BFR on the concentration of PF 920 was shown (Fig.2): at low concentrations we observe maximum alterations. In the acidic condition (pH 0,125) a rather wide range of concentration of polyelectrolyte was found (from $4 \cdot 10^{-7}$ to $4 \cdot 10^{-3}$ g/ml), in which linear alteration of optical density was observed at the wavelength $\lambda = 512$ nm (Fig. 3).
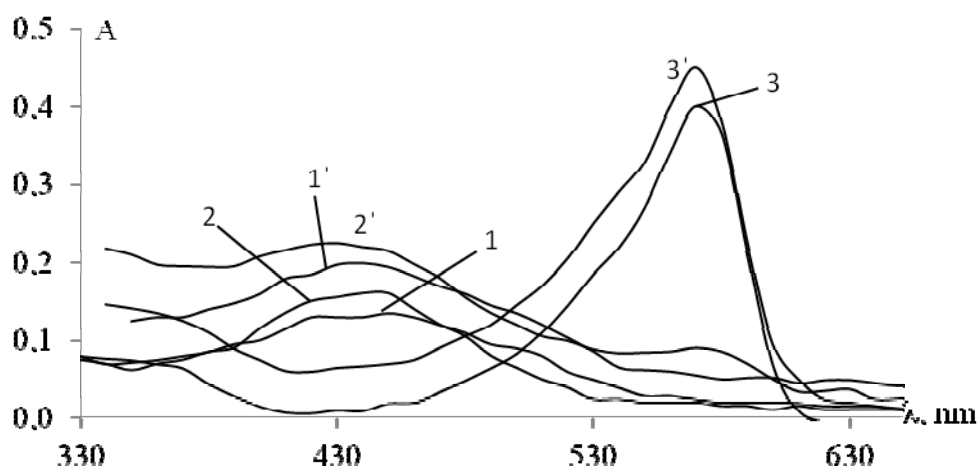
Fig. 1. Absorbance spectra of BFR solutions (1-3), solutions BFR-PF 920 (1'-3') by pH condition: pH=0,1 (1-1'); pH=4,1 (2-2'); pH=9,1 (3-3'). $C_{BFR}=2 \cdot 10^{-5}$ mol/l, $C_{PF920}=4 \cdot 10^{-5}$ g/ml, l=1 cm, SF-26
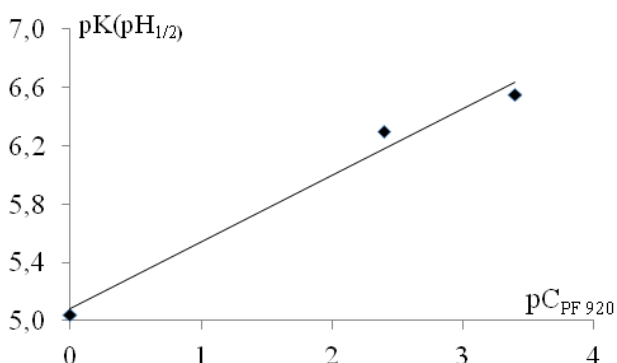
Fig. 2. Dependence of pK^{a} BFR (pH$_{1/2}$ in the presence of PF 920) on PF 920 concentration (g/ml), C$_{BFR}$ = 2·10^{-5} mol/l; l=1,0 cm; SF-26
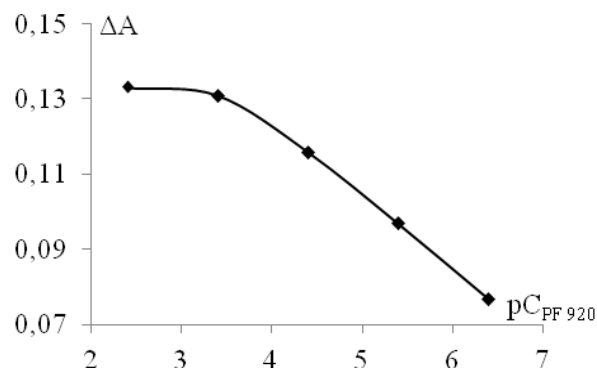
Fig. 3. Dependence of optical density of BFR-PF 920 solutions on the concentration of polyelectrolyte (g/ml), at λ=512 nm and pH 0,125; C$_{BFR}$ = 2·10^{-5} mol/l; l=1,0 cm; SF-26

Data correlation provided an opportunity to determine the concentration of PF 920 (4·10^{-4} g/ml), at which maximum alterations of spectral and protolytic properties of the dye are observed.

The new analytical system, which was created, can be used for monitoring the flocculant in water.

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THE EFFECT OF MICROWAVE RADIATION TREATMENT ON PHYSICO-CHEMICAL CHARACTERISTICS OF DIETARY FIBER

Food as a fundamental biological process and a basis of life is of great interest, due to a variety of reasons.

The scholars proved the importance of role of biopolymers that were previously named «Ballast»: nowadays they have the status of dietary fiber (DF), fulfilling not only nutritious, but also prophylactic functions. Although fiber does not carry essential

nutrients, its consumption is required for normal functioning of the gastro-intestinal tract and maintaining health in general.

The most important area of research is to enrich knowledge about the possible mechanism of action of microwave radiation (MR) in various substances, including natural polymers.

On the basis of previous scientific studies [1,2] we summarized information concerning physical and chemical processes, occurring under MR of different substances. It is shown that at present time there is no complete theory of elementary processes that lead to the emergence of a number of energy-intensive chemical and physicochemical effects, influenced by MR processing.

Studies have been conducted on DF properties, namely the ability to absorb and swelling.

We defined physicochemical characteristics (ability to absorb and swelling) of the fiber of various origins (pectin and psyllium) and its change under the influence of microwave treatment. It was shown that the kinetics of swelling of psyllium, which was previously processed by MR, significantly differs from the untreated polymer. It was found out that microwave processing reduces swelling from 18 min to 10 min and increases the degree of swelling. The interaction of pectin solutions with copper salts was investigated. We revealed changes in the complex formation of the above-mentioned polymers, treated by MR, namely, the appearance of absorption bonds at $\lambda = 400$ nm, which is characteristic of d-π transition between the central atom and Cu ligand.

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THE STUDY OF ECE–PROCESSES IN ELECTROCHEMISTRY

Electroanalytical methods are widely used in the analysis and physico-chemical studies [2]. They allow us to investigate complex multistage electrochemical reactions. Electrogravimetric method was the first method to use the masses of substances, formed on the electrodes. It was followed by polarography method. Polarography method has recently become popular. It helped to understand better the phenomena occuring during electrolysis at the interface phase «electrode-solution». The methods of research of electrochemical systems became potentiostatic, galvanostatic and kulonostatic methods.

ECE processes are electrode reactions with a three-stage mechanism: two electrochemical stages and a chemical one that separates them [4; 5]. The electrode process which is carried out according to the ECE-mechanism can be represented by the scheme:

$$Ox + n_1 e \leftrightarrow Red \rightarrow Ox' + n_2 e \leftrightarrow Red'$$
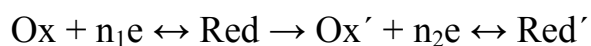
The substance Ox, present in the solution, accepts electrons from the electrode n_1. Thus, Red – the product of the first electrochemical stage – is formed, which gradually turns into Ox'. This chemical reaction is usually conducted with the participation of an additional substance. It may be a compound that forms a complex with Red. This reaction takes place at a speed characterized by the constant k and can be limiting for the whole process. The substance Ox', which is formed as a result of the chemical reaction, is further reduced accepting electrons from the electrode n_2. The products of the chemical stage (intermediates) are difficult to fix analytically. They exist during a short amount of time and are produced in small quantities.

The peculiarity of ECE-mechanism for the protein-film system was studied theoretically by the method of voltammetry. Theoretical rectangular volt-amperograms have different forms, depending on difference in energy between two stages of electron transfer, however, they also depend on the kinetics of the first and second

electron transfer, as well as on the speed of chemical reaction. Guidelines [3] present qualitative recognition of the surface of ECE-mechanism, along with its differences from the similar surface of redox systems. The reliable methods for assessment of kinetic parameters of the stages of electron transfer and the result of chemical reaction were proposed. The obtained theoretical results can be used in organic electrochemistry.

The system with ECE / DISP1-mechanism differs by the fact that its chemical stage is isomerization. It was studied by current-voltage simulation on half-hemispherical microelectrodes in the range of speed scanning and the support coefficient. The researchers [1] investigated a wide spectrum of rate constants of the intermediate chemical stage. In a certain range of rate constants significant differences of two mechanisms were observed. It was established that for intermediate values of rate constant of the chemical stage, the reducing current, appearing in ECE-mechanism, is decreased according to the amount of current in DISP1.

Further studies of ECE-processes are possible in such areas as quantum-chemical modeling, improvement of equipment in order to provide fixing of intermediates and the combination of electrochemical methods with modern techniques of nano research.

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DENUDATION AS A CAUSE OF EARTHQUAKES

The large quantity of major earthquakes happens in two seismic zones called Pacific and Mediterranean-Trans Asian. The Pacific region accounts for about 80 % of all earthquakes, the Mediterranean-Trans Asian is responsible for 15 %, other 5 % occur in the remaining seismic zones.

Scientists are studying earthquake precursors: water regime, deformation of crust, atmospheric conditions, changes in the properties of rocks and the geomagnetic fields, anomal behavior of animals.

Denudation is a process of appearance of collapses at the destruction of rocks by fluctuations in temperature, wind and water. Denudational earthquakes are caused by external factors which control the flow of solar heat. Denudation is less than 1 % of all earthquakes.

Denudational earthquakes usually occur in localities of composed limestone, gypse and other easy soluble rocks, in which caves of different sizes arise. With a significant growth of the caves, their ceiling collapses under the weight of the overlying layers. If the mass of the collapsed rock and the height of the collapse are larger, the thrust felt on the surface is stronger. Sometimes the first collapse is followed by another or even several, with intervals of several days. If the underground collapse reaches the surface, then the failure occurs, more often in a funnel-like shape.

The strength of landslide earthquakes exceeds about 5 points, rarely – 6–7 points in the epicenter, and it can lead to the appearance only in connection with the formation on the surface of landslides.

Here are the most significant denudational earthquakes:

1. In 1915 in the Volchansk area of the Kharkiv region the earthquake covered the area of up to 100 km in diameter. In Kharkiv, citizens felt the shaking of buildings, heard the sound of windowpanes, and the hanging lamps swayed. Doors opened in some houses.

2. In India, on December 11th, 1967, in the area of the Kojn Dam, an earthquake with a magnitude of 6.4 occurred, 177 people died. It was caused by the filling of the reservoir. A great deal of damage was in the near located town of Kojna-Nagar. The occurrence of strong induced earthquakes with magnitudes of about 6 is known in the construction of the Assuan dam in Egypt, the Kojn dam in India, the Caribbean in Rhodesia, and Lake Mead in the USA.

3. In 1974, from the slope of the Vikunaek Range, from about two kilometers, in the Peruvian Andes, nearly one and a half billion cubic meters of rock fell down into the valley of the Mantaro River and buried 400 people. The landslide with incredible force hit the bottom and the opposite slope of the valley, and seismic waves from this impact were recorded at a distance of almost 3000 kilometers. The seismic energy of the impact was equivalent to an earthquake with a magnitude greater than 5 by the Richter scale.

In the south-west of Germany and other places, which are rich in calcareous rocks, people sometimes feel weak fluctuations in the soil. They are caused by the fact that there are caves under the earth. The leaching of calcareous rocks by underground waters caused the formation of karsts and press of heavier rocks on formed voids, and they sometimes collapse causing earthquakes.

The core movements are unceasing transformation of the Earth's surface, and the consequences of these changes bring a lot of suffering for humankind. Scientists have gained enough knowledge about the causes of natural disasters and are studying their consequences carefully.

We want to believe that soon the Earth researchers will create the accurate method of prediction of natural disasters and earthquakes.

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THE SYSTEM CRISPR/cas9 – UNIVERSAL TOOL FOR GENETIC ENGINEERING

In 1993, the Spanish explorer Francisco Mohca found in the genome of the archaea *Haloferax mediterranei*, a repeating sequence separated by gaps. He called them CRISPR and continued to search for them in the genomes of other microbes. Until 2000 he found them in 20 microorganisms, also in *Yersinia pestis* and other pathogens. In 2002 there were opened CAS genes – the genes of CRISPR loci encoding proteins. In 2007, researchers led by Philippe Horvath confirmed CRISPR/cas adaptive immune system in the experiment with lytic infection of lactic acid bacteria *Streptococcus thermophilus* [1].

CRISPR/cas9, a new technology for editing genomes of higher organisms, is based on the adaptive acquired immunity of bacteria aimed at the destruction of foreign DNA. This system consists of particular sections of bacterial DNA – short palindrome repeats, regularly spaced groups (CRISPR regularly interspaced short terminating in short palindromic repeats). Between identical repeats are short sections of unique DNA spacers. Additionally, CRISPR-cassettes are close to CAS genes (CRISPR-associated genes). Protein products CAS genes have nuclease activity.

CRISPR locus contains unique fragments of foreign DNA (spacers) that are stored by the body after infection. In the case of re-invasion of this foreign DNA, with CRISPR locus is transcribed, the RNA molecule that is fragmented with complex protein CRISPR/cas system. RNA together with cas proteins to bind and cut the complementary sections of the foreign DNA (procaspases) [3].

The overall strategy for the use of CRISPR/cas9 in genetic engineering involves four basic stages:

• selection of target nucleotide sequences in the genome to make a gap;

• creation of nuclease design aimed at the selected target;

• delivery of this design in the cell nucleus;

• analysis of the mutations.

One of the most difficult steps is the selection of specific sites for making gap. Here it is necessary to avoid duplicate sites to cut DNA only at a particular place. For this you need to make a preliminary bioinformational analysis of DNA.

Today CRISPR/cas9 is used to edit the DNA of different organisms. The system is already used for modification of induced pluripotent stem cells (iPSC) and correction of their genetic material with the subsequent introduction of cells in human blood [2].

By means of CRISPR/cas9, researchers can generate a transgenic animal in one step, by injection of transgene, mRNA coding for cas9 and RNA in the zygote. Furthermore, injection of several RNA allows you to edit multiple genome sites. The technology was tested on all model organisms, including drosophila, axolotl, rats and large animals such as macaques, rabbits, sheep, goats and pigs.

Genome editing with CRISPR/cas9 is used for genetic changes in plants to obtain resistance to pathogens, herbicides etc. Thus, obtained genetic changes in plants of: wheat, rice, tobacco, sorghum and sweet orange. But when you create transgenic organisms with CRISPR, it becomes impossible to identify modified organisms and this is an ethical problem [4].

System for editing genomes CRISPR/cas9 provides humanity with enormous prospects in the creation of genetically modified organisms and gives hope for overcoming severe genetic and viral diseases. Although CRISPR/cas9 has a broad use in science, and today it has achieved considerable success, it has several disadvantages. Unfortunately, there is no answer to critical questions about bioethics and safety in the use of CRISPR/cas9.

American scientists were able to modify the system for genome editing CRISPR/cas9 for reducing the number of errors, but to say that it will not harm a person early [5].

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CORROSION OF METALS AND WAYS TO PREVENT IT

It is known that most metals are contained in ores not in pure form, but in various chemical compounds.

Corrosion is the destruction of metals and alloys due to chemical or electrochemical effects of the external environment. Metal sites that have undergone corrosion damage completely lose their mechanical properties.

Corrosion brings huge losses, its destructive effects is seen in everything that surrounds us; because of corrosion, machines, mechanisms, as well as various equipment, are damaged. Protection from corrosion and its prevention are both labor-intensive and costly measures.

When the metal is affected by gases, this process is also referred to chemical corrosion. Traces of it are visible on silver objects, which eventually become covered with a dark bloom. It happens due to interaction between silver and the sulfur compounds in the air: silver sulfide formed during this reaction is deposited on the top layer of the silver objects.

As the researchers state, electrochemical corrosion is the most common and harmful form of corrosion. Such corrosion is dangerous and unpredictable [1]. It can arise in one piece of metal, which consists of various compounds. At the same time on the surface of the material there are various galvanic structures, and water from rain, dew and steam becomes an electrolyte.

One of the ways to prevent corrosion is coating of metal products with paint and varnish materials. Varnishes and paints protect the metal from the effects of the environment and other metals, but this tool is not durable, as the paint is gradually destroyed, which requires a new coating [2].

One of the most common, ways of protection of metal structures from corrosion is fire protection. The surface of the metal is covered with a special composition or a heat insulating structure. Parts of metal structures are pretreated: they are cleaned from corrosion and soil contamination.

Galvanic method of metal protection is also widespread. With the help of this process many objects, products and mechanisms are effectively protected against corrosion. The parts of cars and silverware are processed in a galvanic way [3].

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DETERMINING PROPERTIES
OF THE FLOCCULANT PURO FLOCK 920

Working with flocculants requires information about their properties. One of the most important characteristics of the flocculants which have properties of polyelectrolytes is charge density in the polymer chain. Typically, along with increase in charge density, the flocking capability of flocculants also increases, thus reducing expenditure of polymers for water treatment.

Puro Flock 920 was titrated potentiometrically by the solutions of NaOH and HCl (Fig. 1).

The view of the curve (Fig. 1) shows that there are two types of major groups of polyampholyte. According to the results of titration (Fig. 1) we found out $pK^a = 4,25$, which corresponds to the dissociation constant of polyacrylamide, and $pK^a = 9,2 – 3$ for methyl vinylpyridine. The calculated isoelectric point is equal 6.725 [1].
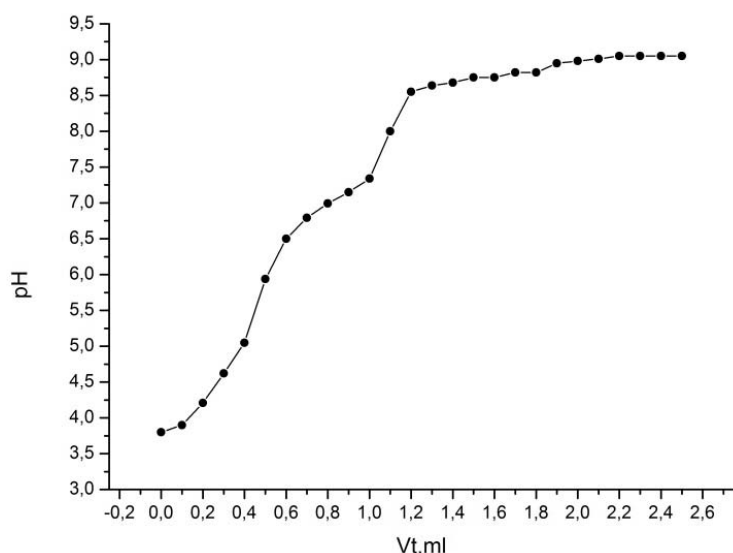
Fig. 1. Potentiometric titration curve of Puro Flock 920 (0.8 g) in the solution of NaOH (4,8 × 10⁻³ mol/l)

After solution extraction of the sample of Puro Flock 920, the titration results did not change, indicating that Puro Flock 920 is a copolymer of polyacrylamide with 3-methyl vinylpyridine [2].

The first equivalence point corresponds to the volume of 0.4 ml, and the second one – 0.7 ml. We have defined the molar mass of the first component of the polyelectrolyte $(100 \pm 4) \times 103$ g/mol and of the second one – $(60 \pm 4) \times 103$ g/mol.

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COMPLEX FORMATION OF Cu (II) CATIONS WITH ALBUMIN IN AQUATIC MEDIUM

Binding series of amino acids and albumin with metal cations in aqueous solutions can serve as a model of real biosystems, where metal atoms act in the composition of complexes with amino acids, proteins and other natural compounds [1]. These complexes ensure the normal course of biochemical processes, stimulate metabolism,

participate in blood formation, affect the growth, reproduction and heredity of organisms [2].

Serum albumin is the most important transport protein with the unique ability to bind ligands of different chemical nature. It is known that the chemical properties of protein largely depend on its structure. Depending on the pH of the medium, the conformation of serum albumin may vary. The most compact conformation corresponds to the isoelectric point of the protein (pH = 4.8), at which the number of positive and negative charges in the protein becomes the same. When the pH of the medium changes, unfolding of the protein globule can occur both partially and throughout all the macromolecule of albumin [3].

In the present work, the interaction of cuprum cations with human serum albumin in an aqueous solution as a function of pH in the model system Cu^{2+}-albumin-water was studied. The subject of the study was an aqueous solution of human serum albumin.

Varying the pH of the medium, which led to a change in the conformation of the protein molecule, the dependence of the degree of binding of the metal cation to albumin was studied. Solutions of albumin were given pH values in the range 3.5–7.5. This range of values was chosen on the basis that the formation of copper hydroxide occurs at high pH. It was experimentally established that the process of formation of protein-metal complexes takes no more than 120 minutes after mixing the solutions. The residual values of the metal cations in the mixture were determined with the atomic absorption method, also dependencies of the bound metal concentrations on the pH of the initial solution of albumin were obtained.

In the pH range 3.5–5.5, a gradual increase in the degree of binding was observed, which in the model system at pH = 5.5 was 90 %. It should be noted that at pH values slightly shifted to the alkaline region, relative to the isoelectric point, the protein molecule is more stable. Also, the protein molecule acquires a negative charge, which determines the maximum value of the degree of binding in the model system. At the further increase of pH, the degree of the metal-protein cation binding decreases, and at pH = 7.5 it is 70 %. It is known that depending on the pH of the medium,

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albumin can take several isomeric forms. With the results obtained it is seen that the conformational state of the peptide chain, due to which the potential attachment site can be opened or blocked, affects the amount of bound metal. Thus, it has been shown that binding of metal cations to a protein is affected not only by the ionization of amino and carboxyl groups of amino acids, but also by the conformation of the molecules of the biopolymer and the solvent.

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SPECTROPHOTOMETRIC DETERMINATION OF THIAMINE USING 18-MOLYBDODIPHOSPHATE HETEROPOLY COMPLEX

There are substances which are necessary for humans. Thiamine, also called Vitamin B_1, is one of the most common and, at the same time, one of the most important representatives of such compounds. The key role of this vitamin is the prevention of beriberi and neuralgia. Thiamine also helps the nervous system to function properly. According to the statement of modern scholars, it is an "anti-stress" vitamin because it strengthens the immune system, as well as improves the body's ability to withstand stressful conditions [1]. Obviously, it is essential to provide a simple, sensitive and selective method for spectrophotometric determination of this vitamin. The present study is dedicated to the development of such method.

The proposed method for thiamine determination is based on the oxidation of thiamine by 18-molybdodiphosphate heteropoly complex (18-MPC). Molybdenum heteropoly complexes with a Dawson structure are rather strong oxidants [2].
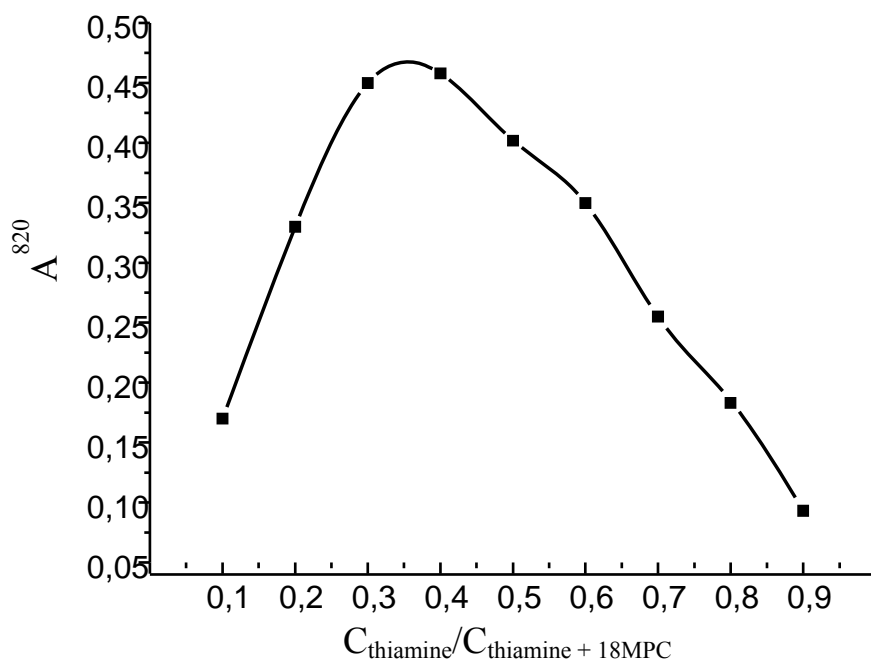
Fig. 1. Continuous variation plot for the reaction of 18-MPC with thiamine

Due to this key feature, the above-mentioned compounds are very perspective reagents for chemical analysis, which provides a fruitful area for investigations.

It was found out that even small concentrations of thiamine can be determined with the proposed method. Optimal conditions for the reaction were specified in which maximum and constant absorbance is obtained. The reaction between 18-MPC and thiamine proceeds completely only at a high concentration of the reagent. 6.4×10^4 mol/L concentration of 18-MPC was chosen as optimal because in these conditions constant and maximum absorbance was achieved. No less than 5 minutes is necessary to finish the reaction. Stoichiometric ratio in the reaction between 18-MPC and thiamine was determined by the method of continuous variation (Job`s method). As we can see from the figure, the ratio of thiamine and 18-MPC is equal approximately to 1 : 2. Hence, 1 mole of thiamine is capable of reducing 2 mol of 18-MPC.

The interference of other B-vitamins (such as B_2, B_6, B_{12}) was studied. It was stated that even a large excess of the vitamins of B-group does not have influence on

the measured absorbance. The developed method was successfully applied to the determination of thiamine in various pharmaceutical compounds.

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EFFECT OF PH ON CATION BINDING WITH PROTEINS IN AQUEOUS MEDIUM

While cleaning household and industrial waste water, proteins of different nature are used as bioconcentrators, characterized by a high binding capacity.

It is know that nickel ions in aqueous solution are complexing agents and link anions of amino acids with non-toxic stable complexes [1].

Complex formation between nickel and albumin is particularly interesting, because albumin consists of several ligand group.

Coordination formations with Ni (II) from nitrogen-containing groups (Arg, His, Lys) and the acidity of the medium are of particular importance, because protonated aminogroupes are not ligands.

It should be noted that the ability to bind the metal is provided by binding site structure, in particular, by the totality of steric and conformational factors of the protein molecule.

It is well-know that the albumin molecules can easily be subjected to more than one pH-dependent conformational changes.

We can assume that such transitions lead to the disclosure of cross-domain regions and changes in binding sites. PH-dependent conformational changes of albumin will affect nickel cations with protein molecules binding.

The object of our study was model systems comprising an aqueous solution of albumin and Ni (II) cations.

Determinatoin of the residual content of nickel was carried out on the atomic absorption spectrophotometer C- 115 PKS.

It is known that metal ion (Ni^{2+}) in the active center can act as an electrophilic water activator – hydroxyl ion generator, whose reactivity is significantly higher than that of water.

By lowering the pH of protonation, the metal ions compete effectively for the water molecule and the water molecule is removed from the complex by acido ligands, with increasing pH in the system another potential donor appears – OH^- ion.

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THEORETICAL STUDY OF UV-Vis ABSORPTION SPECTRUM OF ASTRA PHLOXINE

Polymethine dyes are extensively used as spectral sensitizers in photographic materials, as probes for biological systems, laser materials etc. In chemical analysis their use as countercations in ion association complexes with anionic species is well known. Synthetic organic dyes are traditionally studied using analytical-separation methods, such as high-performance liquid chromatography [1] and pyrolysis-gas chromatography/mass spectrometry [2].

One of the most often used representatives of polymethine dyes is Astra Phloxine, due to its excellent thermal, chemical and photochemical stability, high molar absorption coefficients, high fluorescence quantum yields and good solubility.

Over the last few decades, quantum chemical calculations of molecular spectra have become a fruitful area of investigation. In our research we presented the results of quantum-chemical simulation of Astra Phloxine UV-Vis absorption spectra at the level of time-dependent density functional theory. It was shown that among the applied functionals (CAM-B3LYP, WB97XD, M11, M06 and PBE1PBE), the absorption spectrum of Astra Phloxine is best simulated at PBE1PBE level. The vibrationally resolved electronic spectrum was simulated within the Franck-Condon approximation [3; 4] (see Fig. 1).
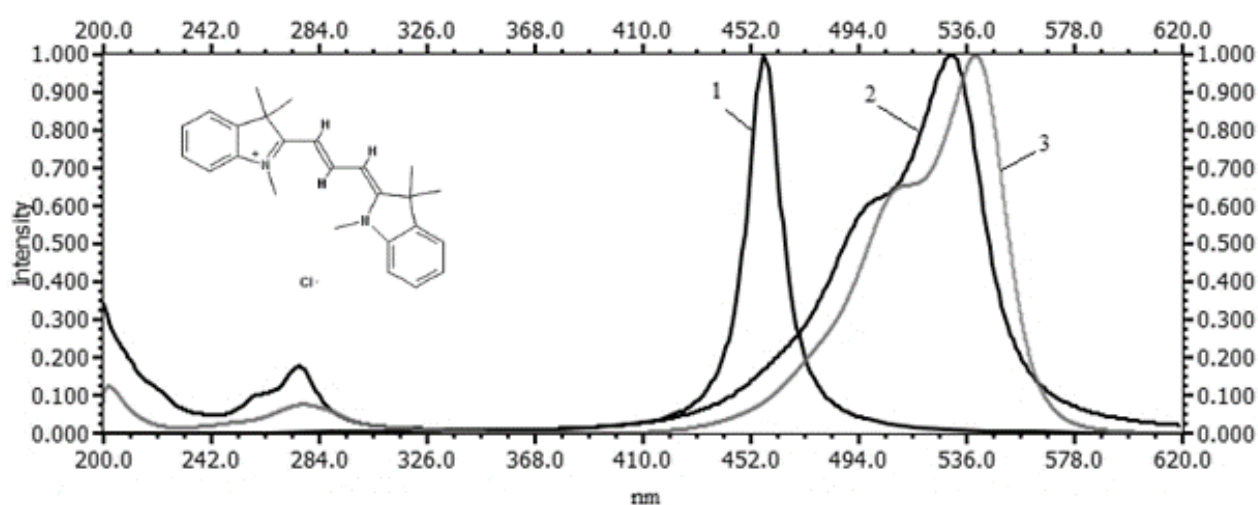
Fig. 1. Absorption spectra of Astra Phloxine:
1 – spectrum, simulated at SMD-TD-PBE1PBE/6-311++G(d,p) level of theory, 2 – harmonic vibration band for long-wavelength excitation, calculated at SMD-TD-PBE1PBE/6-31+G(d), 3 – experimental spectrum

The comparison of simulated and experimental spectra reveals the necessity of taking into account solvent effects and vibrational character of long-wavelength excitation.

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18-MOLYBDODIPHOSPHATE AND
17-BISMUTH MOLYBDODIPHOSPHATE AS ANALYTICAL REAGENTS
FOR SPECTROPHOTOMETRIC DETERMINATION OF ASCORBIC ACID

Heteropoly complexes (HPC) with Dawson structure have been used for more than 100 years as analytical reagents for the spectrophotometric determination of different reducing agents (ascorbic acid, phenolic compounds, amino acids, catecholamines, epinephrine, thiamine etc.). As a result of the reduction reaction of oxidized (yellow) form of HPC by reducing agents, intensely colored compounds – heteropoly blues (HPB) are formed. The content of substances, present in the sample, is determined according to the intensity of coloring of HPB at a wavelength which corresponds to the maximum absorption. The spectrophotometric methods which are based on the usage of HPC with Dawson structure are characterized by simplicity of implementation, low cost, and they do not require expensive equipment or special skills of the chemist-analyst.

Recently, we have proposed a new perspective analytical reagent – 18-molybdo-diphosphate (18-MDC), which can be used in a wide range of pH 2-10. It is quite convenient when it is necessary to analyze a mixture of substances, containing two reducing agents with different capacity. The example is the method of determination of ascorbic acid (Asc) and polyphenols (PC), which are present simultaneously in plant samples. The essence of this method implies that at pH 3-4 (acetate buffer solution) the content of Asc is determined, further the cumulative amount of PC and Asc is determined at pH 9.5 (borate buffer solution). The content of PC is found from the difference in values, obtained during two experiments. The main disadvantage of this method is that the speed of the reaction is not high enough. Thus, a full reduction of 18-MDC by Asc requires around 15 minutes, while the reaction with PC may take more than 1 hour.

It is possible to reduce significantly the time of Asc oxidation reaction if we add a twofold excess of $Bi(NO_3)_2$ to aqueous solution of 18-MDC. The result is a new

HPC with Dawson structure – 17-bismuth molybdodiphosphate (17-BiMDC) which is reduced by Asc under optimal values of pH 1.2-2.0 during 5 minutes. The usage of 17-BiMDC as an analytical reagent for determination of different types of reducing agents is limited by the fact that, firstly, at the increase in pH in the solution low-solubility hydroxyl complexes of bismuth (III) are formed and, secondly, in highly acidic media HPC hydrolyze much faster.

It is known that if 18-MDC and 17-BiMDC are used, such compounds as sugars, amino acids, phenolic compounds and sodium bisulfite do not prevent from determination of Asc. There are no data concerning interfering influence of oxyacids and anthocyanins, which are present in plant samples in large amounts. Therefore, we conducted a research to clarify the impact of amber, citrate, oxalate and tartaric acids and anthocyanins on the determination of Asc with 18-MDC and 17-BiMDC. Based on these data, we made conclusions that can serve as a recommendation for selecting an analytical reagent for determination of Asc by spectrophotometric method.

The impact of oxyacids on the stability of oxidized (yellow) form of 18-MCD and 17-BiMCD was investigated on model solutions. We found out that presence of oxyacids results in partial decomposition of HPC with the formation of complexes with molybdenum (VI). Also it was proved that oxyacids do not prevent from determination of Asc with 17-BiMDC in model solutions with final volume 25 ml, which, apart from Asc, also contained 0.48 mg of citrate, 0.35 mg of succinic, 23 mg of oxalate and 38 mg of tartaric acids. The view of calibration curve in the concentration range of Asc 4-32 mmol / L, which was formed without oxyacids and within their presence ($\lambda = 720$ nm, $\tau = 5$ min), does not change. With the further increase in concentration of oxyacids in model solution, the reducing reaction of 17-BiMDC by Asc slows down. Therefore, the time of reaction should be increased up to 10-15 min.

The impact of oxyacids on the results of determination of Asc with 18-MDC was also tested on model solutions with final volume 25 ml, which, apart from Asc, also contained 3.8 mg of citrate, 3 mg of tartaric, 1.5 mg of amber and 0.5 mg of oxalic acids. Under the optimal conditions, the calibration curve for determination of Asc, as well as Asc in the presence of oxyacids ($\lambda = 820$ nm, $\tau = 15$ min), was

formed. We determined that the calibration curves without oxyacids and within their presence in the concentration range of Asc 16-32 mmol / L are the same, but at the lower concentrations of Asc 4-12 mmol / L the presence of oxyacids results in decrease of absorbance of HPB. For clarification of the reasons for such behavior of the system, we recorded the spectra of absorbance of HPB, which were obtained as a result of interaction of Asc with 18-MDC at the ratio of 18-MDC:Asc = 50:1 and 6:1 in the absence of oxyacids and in their presence. When the ratio of the components of 18-MDC and Asc is 6:1, the spectra of absorbance of HPB have a distinct maximum at 820 nm, which corresponds to the formation of two-electron HPB. In the spectra of light absorption of HPB with the ratio 18-MDC:Asc = 50:1, the maximum is shifted bathochromically to 1000 nm towards the formation of one-electron HPB. The presence of oxyacids in both cases does not change the type of spectra of light absorption.

It is known that the reaction rate is influenced by the concentrations of Asc, as well as of 18-MDC. The presence of oxyacids reduces the overall reaction rate to a greater extent – thus, 15 minutes is not enough to complete the formation of HPB. We found out that 30 minutes is enough to finish the reaction for the entire range of concentration of Asc.

For plant samples having their own intense coloring, the impact of matrix of the analyzed sample was investigated using the addition method. We found out that the amount of oxyacids, contained in plants, does not alter significantly the results of determination of Asc.

Table 1. Comparison of the content of Asc, obtained using 18-MDC and 17-BiMDC, with reference data

Plant sample	Content of ascorbic acid		
	Reference, mg AA / 100 g of berries	experimental data mg Asc / 100 ml of juice	
		18-MDC	17-BiMDC
Black currant	100 [1]	55,1±9,9	49,3±1,7
Red currant	50 [1]	18,1±2,9	20,9±1,8
Cornelian cherry	60 [2]	15,0±0,4	63,0±3,0
Viburnum	80[3]	21,3±1,7	14,4±3,5

The proposed methods for determination of Asc were tested on fresh juices from frozen berries of cornelian cherry, viburnum, red currant, as well as on the commercial juice of black currant. The results of determination of Asc in plant samples, using

18-MDC and 17-BiMDC, as well as literary data on the content of Asc in fresh berries, obtained by chromatographic methods, are shown in the table. In most cases the results of determination of Asc, which were obtained using 18-MDC and 17-BiMDC, are similar, but as compared to the reference data, the values are lower. Primarily, it is due to the fact that the content of Asc in a certain plant sample is not a constant value and may change depending on the type, place of plant growth, the period of ripening in which the berries were gathered, as well as on the time of storage.

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ELECTRODEPOSITION OF DISPERSED TIN WITH ADDITIONS OF TITANIUM COMPOUNDS FROM ALKALINE ELECTROLYTE

Modern perspective materials, based on valve metals and their oxides, can be used, in particular, for the manufacture of gas sensors, fuel cells, catalytically active anodes and corrosion resistant coatings [1, p. 53–55]. Electrochemical methods of obtaining such composites are cost-saving, environmentally safe, and they allow us to control the composition of the material by changing the mode of electrolysis. A mixture of tin and titanium oxides is a representative of the described group of materials and can be used in all the above-mentioned areas, being available and non-toxic.

Earlier we implemented electrochemical incorporation of titanium compounds directly into the amount of tin sediment by introducing metatitanate potassium into the alkaline electrolyte tinning [2]. The aim of the previous studies was to obtain smooth coatings with good adhesion to the substrate.

The main aim of the present work was obtaining porous or powdered Sn-Ti materials, which can be used as additive to corrosion protection pastes or as component of alloys used as active bases for catalytically active electrodes.

The optimal conditions for obtaining porous sediments, which can be easily detached from the substrate, are the following: electrolyte temperature – 20 ° C, current density – 2÷5 mA/cm^2, additive concentration – 1÷2 mmol/l. The titanium content in the coating was determined spectrophotometrically. It was 1.7–2.1 %, which is up to two times higher than the maximum values specified for the smooth surfaces. The conducted tests showed high protective ability of the pastes produced on the basis of the obtained powder.

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SPECTROPHOTOMETRIC DETERMINATION OF MERCURY(II) AND CADMIUM(II) AS A IODIDE COMPLEX WITH ASTRAPHLOXINE AND RHODAMINE 6G

Ionic associates (IA) of anionic complexes with organic or inorganic ligands and dye cations are widely used for spectrophotometer determination of a number of substances. One of challenges in these procedures is the calculation of absorption spectra of excess dye. The most common case is when the unreacted dye was extracted. Sometimes changes in the dye absorption spectra, which occur during the formation of IA, are considered. For solubilization of the precipitate, such reactions

are carried out usually in the presence of surface-active compounds [1$ 2]. We have shown that under certain conditions the use of surfactants can be avoided. In this case specific stable IA are formed, and their color is much more intense than the colour of those in which IA were used.

a)   b)
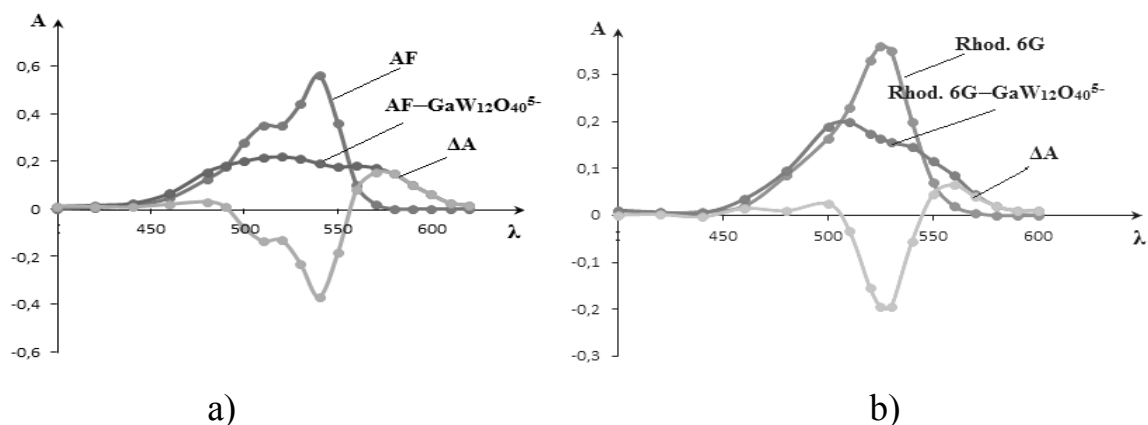
Fig. 1. Absorption spectra of IA 12–tungstogallate with astraphloxine (a) and rhodamine 6G (b).
$C_{12\text{-VGD}} = 4 \cdot 10^{-5}$ M, $C_{AF} = 4 \cdot 10^{-6}$ M, $C_{Rhod.\ 6G} = 4 \cdot 10^{-6}$M, $\ell = 0,5$ sm

In order to justify the choice of the dye, we have previously investigated the interaction of heteropolyanion (HPA) with representatives of the major classes of cationic dyes, such as triphenylmethane, polymethine, rhodamine, triazine, azo dyes. IA spectra, obtained in a sufficiently large excess of the HPA, were measured, which made possible to obtain IA spectrum without additions of dye spectrum. In all studied systems spectral changes of one type were observed. In IA spectrum two new bands appear to be shifted batho- and hypsochromically to the original dye strip. Accordingly, the spectrum of deviation from additivity has two peaks. Generally, the maximum in this spectrum is shifted bathochromically and has a much higher intensity. Absorption in this area can be used for development of analytical methods for determining HPA or other anions.

For further investigation, as the main systems we chose astraphloxine (AF) as a cationic dye and anionic halide complexes which include Hg(II) and Cd(II). The peculiarity of such systems is that the control experiment has less absorption in the system Hg(II)–Buffer solution–AF. For example, with analytical wavelength for

rhodamine $\lambda_{\text{analyt}}\ \varepsilon_{Rod.6G}$ = 3863 (572 nm), and 988 (602 nm) mol⁻¹·L·sm⁻¹. Also, the necessary excess of the dye for the complete formation of IA is much less for astraphloxine than for rhodamine. This results in a lower light absorption value of the control experiment. Molar light absorption coefficients were calculated for a wavelength corresponding to the maximum deviation from additivity and were estimated as $8,3\cdot10^4$ mol⁻¹·L·sm⁻¹ and $7,0\cdot10^4$ mol⁻¹·L·sm⁻¹ for Hg(II) with AF and rhodamine 6G, respectively.

The same changes occur in the system with Cd (II). It was found out that the solutions of IA AF with $[CdJ_4]^{2-}$ и $[HgJ_4]^{2-}$ are aggregatively stable at concentrations of Hg(II) and cadmium(II) less than 10^{-6} mol/L. The quantitative formation of IA for the Hg(II)–Buffer solution–AF system is observed when using 5 ml of phthalate buffer solution and $6\cdot10^{-6}$ mol/L AF. For the Cd(II)–KI–AF system, the concentration of potassium iodide was $5\cdot10^{-2}$ mol/L, and $4\cdot10^{-6}$ mol/L for AF.

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THE LICHEN INDICATION MAPPING OF GURIVSKY FORESTRY

In the conditions of the air pollution by the sulfur dioxide, the lichens complexes are characterized by the decrease in species composition, projective cover and the increased thallus damage.

Taking into consideration all the mentioned indicator properties of lichens, the lichen indication mapping is an important task for the evaluation of an environmental state of forest ecosystem in the Ukraine's industrial regions.

For our research, we selected Gurivsky forestry. The area of Gurivsky forestry is 2159 ha. Its territory is divided into 3 districts and a master station. The average air temperature is +7,8 C; the maximum +38 C; minimum -34 C. The dominant type of soil is black earth. 16 types of trees grow on the forestry territory. The main epiphyte plants are the lichens. On the basis of the analysis of the species composition of lichens in the conditions of Gurivsky forestry it was found that 16 species (which belong to the 7 genus and 4 kinds) grow on its territory.

Gurivsky forestry is an unexplored territory in the sphere of lichenology. It is also worth mentioning, that among the found species. foliose and fruticose lichens were discovered, which means that the forestry state is satisfactory. Beginning with the 4th area such species as *Xantoria parietina* disappear, which is also a good sign, as these species grow only on quite polluted localities. Also it is an interesting fact that on the 4th area probably a Red Book species, *Anaptychia speciosa*, was found. As a result of the ecological comparative analysis, it is found out that the main peculiarities of the lichens complex of Gurivsky forestry in general are the stability and monocenotic structure.

Due to the analysis of the geographic spectrum of epiphyte lichens of Gurivsky forestry, we have made a conclusion that a predominant element on the investigated area is a multiregional (9 spices, 56 %). On the second position boreal and nemoral elements are placed (3 spices, 19 %). The last position is occupied by an everyholarctic element (1 spices, 7 %).

According to the analysis of likeness of the lichens complex based on Jaccard index, the most similar are the areas number 5 and 6, which makes up 0,93 units of similar species.

According to the frequency of finding lichens on the tree species, *Quercus robur* takes the first place. Moving to the lichenoindication mapping of Gurivsky forestry, we should mention the following: the western part of the forestry, which was divided into 6 areas, was chosen for investigation. On the each area, 6-10 trees were assigned, from which information about quantitative and qualitative composition of lichens of Gurivsky forestry was gathered. The equidistance of each area is nearly 400 meters

one from another. On the each tree, at least four areas were described: two near the base of the trunk and two at a height 1-1,5 meters. It is important to note that the description and examination of the epiphyte lichens cover were done during the route study on the whole territory of the investigated district. Consequently, we found that: 1 area – 4 spices; 2nd area – 7 spices; 3^{d} area – 9 spices; 4th area – 12 spices; 5th area – 14 spices; 6th area – 15 spices. The main regularity of the spreading of lichens on the investigated area is that the farther the area is from the road, the more species grow there.

The received results of scientific researchers can be used for solving the problem concerning the selection of biomonitoring systems and prediction of the forest ecosystems' state with the help of the lichen indication mapping in the conditions of an industrial region.

The main recommendations for saving and recovery forest ecosystem with the help of lichen indication mapping are:

- use of a proven assortment of plants, which are stable to anthropogenic pressures;

- compliance with the rules of farming care accordingly to the environmental features of tree species plants;

- setting biomorphological characteristic of thallus of epiphyte lichens.

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FEMTOCHEMISTRY

Femtochemistry is a branch of chemical kinetics. As is known, A. Zivail received the Nobel Prize in Chemistry in 1999 "for the study of chemical reactions in real time with the help of femtosecond spectroscopy" [1].

The main result of his work was that it became possible to observe the course of elementary chemical reactions in real time and, thus, a new branch of chemistry was

created – femtochemistry which studies chemical processes in the femtosecond time range (10^{-15} – 10^{-12} second).

In the process of development of chemistry kinetics was separated as the science of chemical processes. This science is universal, it is suitable for describing all chemical reactions – from the formation of ores in geochemical processes with the duration of many millions of years before the explosion that occurs over millionths of a second.

The study of elementary reactions deals with a special section of chemistry – chemical dynamics. The main task of chemical dynamics is to determine the structure of transition state and to trace the dynamics of its formation and decay in real time. The science which studies the speed of temporal behavior of the reacting system, responsible for the conducted reactions, is called chemical dynamics. Unlike chemical kinetics measuring the time between chemical events, its successor – chemical dynamics – measures the time of the event itself, monitors the movement of atoms at the time of conversion of the reagent into products. And if the chemical reaction is the heart of chemistry, then the chemical dynamics is the cardiogram of this heart [2].

Specialists in femtochemistry observe chemical reactions from inside – how atoms move in time and space, when the reagent molecules are converted into product molecules. This is the major achievement of modern chemistry: it has discovered direct ways of investigating the mechanisms of chemical reactions, and, therefore, ways of controlling reactions. The success, achieved with the use of femtosecond pulses, led to the discovery of another science – femtobiology.

Features of femtosecond pulses allow us to provide high temporal resolution, to form coherent vibrational – rotational wave packets. It is easy to carry out multiphoton absorption processes, to affect the surface of potential energy. The main directions of this new field of research are the study of detailed microscopic chemical processes and their management on a femtosecond time scale.

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PROBLEMS OF CULTIVATION OF MEDICINAL PLANTS IN UKRAINE

For several decades, scientists and practitioners have observed the increasing demand for therapeutic and prophylactic agents of natural origin. Modern trends in Ukrainian market of medicinal plants show us that it is very promising. Herbs are in demand and value not only in the field of medicine and pharmacy but in other branches of the national economy.

The aim of this work is to analyze and explore the modern state of Ukrainian market of medicinal plants. Medicinal plant is a plant that is the source of medicinal raw materials and medicines to treat people and animals. In Ukraine, the first plantation of herbs were planted in the early seventeenth century. Poltava region began with sage, St. John's wort, valerian and others. The market of pharmaceutical raw materials, imported to Ukraine, exceed by 16 times the export sales abroad. Ukraine has favorable conditions for growing medicinal plants – soil and climate, especially in the Crimea and the Carpathians. Drugs of plant materials in Ukraine are produced by more than twenty companies, such as DP "Agrofirm Yang", JSC "Lubnyfarm", JSC "Fitofarm" and others. The largest pharmaceutical factory in Ukraine is in Donetsk region. It is JSC "Fitofarm" that makes the use of biologically active plant substances for medical purposes [1].

The biggest factor that affects the production of medicinal plants is the need for a considerable amount of manual labor, resulting in significant labor costs. Manual harvesting of medicinal plants dramatically increases the cost of raw materials and profitability does not exceed 10–20 % [3]. For some plants, it is possible to use an alternative way – compact cleaning technique, but today its use is constrained by lack of funds. No less significant factor influencing the production of medicinal plants and their processed products is the need for drying medicinal raw materials. Most medicinal plants need to be spread by hand for drying immediately after manual cleaning. Drying small portions of raw material does not require large financial investments. Small producers of dried plants, usually under the eaves, as well as medium and large ones use a special dryer. The paradox of the national business is the use of dryers that run on liquid fuel, which increases the cost of farmed products.

Currently, introducing equipment for drying medicinal plant, which would work on alternative fuels, is an urgent problem. Today harvesting of wild medicinal plants does not meet the needs of pharmacies and chemical-pharmaceutical industry [2].

The findings of this study. From the economic standpoint, the development of the market of medicinal plants is very promising. Firstly, it has a high level of profitability. In particular, the profitability of growing some herbs (such as stevia in a greenhouse) exceeds the profitability of growing strawberries and can reach 50–100 %. Achieving a high level of profitability in the industry is the subject of integrated development of production, which should cover the stages of growing, processing and manufacturing of medicines, advertising and sales. The development of new energy saving technologies of cultivation, harvesting and processing of medicinal plants are equally important. Under today's conditions, the existing production does not meet demands. Addressing drug crop will allow us to significantly increase the volume of harvesting medicinal plant and provide the Ukrainian industry and farmers using competent professional approach to growing medicinal plants.

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THE TIME BUDJETS AND TERRITORIAL DISTRIBUTION OF PRZEWALSKI'S HORSES (*EQUUS PRZEWALSKII*)

Przewalski's horse (*Equus ferus przewalskii* Polj., 1881) disappeared from the wild in the 1960s. However, this species was saved from extinction thanks to the efforts of scientists. Przewalski's horses currently live and reproduce successfully in zoos, reserves and natural parks around the world. The largest population of horses is located in the Biosphere Reserve "Askania Nova", Ukraine. The behavior of

Przewalski's horses wasn't studied until they disappeared in nature. Nowadays scientists pay a lot of attention to social behavior of horses, but bachelor groups compared to reproductive ones are studied less.

The aim of this work was to compare the time budgets of Przewalski's horse and their preferences to certain zones in the paddock.

The observation of the male bachelor group of Przewalski's horses was conducted at the Biosphere Reserve "Askania Nova" named after Faltz-Fein in summer, 2015. The group consisted of stallions (n = 9) of different age (6-21 years). There were Zakat (6 years), Lepet (13), Palats (14), Bulat (14), Lovelas (14), Vernij (17), Vityaz (19), Losk (19) and Parus (21) among the horses. During the study, the animals were located in the paddock which was divided into 23 zones. Observations were carried out by the method of time slices (interval of 2 min) which allowed to note the type of activity of each animal and its location.

According to numerous studies, trophic behavior prevails in the time budgets of Przewalski's horses in captivity and after their reintroduction ($50 \pm 9.5\%$ of observation time). Horses rest in breaks between grazing. Locomotor activity takes from 7.0 to 10.0 % of time during the day. Comfortable behavior is intended to minimize the harmful effects of environmental factors such as heat, wind, storms and insects. Horses procure self-care by using autogrooming (licking, scratching, biting), scratching on subjects and wallow in the dust. The proportions of area where horses live can vary and depend on available land. Everyday life of horses is rhythmic: they visit certain places of their territory at a regular time.

Thirty types of activities were noted during our observation of horses. They were divided into 8 main behavioral groups: trophic behavior, rest, movement, orientatation, comfortable behavior, interactions, exploratory and other kinds of behavior. The distribution of behavioral patterns by hours is presented in Table 1.

Trophic behavior had the highest percentage of daily time budget (from 51.7 to 62.4 %). Horses spent fifth of the day for rest (20.4 %). There were pronounced benefits to feeding horses in the evening due to the high air temperatures during the day. Significant differences in the preference to rest were observed for Lovelas and Vernij compared with other animals. Horses rested standing (often next to each other's muzzle or muzzle to tail). They spent on average 8.8 % of time per day for movement. Comfortable behavior took 1.0 % in the time budgets of horses.

Table 1. Time budget of Przewalski's horses by hours

Behavioral pattern / hours	05:00 – 10:00 (%)	10:00 – 15:00 (%)	15:00 – 20:00 (%)	Total (%)
Trophic	47.3	54.6	66.0	56.2
Rest	27.3	23.1	11.5	20.4
Movement	8.6	7.1	10.8	8.8
Orientate	13.4	9.7	8.3	10.4
Comfortable	0.8	0.9	1.2	1.0
Interactions	1.9	4.4	1.8	2.7
Exploratory	0.1	0.1	0.1	0.1
Other	0.7	0.3	0.3	0.4

Horses usually scratched shoulder, leg, croup and stomach. The interactions between horses took on average 2.7 % of time budgets. Exploratory behavior was presented by sniffing and digging the ground. Another behavior took 0.4 % in the budgets of time and included urination (0.2 %) and defecation (0.2 %). So, we can make a conclusion: trophic behavior and rest prevail in the time budgets of all animals.

The distribution of space usage by horses is presented in Fig. 1.
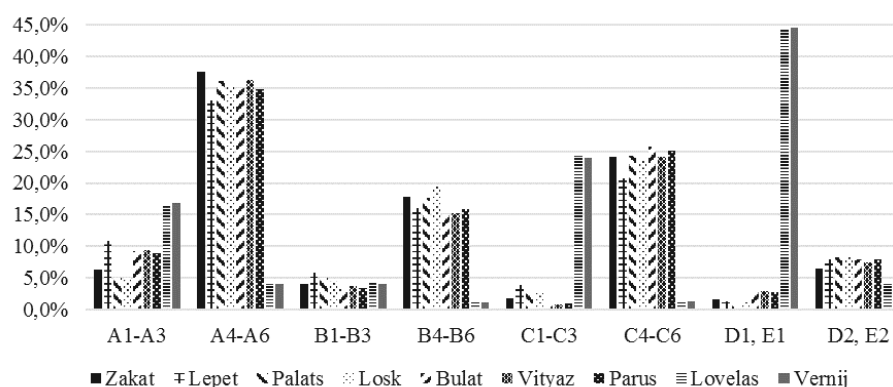
Fig. 1. Preferences to being in different zones (% of total time)

In the zones A1-A3 we can observe the prevalence of staying there of Lovelas and Vernij (16.5 and 16.9 % respectively), while other horses were there during not more than 9.5 % of time. Conversely, Lovelas and Vernij visited zones A4-A6 less frequently than others (4.1 % each), and the remaining animals were there from 33.0 to 37.6 % of time per day. All horses used areas B1-B3 almost equally (from 3.3 to 5.9 %). Lovelas and Vernij avoided zones B4-B6 (1.2 and 1.1 %), while other horses stayed there from 15.1 to 19.5 %. In areas C1-C3 there were almost only Lovelas and Vernij (24.4 and 24.0 %), other stallions visited it from 0.9 to 4 %. Both stallions also avoided zones C4-C6 (1.3 %), the rest of the horses were there from 23.6

to 25.7 %. Lovelas and Vernij preferred to be in areas D1, E1 (44.3 and 44.7 %), other animals visited this part of the second paddock equally often (from 1.0 to 2.9 %). All the horses visited areas D2 and E2 with almost equal frequency (from 4.0 to 8.3 %). So, the group of horses that were usually in one and the same units of paddock was discovered (Lovelas and Vernij in the one part, the rest of the horses in the other).

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QUANTUM-CHEMICAL ANALYSIS OF ELECTROCHEMICAL PROCESSES INVOLVING COPPER IONS AND MALEIC ACID

The qualitatively new stage of development of electrochemistry is associated with actual problems of modern technology, which are based on the usage of nanosystems in the production of new functional materials [1; 2]. The basic problem of nanotechnology is insufficient development of theoretical ideas regarding the behavior of individual particles and structures in the range of micro- and nanosize. The main problem is the absence of a unified theory of action of surfactants on electrode processes in solutions of metal ions. This is due to the fact that the information concerning the influence of additives on the electrode process has been mainly associated with their impact on individual stages. It seems to be extremely difficult to separate the effects of surfactants on the particular stage using experimental electrochemical methods, because all the stages of discharge and crystallization of metals mutually affect each other. Some progress can be achieved in this case by combining experimental methods with quantum-chemical modeling.

The aim of this work was to study the influence of maleic acid (MA) on the electrode processes that accompany electrodeposition of copper from an aqueous

solution using theoretical quantum-chemical method. Copper aqua complexes (Cu^z, where $z = 0, +1, +2$) and polyligand complexes with MA have been chosen as the object of research. Modeling of possible structures has been performed using B3LYP functional. Solvation effects have been taken into account using polarization continuum model. Wachters+f basis set has been used for copper atoms and 6-311G(d,p) basis set has been used for hydrogen and oxygen atoms.

In previous experiments, it has been found out that yellow complexes of Cu^+ accumulate in the anodic space of electrochemical cell during the electrolysis of the solution containing 0.1 mol/L $CuSO_4$ and 0.1 mol/L MA. They mix with the source electrolyte and produce a green-colored solution. On the other hand, no change of color has been observed in the cathodic space of the cell. The electrochemical copper deposit obtained on the cathode has fine-crystalline structure [3].

Based on the research findings the theoretical possibility of formation of copper σ- and π-complexes with MA has been found. Thus, oxygen atoms from carboxyl groups, as well as the C=C fragment of the MA molecule can act as complexation centers. However, the fact that hydrophilic COO^- and COOH groups in the solution are surrounded by several layers of water molecules is a significant complication in the first case. Considering the experimental observations we can suggest the following mechanism of anodic process. At the first stage MA adsorbs chemically on the copper anode through the formation of π-bonds between surface copper atoms and C=C fragments of MA. At the second stage electron detachment causes formation of Cu^+ π-complexes, where these π-bonds are preserved. The resulting Cu^+ π-complexes with MA are stable enough and they can be detected visually. The saturated analog of MA – succinic (dicarboxylic) acid has not exhibited the ability of formation similar colored Cu^+ complexes under the same conditions.

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AMYLOLYTIC ENZYME PREPARATIONS
IN THE PRODUCTION OF BREAD

Enzyme preparations increase biochemical processes catalyzed by enzymes. They are present in preparations in order to improve the quality of bread or accelerate technological processes of its production. There are two ways of cultivation of microorganisms, which produce enzymes: surface cultivation and deep cultivation. The first method is used for cultivation of mold fungi, it is characterized by the development of mycelium on the surface of a solid or liquid substrate. The deep culture of microorganisms is grown on liquid culture medium with vigorous aeration in hermetically sealed device and under sterile conditions.

Enzyme preparations, showing amylolytic activity, are biocatalysts. They increase the rate of hydrolysis of starch. It leads to an increase the gas- and sugar-forming ability of flour.

α-amylase is an endoamylase, that causes the hydrolytic cleavage of α-1,4-glycosidic bonds within the highly polymerized substrate – starch. α-amylase attacks a whole starch grain and loosens the surface, forming channels. The gelatinized starch is hydrolyzed with forming low molecular weight dextrins. The main producers of α-amylase are strains of *Aspergillus oryzae* of fungal origin, *Bacillus subtilis* of bacterial origin. Bacterial α-amylase is more resistant to high temperatures and has an increased dextrin ability in enzyme preparation Amylosubtilin D10x. Due to this ability, the preparation shows the greatest dextrinolitic activity in the first baking period. It is used as one of the effective means of slowing the staling of the bread crumb during storage.

Unfermented malt rye is also used as a source of α-amylase. The basic technological scheme of production of this malt includes the following stages: grain cleaning, washing and disinfection of grain, soaking of grain during 24–36 hours, germination of grain. The malt is dried for 24 hours with a gradual increase of temperature to 60–62 °C. It is ground enzymatically after drying. This active malt has a light yellow color with gray tinge. There occur activation and formation of α-amylase in the germinating grain. The unfermented malt, which contains amylolytic enzymes, is

used in bakery production for saccharification of brewing during the preparation of brewed bread, for improvement of quality of wheat bread, that consist of the flour with reduced sugar- and gasforming ability, for saccharification of brewing during the preparation of liquid yeast, leaven.

Glucoamylase catalyzes successive cleavage of terminal resid of α-D-glucose from the non-reducing end of the substrate. This enzyme has an exogenous mechanism of action on the substrate. Many glucoamylases have the ability to rapidly hydrolyse both the α -1,4-bond and the α -1,6-glycosidic bonds. But it happens only in the case, when the α -1,6 connection is followed by α -1,4 connection. The main feature of glucoamylase is the ability to hydrolyze a highly polymerized substrate ten times faster than oligo- and disaccharides.

Producers of glucoamylase enzyme preparations, which are used in bakery production, are *Aspergillus awamori* and *Aspergillus niger. The* enzyme glucoamylase is the most active at low pH, that's why it is introduced into acid-containing semi-finished products – starter cultures, for the accumulation of glucose in floury environments. The hydrolysis of gelatinized starchy raw materials has very good results in optimal conditions of enzyme action. If the preparations of glucoamylase are introduced in semi-finished products, made from rye flour with increased autolytic activity, the amount of dextrin will decrease. The properties of bread crumb will improve. The efficiency of glucoamylase will rise, if this enzyme is used with preparations of α-amylase.

The accompanying proteolytic activity of amylolytic preparations is a considerable disadvantage in their use, that's why it obstructs their use in flour processing with reduced gluten. Bread products of better quality are obtained by simultaneous application of amylolytic enzyme preparations and improvers of the oxidative action.

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COMPUTER ANALISIS OF FORMATION OF Co(II) COMPLEXES

Complex compounds of transition metals are an important class of substances which find wide application in analytical chemistry, in the synthesis of various polymeric materials and compositions.

The definition of constants of instability of complexes plays an important role in the justification of choice of the ligand, as well as in determination of the composition of the electrolyte and the ratio of components in alloy coating. The availability of information on ionic equilibriums in electrolyte solutions and their quantitative characteristics are a prerequisite for flexible management of the process of formation of coatings of the specified composition and structure [1].

Prediction of the stability constants of complexes has not become a standard procedure yet, due to structural diversity of objects. The complexity of prediction of stability constants is one of the main reasons for the small number of publications upon "structure-property" models in this area. Therefore, the study of complexation of cobalt(II) ions is an urgent task [2].

The object of our study is the process of complexation of cobalt (II) ions, and the subject of study is the stability constants of complex compounds.

We used quantum-chemical modeling, together with non-empirical methods of WinGAMESS program. Visualization of structures was carried out using ChemCraft program.

Based on the analysis of the results of quantum-chemical calculations of (WinGAMESS) complex compounds of ions Co^{2+} with H_2O, NH_3, OH^-, F^-, Cl^-, Br^-, I^-, Ac^-, CN^-, Ak^- general form $[Co(H_2O)_{6-n}L_n]^{2+nx}$, it has been shows that the result of interaction of structural components is simultaneously reflected in values of the effective charge of the central atom (z^*_{Co}), as well as in values of stability constants of the complexes. This results in the existence of linear correlations $lgK = A + B \cdot z^*_{Co}$, whose parameters are determined by the nature of donor atoms of the ligands. The constants A and B for chlorine (-6.31; 5.79), nitrogen (125.41; -69.86) and oxygen (30.17; -17.71) have been found out. We also calculated the stability constants for

complexes of CO^{2+} with acrylate ions, the data about which are absent in literature: $lgK_1=1.2$ and $lgK_2=4.3$.

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KINETIC FEATURES OF THE PROCESS OF
ELECTROREDUCTION OF COBALT (II) CATIONS

Cobalt and its compounds are widely used in engineering, as well as in chemical and metallurgical industries [1–3]. Ukraine does not possess cobalt ore reserves. At the same time, secondary cobalt- containing materials are used in a number of industries. These materials are transferred to soluble cobalt compounds using physicochemical methods, and then they are subjected to hydroelectrometallurgical processing to obtain pure cobalt or its salts. When using low-concentration solutions, the technology of cobalt recovery is simplified by reducing the number of neutralization and evaporation operations.

Therefore, the study of cathodic reduction of cobalt with low-concentrated acidic solutions has an important theoretical and applied significance. In literature the kinetic dependences of cobalt cathodic deposition have not been studied sufficiently, so it is important to conduct fundamental studies on the establishment of kinetics of electroreduction of cobalt (II) cations.

With the use of quantum-chemical modeling and potentiodynamic measurements, it was found out that the electroreduction of aqua complexes $[Co(H_2O)_6]^{2+}$ occurs in stages with the formation of equivalent intermediate $[Co(H_2O)_4]^+$, $[Co(H_2O)_3]^+$ and final parts of the product $[Co(H_2O)]^0$. Cobalt ions do not exhibit a catalytic effect on the evolution reaction of hydrogen, however, one of the intermediate products of their

two-electron electroreduction is capable of participating in the reaction, which results in the formation of a hydroxide.

Kinetic studies of the process of electroreduction of cobalt (II) aquacomplexes made it possible to establish that acrylic acid exhibits electrochemical activity and catalyses electroreduction of cations of CO_2^+. The increase in temperature slightly affects the electroreduction of cobalt (II) aqua complexes on a copper electrode.

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PLASMA-CHEMICAL SYNTHESIS

Isolated nanoparticles are usually prepared by evaporation of a substance at a controlled temperature in the atmosphere of inert gas with low pressure, followed by steam condensation near or on the cold surface. This is the easiest way to produce nanocrystalline powders, because of its high performance. Unlike evaporation in vacuum, the atoms of the substance, vaporized in a rarefied inert atmosphere, rapidly lose kinetic energy, because of collisions with gas atoms, and form clusters. Installations using the principle of evaporation-condensation differ by input of the evaporated material; by energy supply for evaporation; by working environment; by organization of condensation; by collection of the resulting powder [3, p. 4–10].

One of the most common chemical methods of obtaining highly dispersed powders of nitrides, carbides, borides and oxides is plasma-chemical synthesis. The main conditions for obtaining superfine powders by this method is the reaction behavior in non-equilibrium conditions and the high rate of nucleation of a new phase

at a low speed of their growth. In the real conditions of plasma-chemical synthesis it is efficient to carry out the preparation of nanoparticles due to the increase of cooling rate of plasma stream, in which the condensation from the gas phase takes place. This reduces the size of the resulting particles, as well as suppresses the particle growth by merging them in a collision. In plasma-chemical synthesis with low temperature, ammonia, hydrocarbon, argon plasmas are processed by arc, glow, high or ultra high frequency discharges. Characteristics of the obtained powders depend on the raw materials, technology of synthesis and the type of plasma torch. Particles of plasma-chemical powders are single crystals and range in size from 10 to 100–200 nm or more [1, p. 351].

The main drawbacks of plasma-chemical synthesis are a wide distribution of particles by size and, therefore, the presence of relatively large particles – 5 microns, i.e. low selectivity of the process and high content of impurities in the powder. Nowadays, highly dispersed powders of nitrides of titanium, zirconium, hafnium, vanadium, niobium, tantalum, boron, aluminum and silicon, carbides of titanium, niobium, tantalum, tungsten, boron and silicon, magnesium oxides, yttrium and aluminum have been obtained using plasma-chemical method.

Plasma-chemical synthesis includes several stages. At the first stage we observe the formation of active particles in the arc, high-frequency and microwave plasma torches. Plasma torches are the most powerful, and they have the highest coefficient of efficiency, but the obtained materials are contaminated by the products of electrode erosion. However, electrodeless high-frequency and microwave plasma generators do not have this drawback. At the next stage of hardening, an allocation of interaction products takes place. The choice of location and rate of hardening allows obtaining the powders with predetermined composition, shape and particle size.

Plasma-chemical powders of carbides of metals, boron and silicon are typically obtained by reacting the chlorides of corresponding elements with hydrogen and methane or other hydrocarbons in an argon arc or high-frequency plasma; nitrides are obtained by reacting the chlorides with ammonia or by mixing nitrogen with hydrogen in low-temperature microwave plasma. Using plasma-chemical synthesis, it is also possible to obtain multicomponent ultrafine powders, which are a mixture of carbides and nitrides, borides and nitrides, nitrides of various elements etc.

Plasma-chemical synthesis is rather similar to gas-phase synthesis using laser heating of the reacting gas mixture. It provides controlled homogeneous nucleation and eliminates the possibility of contamination [2, p. 416–418].

Gas-phase synthesis, using laser to form radiation and maintain plasma, in which the chemical reaction takes place, has proved to be an effective method of producing molecular clusters. Molecular clusters are a new structural modification of the substance, therefore, we should discuss in more detail the success and emerging opportunities of creating previously unknown polymorphic modification of substances with nanometer-sized structural elements. Molecular clusters occupy a special place among substances with a nanostructure. The best-known among them are the fullerenes – a new allotropic modification of carbon, along with graphite and diamond. The search for new molecular clusters ended in the discovery of a new, unusual, stable charged cluster Ti8C12 + which corresponds to the molecule of stoichiometric composition Ti8C12 in the form of pentagon decahedron. Clusters of Ti8C12 were obtained using the method of gas-phase plasma-chemical synthesis. The inert gas-helium was used, and the reagents were hydrocarbons (methane, ethylene, acetylene, propylene and benzene), as well as titanium vapor. Neutral and ionized clusters were isolated from the reaction products and were analyzed on the mass spectrometer. In general plasma-chemical synthesis with different variants of creating plasma is one of the most promising methods of obtaining various nanostructured materials.

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USE OF VANILLIN AZINE FOR DEMONSTRATION OF CHEMILUMINESCENCE

Chemiluminescence is luminescence which results from the chemical reaction. It is emitted by reaction products or other compounds, excited by energy transfer from reaction products. Chemiluminescence is related to exothermic chemical processes.

Usually oxidation of luminol (Structure 1) under different conditions is used for demonstration of this phenomenon [3]. Also, the reaction of aromatic esters of oxalic acid (Structure 2 as an example) with hydrogen peroxide is sometimes used for this purpose [1].
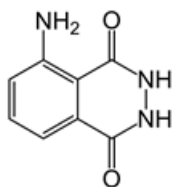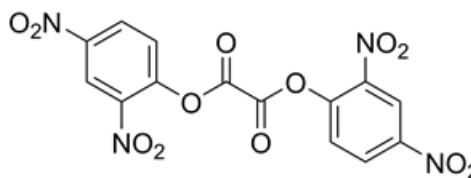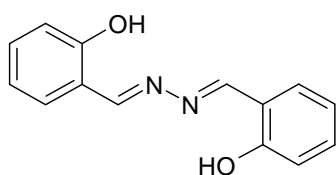

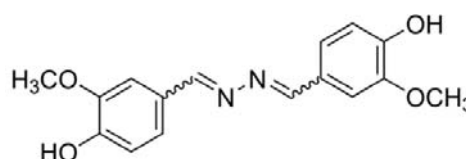**Structure 1**   **Structure 2**

However, the above-mentioned reactions are not the only examples of chemical interaction which is accompanied by chemiluminescence. In the article by Y. B. Tsaplev "Chemiluminescence of azines" it was shown that oxidation of salicylalazine (Structure 3) by sodium hypochlorite in DMSO/H2O medium results in intense chemiluminescence. Also, the mechanism of the reaction was discussed [2].

We suggested that it may be possible to use oxidation of aromatic aldehyde azines for demonstration of chemiluminescence.

To find out, if it was true, a synthesis of vanillin azine (Structure 4) was carried out by reacting the excess of vanillin (2 moles) with hydrazine in water in the presence of a small amount of citric acid as a catalyst.

Structure 3   **Structure 4**

Oxidation of vanillin azine was performed similarly to the method, described in the above-mentioned article [2]. When the solution of sodium hypochlorite was added to DMSO solution of vanillin azine, there was a notable flash of green light. The mechanism of this reaction seems to be similar to that of oxidation of salicylalazine.

Apart from sodium hypochlorite, we also used hydrogen peroxide (35 % solution) as an oxidant. A small amount of hydrogen peroxide and solid NaOH was added to the solution of vanillin azine in DMSO. After this, a blue luminescence appeared in the mixture, which could be observed for 10 minutes in the dark room.

As a conclusion, oxidation reaction of vanillin azine under different conditions can be used for demonstration of chemiluminescence. The benefits of this demonstration are:

1) use of commercially available reagents;

2) simplicity of synthesis of a target compound;

3) synthesis of vanillin azine demonstrates the principles of green chemistry (usually, synthesis of azines is carried out by refluxing reagents in organic solvents for several hours).

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WEATHER AND MOOD. DOES IT HAVE A LINK?

Many people believe that good weather can make a good mood, for example: if it rains someone becomes depressed. But does it make sense?

About 60 thousand years ago a few groups of people immigrated from East Africa to other continents and after the journey their descendants settled down around the whole world. Anthropologist Olga Artemova says: «Our ancestors were compelled to adaptation in the new environment. They tried to understand the weather by their body, studied to feel it by the changes of their health. That was only for surviving in

wildlife. For example, low pressure was a symbol for future hurricane. Apprehension of thunder concerned the low pressure in genetic memory ancient people. That was the only way to know what the weather would be like.

Psychologists, meteorologists, geographers and explorers were learned about how the weather influences on human's organism and mood.

Psychologist Margarita Zchamkochian says: "If we have fun and it is shining we would probably think that our good mood is because of the weather. But if it is raining we will not care about that. When situation is under control we would probably do not mention it. That's how stereotypes, assumptions and social settings work. And if we have coincidence we do remember it and tell others. Actually, society can have good mood because when the sun is above the horizon, people usually go for a walk to meet some friends. Usually right that way"

Mood is an emotional condition which makes our life nicer and it does not depend on specific circumstances. When we are happy, we do not care about one thing, we are happy because of everything in our environment. Our mood can be changed few times within 24 hours, but it can be explainable by the individual biological rhythm.

History has attempts to improve that phenomenon in a scientific way. Researchers asked volunteers to fix their emotional condition for a few months and then compared their evidence to weather reports. And didn't find anything.

But I know some humans react to the weather by headache, pain in legs, exacerbation of chronic disease. Physicist Tatiana Breus says about the meteorological sensitivity: "Our organism is a very complicated system of different rhythms. For example, heartbeat, cardiovascular and respiratory rhythm. Abrupt air temperature, atmospheric pressure or wind power changes and solar activity can bring the organism out of the balance. In the end, we can feel emotional and physical discomfort."

Only 3 % of adult population can feel such an edgy weather reaction. Meteorological sensitivity is a simple physiological phenomenon, by virtue of one, human's organism can have normal reaction to the environmental changes which help us live in harmony with the world. One type of people can easily adapt, but the other type cannot. As for the painful reaction to the weather, it's only individual human nature. Some people inherit it or it is just due to the weak immune system.

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THE USE OF TIME SERIES FOR BRENT CRUDE OIL PRICES FORECAST

The task of the world processes forecast by using time series is actual in our time. The processes which behavior has to be forecasted are most often described by time series. Examples of such processes can be: the task of forecasting the stock price on the stock exchange, currency rates, prices for precious metals or energy resources.

The problem of Brent crude oil prices forecast based on time series research is considered. The time series contains 6861 elements that correspond to the daily price change, starting from August 16, 1990 till December 31, 2016 (Fig. 1).
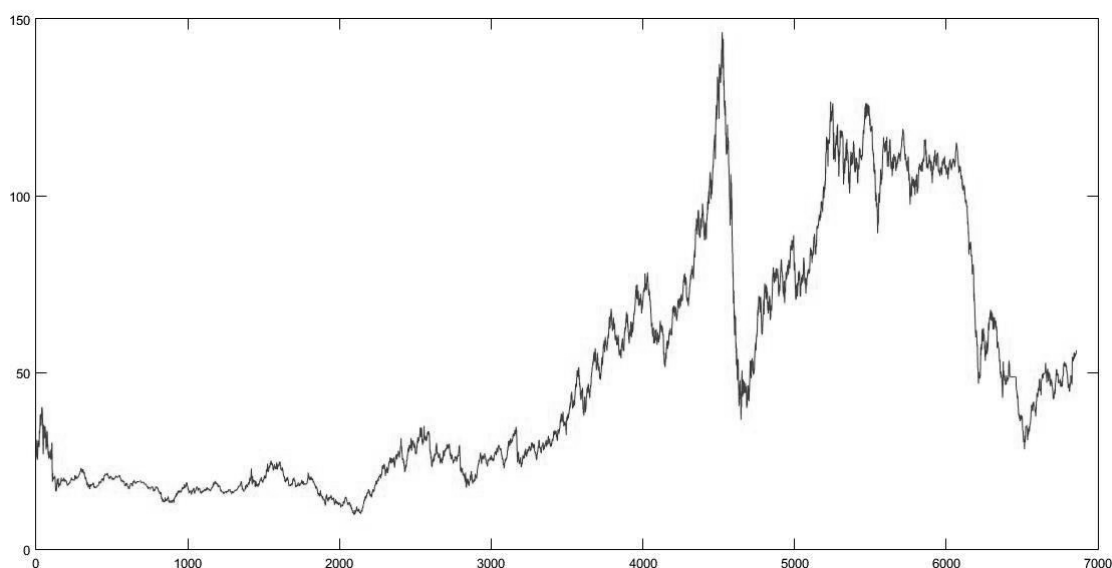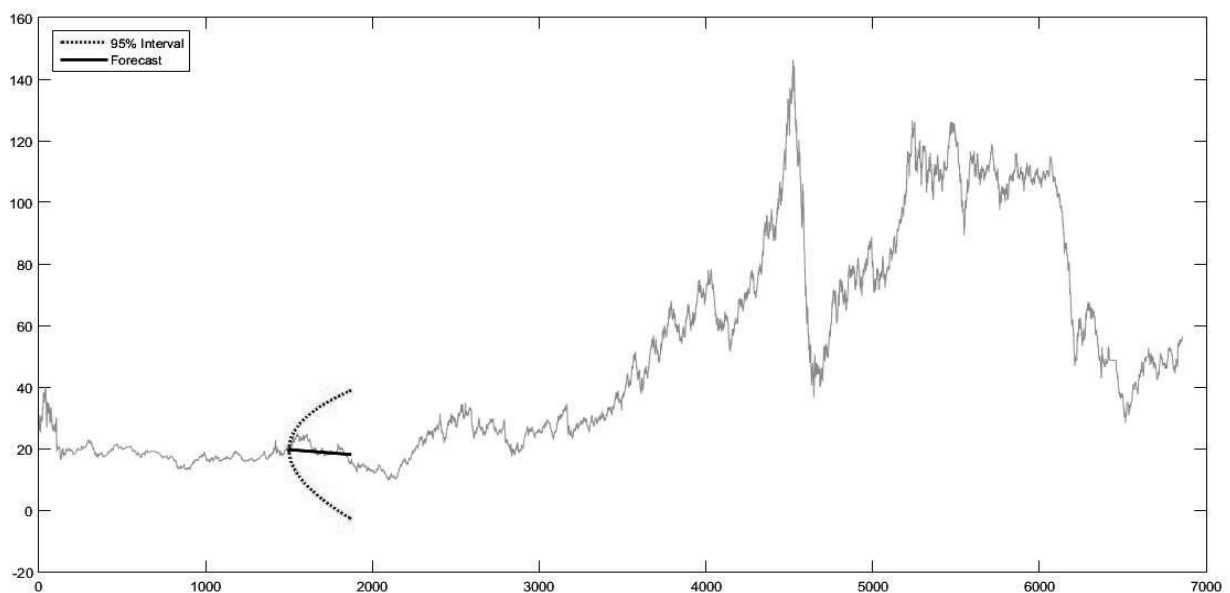

Fig. 1. Brent crude oil price time series visualization

According to Tikhonov, there are about 100 forecasting methods and models which are mentioned in reference [1]. The forecasting method is a sequence of actions that need to be taken to obtain a forecasting model. The forecasting model is a functional representation that describes the process under research and is the basis for obtaining its future values.

The ARIMA model [1] was used to research the process of Brent crude oil prices formation. It is important to mention that this model was used to research similar processes in papers [2; 3].

This model was applied to the obtained time series. Also the attempt, based on the first one and a half thousand values, was made to give the following forecast: will the oil price rise or fall over the next 365 days?

The model showed a positive result (Fig. 2), namely, it showed a tendency to a price fall during the period of 365 days.

Fig. 2. The visualization of Brent crude oil price time series with forecast

It is planned to apply more accurate methods to obtain precise prices in a given period of time in further research.

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APPLICATION OF INFORMATION TECHNOLOGIES
FOR HUMAN HEAD TRANSPLANTATION

Human is the most complex and magnificent machine in the world. Since ancient times doctors have been looking for the ways of surgical treatment for various diseases. Medicine is developing and what was impossible and seemed something "out of the fantasy world", now is a routine operation. Such operations can be considered to be organ transplants. 50 years ago to transplant a person's heart seemed incredible, but now thousands of people live with a donor heart. It should be noted that the development of medicine in general would not have reached such a level without the latest Information Technology. One of these technologies is virtual reality, which is not only used in health care for training doctors and rehabilitation of patients, but also is an important stage on the way to recovery and adaptation.

In this work we want to investigate the current achievements in the field of neurosurgery.

Human head transplantation! This is a surgical operation that implies in the transplantation of the head of one organism to another body, which involves decapitation of the patient.

Head transplantation has been performed on animals such as monkeys, dogs and rats, but then there was a fundamental problem of splicing neural fibers of the spinal cord. Therefore, cases of head transplantation from person to person are unknown. And there was no sense in such operations because it was impossible to restore the motor activity and control over the transplanted body [7].

One of the main problems hampering the operation is the lack of a developed technology for connecting fragments of the cut spinal cord. As a result of surgical intervention, the patient becomes a quadriplegic after the transplantation: the brain can not control the muscles of another person`s body [7].

The procedure for head transplantation of the head is assessed negatively from the ethical point of view by many scientists.

Perhaps soon we will hear about operations in the spirit of Frankenstein: Italian neurosurgeon Sergio Canavero announced the development of technology that allows for a head transplant. He announced the launch of the ambitious HEAVEN / AHBR project for head transplantation using a special procedure, which he calls the "GEMINI protocol" [4].

In February 2015 the physician Sergio Canavero published an article in the International Journal of Neurosurgery dedicated to the surgical operation of a human head transplant to a donor's body under hypothermic conditions. Thirty-year-old programmer from Russia Valery Spiridonov agrees to become the first person to undergo this operation [6].

Canavero said that he and Chinese scientists were able to prove: the spinal cord and the brain stem can be quite effectively connected after separation. The surgeon claims that the technique he developed for "gluing" cells with polyethylene glycol demonstrated its effectiveness and in the case of rats the mobility of their limbs was restored by 60 %. He calls his drug "biocides".

The operations were carried out on monkeys too: according to Canavero, in this case the head transplantation was completely successful and the primacy survived after the operation.

If everything that Canavero says is true, then scientists really made a grand breakthrough because at the moment doctors do not have a technique that would completely restore the broken connections between the spinal cord and the brain. Otherwise, this technique would already be used to treat paralyzed people. Canavero, however, does not seek to share his achievements with the scientific community.

The cost of the 36-hour operation will be £ 7.5 million. The donor of the body will be a person whose brain has died, but the body itself is healthy. For the operation the patient's body and donor will be cooled to 15 degrees to reduce the risk of death from lack of oxygen and at the same time protect the organs from changes due to low temperature. Fabrics and blood vessels around the neck will be cut, the heads will be attached to the bodies with the help of special tubes, and then the surgeon will cut with the help of an ultra-thin blade the spinal cord of both men [5]. The head of the recipient will be transplanted to the body of the donor and connected the spinal cord with the use of polyethylene glycol, which in some way affects the substance of

the spinal cord – this is compared with the way spaghetti stick together while cooking. Then it will only be necessary to restore blood circulation, sew the muscles and wait three to four weeks until the spinal cord coalesces [2].

In addition to the actual preparation for the operation, the doctor has to solve a number of problems, including choosing a state that will assume this responsibility and allow the head to be transplanted on its territory. At a press conference in Glasgow Italian neurosurgeon Sergio Canavero demonstrated a special surgical knife that allows for a head transplant operation and a virtual reality system that will help a person learn to use a new body. In addition to these new components of the GEMINI Protocol, Canavero said that his Korean colleagues from the University of Konkuk in Seoul confirmed the results of previous experiments on head transplantation in mice, showing that polyethylene glycol does promote the fusion of nerve fibers and the rapid restoration of motor functions [2].

A young guy suffering from muscular dystrophy is now undergoing a cycle of training using virtual reality – this should help him in the future to learn to live with a new body and avoid the development of "unforeseen psychological reactions". The operation is scheduled for December 2017. The system with which Spiridonov trains is developed by Inventum Bioengineering Technologies [1].

Exacly in surgery the technologies of virtual reality find the widest application. It is understandable because it is difficult to find another field of medicine in which visualization and feedback on the actions of the doctor plays even a more important role. Many new IT technologies are primarily used in the medical field.[8] For example, Stanford University develops and applies software and hardware systems with a high degree of itemisation for various organs and parts of the human body providing tactile feedback. This allows the surgeon to orientate him or herself in the situation not only visually, but also with the help of tactile perception [9]. Obviously, head trasplantation would be impossible without applying the latest IT technologies.

Of course, head transplantation in the modern world can be compared with its grandeur and fantasticness with the flight of the first person to the Cosmos. However, everything ever happens for the first time. And this operation can not only save the life of a young man, but also produce an unreal breakthrough in medicine. Let's hope that such operations will soon cease to seem fantastic and will enter everyday life.

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EXPANSION PROCESSES OF POLYNATIONAL ENGLISH IN THE MODERN WORLD

The English language, due to its transplantation and spreading across the new territories, and the policy of colonial expansion undertaken by Great Britain since the XVI century, as well as the US economic influence in the XIX–XX centuries, took the position of a polynational lingual system in the modern world.

Distribution of the English language occurred in the XIX–XX centuries as a result of the formation, evolution and disintegration of states-colonies belonging to Great Britain, and arranging in such habitats, as North America, Australia, New Zealand, Asia, Africa, the Caribbean and others.

At first English was transplanted beyond its native territory in the 16th century, as a result the mother country gained its colonial power over the territories of North America [Ward G. 2003], that is the *first wave of colonial expansion*; implementation of English in the 17th century was observed in South Asia (e.g., India) [Kachru B. 1976], and this is deemed the *second wave of colonial territorial capture*; further in the 18th century representatives of Anglo-Saxon ethnic group and their lingual system adapted into Australia and New Zealand [Домнич О. В. 2010], which is considered the *third wave of colonization*; in the 19th century English was

transplanted into Southeast Asia (e.g. Singapore) [Tan P.K.W. 2014], South Africa (e.g. South African Republic) [Da Silva A.B. 2008] and East Africa (e.g. Kenya) [Schmied J. 1991], that is represented the *fourth wave of colonial expansion* (see Table 1).

Table 1. The beginning of colonial expansion of Great Britain in the studied countries

Colonial expansion	Century	Country / Continent
The first wave of colonial expansion	XVI c.	The USA, Canada (North America)
The second wave of colonial expansion	XVII c.	India (Asia)
The third wave of colonial expansion	XVIII c.	Australia, New Zealand (Australia, New Zealand)
The fourth wave of colonial expansion	XIX c.	Singapore, South Africa, Kenya (Asia, Africa)

We also note that the end of colonial expansion of both the national varieties (the US, Canada, Australia and New Zealand), and the territorial varieties (India, Singapore, South African Republic, Kenya, etc.) refers to the mid-twentieth century. Thus, we admit that spreading of English is determined by such processes as formation, evolution and disintegration of post-colonial countries in which the language of their colonial past – English – continues to play a significant role and provides (in varying degrees) communicative needs of contemporary ethnic communities of the above-mentioned states.

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INFORMATION TECHNOLOGY OF DETECTION OF A PERIODIC COMPONENT OF A TIME SERIES

Numerous applications of the analysis of time series are in the area of science that is actively developing. Time series describe the extremely wide range of phenomena. Time series are the result of measurement of indexes of both technical systems and the characteristics of the economic, social, biological and other systems. A characteristic feature of the time series is to conduct observations of some object sequentially in time. Discovery of the structure of time series is needed in order to build a mathematical model of the phenomenon, which is the source of the time series.

There are different methods for detection of periodic processes and determination of their spectral components [1]. One of the common methods is the method of trigonometric interpolation based on least squares method. Any periodic sequence can be expanded in a series Fourier, while in front of sines and cosines are the regression coefficients [2]. To estimate the coefficients given continuous function $\varphi(x)$ for discrete approximations of dependence $g(x_i)$, which minimizes the functional form:

$$Q = \sum_{i=1}^{n} (\varphi(x) - g(x_i))^2 \to \min.$$

Decomposition of time sequence of the Fourier transform allows you to find hidden periodicity.

The proposed information technology for detection of periodic components of time series uses least squares method. The effectiveness of the method was studied by means of computational experiment based on the model of time series and based on the real-life series of Electrocardiograms of laboratory animals.

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EXPERIMENTELLE WIRTSCHAFTSFORSCHUNG ALS METHODE IN DEN WIRTSCHAFTSWISSENSCHAFTEN

Die experimentelle Forschung ist eine relativ junge Methode der Erkenntnisgewinnung in den Wirtschaftswissenschaften. Zwar wurden bereits in den 1930er bis 1950er Jahren Experimente durchgeführt, allerdings geschah dies nur sehr vereinzelt. In den 1960er Jahren verhalfen die späteren Nobelpreisträger Vernon Smith und Reinhard Selten der experimentellen Wirtschaftsforschung zu einer größeren Beachtung, die im Laufe der Jahre immer weiter stieg.

Einer der Vorteile dieser Methode ist die Fähigkeit, die Testmuster des Verhaltens in einer aktuellen wirtschaftlichen Situation zu deuten und die Auswahl aus der Vielzahl von Überlegungen zu artikulieren.

Insbesondere seit den 1980er Jahren vergrößerte sich ihre Bedeutung, da es möglich wurde, Experimente an Computernetzwerken durchzuführen, was die Möglichkeiten und die Effizienz der Datenerhebung erheblich verbesserte. In früheren Jahren wurden die Experimente mit Hilfe von Papier und Bleistift durchgeführt, was dazu führte, dass sich die Interaktion der Teilnehmer untereinander und die anschließende Datenerhebung zum Teil schwierig gestalteten. Durch den Einsatz von Computern ist es heutzutage möglich, den Ablauf der Experimentsitzungen zu automatisieren und einen Informationsaustausch der Teilnehmer untereinander ohne Zeitverluste zu ermöglichen. Solche Methode verwendet man jetzt überall: in den Schulen, in den Firmen, in Universitäten u.s.w.. Außerdem werden mögliche Fehlerquellen, wie Zuordnungen und Berechnungen durch das Computerprogramm minimiert [1].

Die Ziele der experimentellen Wirtschaftsforschung gliedern wir in zwei große Teilbereiche. Zum einen dienen Experimente dazu, Vorhersagen von Theorien in einer kontrollierten Umgebung zu überprüfen und möglicherweise zu falsifizieren. Sie können also als Rückkopplung für die theoretische Forschung gesehen werden. Dabei ermöglicht die experimentelle Forschung ebenfalls den kontrollierten Abbau der Diskrepanz zwischen theoretischen Annahmen und realen Bedingungen zu … und kann die Theorie so auch einer Art Stresstest unterziehen bzw. die Einflüsse von Variablen auf Entscheidungssituationen, über die theoretisch wenig gesagt werden

kann, untersuchen. Zum anderen ist das Zusammenspiel von Theorie und experimenteller Handgreiflichkeit jedoch nicht unidirektional, in dem Sinne, dass nur die Theorie Ansatzpunkte für Experimente liefert. Vielmehr dienen Experimente auch dazu, empirische Regelmäßigkeiten, die ihrerseits als Ausgangspunkt für die Entwicklung neuer Theorien dienen können, aufzudecken [2].

Der große Vorteil der experimentellen Wirtschaftsforschung im Vergleich zu anderen Verfahren der Datengewinnung besteht darin, dass sich unter kontrollierten und replizierbaren Bedingungen einzelne Variablen verändern lassen, die die Entscheidungen beeinflussen können. So lässt sich der Einfluss einzelner sowie das Zusammenspiel mehrerer Variablen dezidiert untersuchen. Die Daten werden generiert, indem die Teilnehmer in den Experimentsitzungen reale Entscheidungen in wirtschaftlich relevanten Situationen treffen. Ähnlich wie das Vermögen der in der vergleichbaren realen oder modelltheoretischen Situation handelnden Akteure hängt dabei auch die Entlohnung der Experimentteilnehmer davon ab, welche Entscheidungen sie (und möglicherweise andere Personen) in der entsprechenden Situation treffen.

Wir haben solche Methode in verschiedenen Bereichen verwendet, weil es sich wirklich bei der Arbeit nützlich erwies. Sie hat uns geholfen, fast alle Statistiken im Diplom zu errechnen.

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ACTUAL MEDICAL INFORMATION SYSTEM MODEL ON THE EXAMPLE OF "INFORMATION CARD OF THE PATIENT OF ANESTHESIOLOGY DEPARTMENT"

Information technologies play more and more important role in all spheres of human activity and health care is not an exception in our rapidly developing society. Modern medical organizations produce and store huge amount of data. The quality of

medical care, the development level of countries all over the world and each territorial entity in particular, general standard of living of the population, depends on the efficiency level of using information by doctors and department heads. Information technologies are now becoming an integral part of health care [2].

It is required to create special methods and means of information processing that automate operation of each medical institution department and, primarily, collection and processing of private patient's information to provide an efficient operation in hospital, in addition to its basic functions. Most importantly, that as a result of filling out information about patients, a doctor is able to print the Form of Primary Accounting Documentation № 003-3/o [3], since this document was approved by the Ministry of Health care of Ukraine and it must be present in paper form. Therefore, the creation of information processing systems "Individual patient card of the anesthesiology department" in Dnipropetrovsk regional hospital and its implementation will contribute to effective management of a separate department and, in the future, the whole hospital.

The doctors of the Department of anesthesiology should interview patients to determine the correct type of anesthesia for surgery, fix the answers in the patient's card, analyze information and make the right decision every day. The main carrier of information in hospital, even today, is a folder with papers. A large amount of important operating documentation should be kept in department.

The information model of the patient's card significantly increased the efficiency of work of the doctors and other employees of the department.

The development of the system for a medical institution contributes to [1]:

- reducing the time of a patient's interview, documents registration, which are the results of inspection;

- improving convenience of the doctor's work with a patient, improving the doctor's efficiency;

- beginning of transfer of the document circulation of department to the electronic version (for example, Forms of primary accounting documentation № 003-3/o [3]);

- providing an opportunity to create a system of full and flexible reporting;

- automation of interactions between departments in the future.

The software is developed in C# in the Visual Studio development environment. A relational database, namely created in Microsoft Access, is also used for developing

application in addition to C# programming language. This choice is due to the possibilities of C# to create window applications and the convenience of interaction between Microsoft Visual Studio and Microsoft Office.

The structure of the software product includes:

- an authorization form that contains two fields (login/password). They are designed to protect data from unauthorized access;

- the main form, which contains a table with information about patients;

- an additional form created for adding and editing information;

- the Microsoft Access database which stores and processes all patient information (available and easy to use).

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ARTIFICIAL INTELLIGENCE

Artificial Intelligence is one of the hot topics of today's IT world. The name itself suggests that it is intelligence which is artificially created. It helps to act appropriately at appropriate time using the previous knowledge and experience. Technically speaking, Artificial Intelligence (AI) is the branch of computer science which focuses on creating intelligence to machines. This study started long back in 1956 by John McCarthy, but even today its importance is radically increasing.

To understand the techniques used to implement AI, we should have a clear idea about the way in which our brain works. A brain is formed using millions of cells, biologically termed as neurons. Many signals are passed through these neurons

whenever some information needs to be entered into our body. Based on this information we react accordingly. So, in case of Artificial Intelligence, mainly two approaches are used to implement intelligence. They are bottom-up and top-down approaches. In bottom-up approach, exact model of the human brain is formed whereas in top-down approach, when using computer programs, the brain behavior is copied.

The main factors that need to be considered while simulating intelligence are:

- Representing Knowledge
- Step by step reasoning
- Set Goals and achieve them
- Learning new techniques

Artificial Intelligence cannot be implemented applying normally used programming languages. There are some languages really intended for this purpose. For instance, Lisp and Prolog are the commonly used programming languages for AI. Lisp stands for List Processor and Prolog for Programming in Logic. It is a pure functional programming language where the main engine is a logical programming language.

Nowadays, artificial intelligence has successfully been used in a wide range of fields including medical diagnosis, stock trading, robot control, law, scientific discovery and toys. Industrial robots are also used for packaging of manufactured goods, transporting goods around warehouses or hospitals or removing tiny electronic components with great accuracy, speed and reliability. Robots can move around, manipulate their environment, predict the actions of others and exhibit intelligent behavior. Also, we can see the real prototype of AI in real life. It can be Siri on IOS devices or Google Talk on Android ones. We cannot but mention that mobile developers try to encourage predictive typing, that means that telephone understands what you are speaking about and helps you substituting this or that word. So, we can see that scientists are interested in designing robots that resemble a human.

In conclusion, it is worth saying that AI has its advantages and disadvantages but it is so convenient that approximately through five to ten years it will replace humans in many areas.

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EIGENSCHAFTEN DER INNOVATIONSMARKETINGSENTWICKLUNG

In den letzten Jahren geschieht eine dynamische Entwicklung des Geschäftssektors der Wirtschaft unter den Bedingungen der genügend instabilen Marktsituation, die zu einem verstärkten Wettbewerb und Übersättigung des Marktes führt. Im Marketing werden deshalb die Innovationstechnologien breit verwendet, die den Unternehmen wesentlich erlauben, den Gewinn zu erhöhen und den Sektor des Marktes, der mit ihrer Produkten besetzt ist, zu erweitern[1].

Das Innovationsmarketing ist der Begriff, der verhältnismäßig kürzlich erschien. Der ist im Zusammenhang mit der ungestümen Entwicklung der Spitzentechnologien entstanden. Die vervollkommneten Produkte sollen sich auf den Markt ungehindert eindringen. Um diese Mechanismen maximal auszutesten, haben die Fachkräfte die Arbeit an der Annäherung und Vereinigung der beiden Objekte geleistet: des Marketings und der Innovation.

Heutzutage versteht man unter dem Innovationsmarketing eine Art der wirtschaftlichen Produktionstätigkeit der Unternehmen, gerichtet auf die Kontrolle über die Innovationen, die Optimierung der Produktionsprozesse und des Vertriebes auf Grund der durchgeführten Forschungen und, die Hauptsache, auf den aktiven Einfluss auf den Markt durch die Einführung neuer Produkte [1].

Die Besonderheit des Innovationsmarketings wird von den Besonderheiten des Platzes und der darauf angebotenen Produkte bestimmt [2].

Die innovativen Erzeugnisse sind spezifische Waren auf dem gegebenen Platz. Neben der Neuheit haben sie auch andere Eigenschaften:

− Die Effektivität, die Attraktivität sowie den Risikograd des Innovationsprodukts ist es schwer festzustellen, da sie bis zum Moment ihrer Aufbringen auf den Markt schwer wahrzunehmen sind. Diese Gründe werden auch durch die Einmaligkeit solcher Produkte verstärkt.

− Das Vorhandensein der Autorschaft der Innovationsprodukte (das geistige Eigentum) bestimmt ihre Individualität, die von den Subjekten der Innovationstätigkeit (ihrem Talent, Kenntnissen und Erfahrung) abhängt [2].

– In einzelnen Fällen haben die betreffenden Objekte die Fähigkeit zur Vervielfachung, das heißt, dem unbeschränkten Austausch, zum Beispiel, die Lizenzen.

– Wie bekannt, bilden die neuen Arten des Innovationsprodukts die neuen Bedürfnisse bei den Kunden, die sie nicht sofort bewusst wahrnehmen können. In der ersten Zeit können Innovationsprodukte nicht nur nicht akzeptiert werden, sondern sogar überhaupt abgelehnt. Ebenso können die Neuheiten zur Situation des Erscheinens der neuen Märkte führen, die eine Firma überhaupt nicht erschließen kann. So entstehen Allianzen, Korporationen und andere Formen der Geschäftspartnerschaft [3].

Also ist die Innovationstätigkeit in der Sphäre des Marketings ohne das Vorhandensein im Unternehmen entsprechender planmäßiger Leitungstätigkeit unmöglich. Die Einführung der Marketingleitungsinstrumente in der Innovationstätigkeit wird zu einer der Grundursachen des Erfolges der innovativen Produkte. Die Marketingsinnovationen können sowohl als eine Einzelware oder als eine Technologie des Innovationsmarketings auftreten als auch Folge anderer Innovationsarten sein.

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PERSONNEL OUTSTAFFING IN PROVIDING EFFECTIVE ENTERPRISE PERFORMANCE

Maximizing efficiency and effectiveness, including getting the highest profits and achieving desired results at minimum cost, is a relevant business objective. Many companies are looking for the ways to minimize expenses by saving resources and dismissing employees that have negative impact on the social and psychological climate among personnel and leading to dissatisfaction among workers due to the heavy

workload with a follow-up dismissal. A topical direction of activities is to provide analysis of the ways of cost minimization in the process of personnel hiring through outstaffing in case of the need to involve additional human resources without change in work force number.

It is determined that personnel outstaffing is a way of temporary engaging another enterprise's work force without entering into legal relations with them to perform certain assignments (projects), set by the contract [1]. Outstaffing is generally used by enterprises of various forms where recruitment is used, except public, protection and pharmaceutical fields, that is, those that need any business license. Outstaffing is also served to involve workers in short-term projects, as well as in long-term ones according to the customer demands and business activity peculiarities.

Outstaffing is committed to providing a staff member with all essential work equipment, including the documentation of performance data, remuneration and financial performance statement, reported to the tax inspectorate. Meanwhile, the execution of mandatory insurance agreements, employee replacement and the company's personnel training are possible [2]. It was analyzed that the prerequisites for outstaffing use are as following: complex requirements of domestic legislation in the area of personnel records; reduction of the enterprise mobility by a large number of staff members while an increase of the dependence on them; managers and workers are overloaded with work and as a result they do not have enough time to fulfill assigned tasks; need for flexible working schedule; reduction of the expenditures on administration, staff costs and remuneration.

Key advantages, which are used by the firms that involve additional staff under the terms of outstaffing, include: a company can retain the status of private enterprise engaging a huge number of operating personnel; outstaffing customer avoids fine risks if temporary hired workers are guilty; minimization of time and money costs for personnel search, recruitment and termination and also for accounting records and time sheet documents maintenance.

The main disadvantages of personnel outstaffing comprise: temporary engaged personnel's lack of interest in promotion within a company-customer; a low level of work efficiency and interest in accomplished work; occurrence of disagreement while executing or implementing the outstaffing agreement provisions; misunderstanding

with permanent staff or management team, thus worsening the social and psychological climate within a working team; the temporary staff does not always make enough effort and carry out their work with devotion, thereby leading to the time wasting, financial losses resulting from production downtime caused by the backlog of work and actually a loss of confidence to the outstaffing company in the process of employees' replacement; temporary members can be not aware of certain peculiarities of the customer company's activity, which may lead to the decline in the performance efficiency, as well as to the eventual disclosure of commercial secret.

As a conclusion, it appears that personnel outstaffing supports generally the reduction of the level of administrative risks and costs related to the staff that has a positive impact on the efficiency improvement of the customer company's activities. At the same time, it requires examining the outstaffing company carefully, interviewing a temporary engaged personnel and total controlling the action of such workers at all stages of the project implementation settled by the customer company as it will help to keep the business secret safe and control the quality of the identified objectives realization.

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NEURAL NETWORKS AS A TOOL FOR FORECASTING THE MARKET PRICES DYNAMICS

Forecasting is a look into the future. It is a method, which forecasts the future prospects of the development of an event or phenomenon based on previously acquired knowledge.

Forecasting can be applied to a wide range of activities: economy, politics, production, social sphere and many others. The development of forecasting methods

is associated with the complication of information technologies, in particular, with the growth of volumes of stored data and the complication of forecasting methods and algorithms [2].

Price is the main mechanism of market relations. This is a complex dynamic system, the change of which depends on many factors, such as: production costs, supply and demand, exchange rates, inflation, etc.

It is extremely difficult to cover the whole spectrum of these factors in modern market conditions. Therefore, forecasting of the behavior of similar economic, political, social, and other systems is an intricately formalizable task. The forecast should be based, first of all, on revealing hidden interrelations and regularities between the individual variables of the system.

In addition, forecasting is based on an analysis of retrospective data; in other words, on the analysis of the past and present state of the object of research. As a result of forecasting, the risk of making incorrect, unreasonable or subjective decisions is reduced [2].

There is a large number of mathematical models and methods for analyzing economic indicators. Two approaches are the most popular: technical and fundamental analysis.

Applicable to market price of products, technical analysis is based on the rule that all objective costs of an enterprise (fixed and variable costs, costs of promotion, management costs, etc.) are already included in it. Therefore, the change of a market price is not an immediate reaction on external factors but depends only on the internal environment of an enterprise.

In its turn, fundamental analysis is a direction that seeks to study all the factors associated with the dynamics of price development: changes in market demand and exchange rates, the level of competitive prices and much more.

At present, various intellectual methods, in particular, neural networks are widely used for data analysis [1]. They are an alternative (or complement) for traditional research methods.

An artificial neural network is a mathematical model, as well as its implementation in software or hardware, built by analogy with biological neural networks. This concept arose when studying the processes occurring in the brain, and trying to simulate them.

Neural networks is a common name for special groups of algorithms with such an important property as the ability to learn, which is one of the main advantages of using them. In technical terms, the training of a neural network is a procedure for determining the coefficients of connections between neurons. The sense of teaching is that the neural network finds hidden interconnections and patterns that exist between input and output data, as well as generalizes them.

It is important to note that the analyzed data may be incomplete, contradictory or even knowingly distorted. In case of successful teaching, the neural network returns the correct result based on data that were not in the teaching set or were "noisy". The result of teaching is the stabilization of the network weights. In this case, they say that "the neural network has learned all the examples", "the neural network is taught" [1].

An artificial neural network is a collection of connected and interacting artificial neurons. Typically, neurons have a fairly simple architecture. Each of them deals only with signals that it either receives from other neurons, or sends itself. However, despite their simplicity, while connected to one large network with controlled interaction, they are capable of performing very complex tasks.

Recently, systems based on neural networks are becoming increasingly used to predict financial indicators and categories. This is justified by the following. Firstly, neural network analysis does not impose any restrictions on the nature and type of input information. Both data on total costs and information about the behavior of other market instruments can come to the input. It is especially important in the presence of a correlation between economic indicators. Secondly, neural networks, in addition to general recommendations, are able to find links and dependencies between individual market indicators, to build an optimal strategy for predicting the level of prices. Moreover, these strategies can be adaptive and vary with the market. It is especially important in rapidly changing market conditions.

The application of artificial neural networks in the economic sphere is based on one fundamental assumption – the replacement of prediction by recognition. The neural network does not predict the future, it tries to "understand" the current market condition, compare it with previously encountered situations and most likely reproduce the market reaction. To predict the dynamics of market prices, it is best to

use multi-layer perceptions. The construction of networks with feedbacks in this case is inexpedient because of the short-term memory of such systems and the complexity of their teaching.

Firstly, it is necessary to define the basic characteristics of the data and create a database. At the initial stage, the prediction of the price dynamics is reduced to approximating the functions of many variables from a given set of examples by means of the procedure of immersing a series in a multidimensional space. The neural network's ability to predict directly follows from its ability to generalize and isolate the hidden dependencies between input and output data [4].

Teaching of the neural prediction network is based on a standard approach. All examples are divided into three samples: teaching, validation and test. The teaching sample serves to adjust the synaptic coefficients of the trained neural networks in order to minimize the error at the output of the network.

The validation sample is used to determine the best of several taught networks, as well as to select the time of the termination of teaching. A test sample is needed to control the quality of forecasting. To train a neural network, it is not enough to generate training sets of inputs-outputs, it is necessary to determine the error of predictions. For market categories predicting, the root-mean-square error is ineffective, because when forecasting financial indicators, the main one is the one-pointedness of the forecast and the true value.

Therefore, the error of a neural network is represented as a function of the synaptic coefficients and is minimized by one of the gradient methods:

$$\mathrm{E} = -ln[1 + y * d],$$

where y – output of the neural network;

d – the desired output value.

The error value (E), averaged over all examples, is used to adjust the synaptic coefficients.

After teaching, the neural network is able to predict the future value of the market price based on previous values and other factors that may affect its change.

In conclusion, it should be noted that the use of neural networks in predicting the dynamics of market prices is a promising direction in the development of artificial intelligence systems. Now there are ready-made application products that will help in

solving this problem. Systems, based on neural networks, can significantly reduce the time and financial costs, accelerate the process of analyzing the current economic situation and forecasting the financial condition of an enterprise.

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AUFBESSERUNG DER CHARAKTERISTIKEN DES KRYOMOTORS MIT RINGBRENNKAMMER DES GENERATORGASES

Es ist bekannt, dass Schaltungen mit Abwurf des Generatorgases durch Treibdüsen oder mit seiner Nachverbrennung in der Hauptkammer der Triebwerksanlage die Einschränkungen in Druckgröße in der Kammer und spezifischen Schubimpuls haben, wenn für Turbineenergiezuführung der autonome Treibstoff nicht verwendet wird [1].

Ansteigen der Charakteristiken der Triebwerksanlage ist möglich bei der Nachverbrennung des Generatorgases in der Ringbrennkammer mit weiterer Schwallakzeleration der Verbrennungsprodukte aus der Haupt- und der Ring-brennkammer in der integrierten Treibdüse. Aber bei Ausnutzung der angebotenen Lösung sind Probleme zu erscheinen, die mit Erkaltung der Bildfläche des kritischen Schnittes der Nachverbrennungskammer des Generatorgases mit Tellerdüse verbunden sind. Deshalb ist es zweckmäßig im Erkaltungstrakt des Flüssigkeitsraketentriebwerks die schwammigen Materialien mit Interkanaltranspiration des kryogenen Treibstoff-bestandteils anzuwenden, der einen überkritischen Zustand besitzt [2].

Hohe Koeffizienten der Wärmeabgabe α im Erkaltungstrakt sind durch hochentwickelte Bildfläche des Wärmeaustausches zwischen den schwammigen Materialien und dem abkühlenden Treibstoffbestandteil erreicht, bei viel mehr niedriger Reynoldszahl, als in den verrippten Trakten, was zu Dämpfung der hydraulischen Einbußen im Vergleich zu den verrippten Erkaltungstrakten des Flüssigkeitsraketentriebwerks führt [3].

Derartige Entscheidung erlaubt, den Wärmeaustausch wesentlich zu intensivieren und die Ausnutzung der Schleierkühlungsgürtel abzulehnen. Dabei werden Einschränkungen abgeschafft, die mit der Siedemöglichkeit des Wärmeträgers im Erkaltungstrakt der Triebwerkskammer verbunden sind.

Die Nachverbrennung des Generatorgases wird bei der Überflusskoeffizienten-bedeutung des Oxydiermittels a > 1 verwirklicht. Also, in der integrierten Treibdüse auf Kosten der chemischen Interaktion zwischen den Abbrennungsprodukten aus Nachverbrennungs- und Hauptkammer, bei der a < 1, entsteht die Kräftigung von Düsenstrahlkenndaten.

Laut Ergebnissen der durchgeführten Abrechnungen darf es die Schlussfolgerung ziehen, dass die Anwendung des aussichtsreichen Erkaltungssystems und neuer schaltungstechnischer Entscheidungen erlaubt, Einbußen des spezifischen Schubimpulses des Flüssigkeitsraketentriebwerks und Masse der Hochdruckmagistralen abzumindern, Konstruktion der Speisungssystemaggregate zu vereinfachen und Zuverlässigkeit der Erkaltung der Kammer zu erhöhen.

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MODERN PROBLEMS OF INFORMATION TECHNOLOGIES

Nowadays, problems of engineering and technical sciences, as well as information technologies, are the most relevant and popular all over the world. Moreover, it should be noted that solutions of these problems are highly paid. So what problems have taken us by surprise and why we could not find solution for it?

The first and, perhaps, the most serious problem is the development of engineering and technical sciences in our country. In order to get highly qualified specialists in this field it is necessary:

1. to improve constantly the educational process;
2. to update the information that is used during the educational process;
3. to use modern technical equipment during the educational process.

The main problem of this is the shortage of staff in the field of information technology. The solution of this problem will not come by itself, but the possibility that it will be found in the next 100 years is also very small.

And here the following problem appears. If we cannot use our own information technologies because of their absence or significant disadvantages, it is obviously that the use of foreign information technologies is inevitable. Is it good for us? Yes, of course, and we do not see any problems in this. However, if we continue to adhere to this position, then the first problem, which was mentioned earlier, will not be solved even after 1000 years.

Another problem that needs considering is a low level of awareness of the population in our country, in particular, people from remote regions. This leads to the fact that even possessing modern information technologies, albeit foreign ones, we cannot use them in to the full.

And finally, one more problem concerns the data insecurity. Nowadays, the information is easy to buy, steal, destroy or modify. Precisely these actions bring about the emergence of "an abyss" between what we know and what we actually have.

There are so many problems that it may take long to list them. Unfortunately, we have nothing to boast if in this respect. There are many questions, but no solutions have been found so far. Should we worry about this? I feel positive that it is worth it if we want our children to have everything we do not have.

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THE STUDY OF Q FACTOR ESTIMATION ACCURACY

Resonance structures are widely used as primary transducers. In contrast to resonance circuits, applied in radio engineering, measuring circuits provide significant losses. For the measurement parameters analysis, it is reasonable to estimate the values of the resonance relationship maximum and a Q factor. Information about the estimation accuracy of the mentioned parameters, according to the traditional models, is important for correct measurements.

Let us suppose that there is a driving force which affects the oscillation circuit with the circular frequency p and the amplitude X_0 of the driving force per unit mass of the system. Let δ to be the damping ratio. Thereafter the oscillation amplitude has the following form:

$$A = \frac{X_0}{\sqrt{(\omega_0{}^2 - p^2)^2 + 4\delta^2 p^2}}. \tag{1}$$

To study the amplitude as a function of the frequency p of the driving force, a special program was developed (Fig. 1).
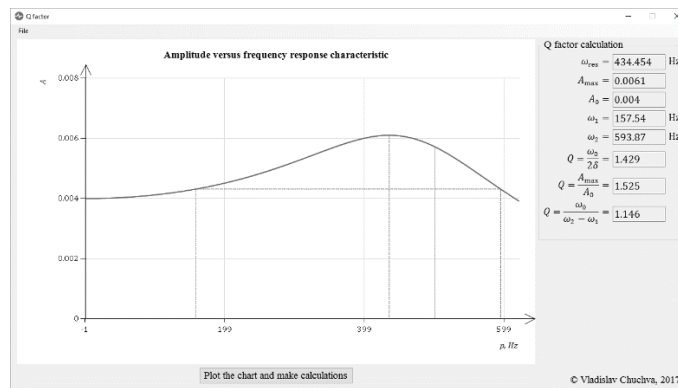
Fig. 1. The image of the program interface

The Q factor of the system is determined as a number of radians in which the phase of oscillations with the damping δ changes when the energy of the system decreases to the value e^{-1} from its initial value E_0:

$$Q = \frac{\omega}{2\delta}. \tag{2}$$

Due to the small damping $\delta \ll \omega_0$ the Q factor is expressed as follows:

$$Q = \frac{\omega_0}{2\delta}. \tag{3}$$

The ratio of the amplitude maximum value A_{max} to the displacement A_0 also expresses the Q factor:

$$Q = \frac{A_{max}}{A_0}. \tag{4}$$

In this case the Q factor characterizes an excess of amplitude of the forced oscillations at the moment of resonance over the value of the displacement A_0 caused by a constant force, which is equal to the amplitude of the driving force.

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The most widely accepted formula for the Q factor determination is the following:

$$Q = \frac{\omega_0}{\omega_2 - \omega_1},$$ (5)

where ω_1 and ω_2 are the values of frequency for which the oscillation energy is twice less than the energy maximum.

Let us use our program to calculate the Q factor values by the formulas (3), (4) and (5) and determine the relationship between these values with given values of X_0, ω_0 and δ.

For example, when $\omega_0 = 500$ Hz and $\delta = 175$ s^{-1} we have $\omega_{res} < \omega_0$ and noticeable deviations between the Q factor values calculated by different formulas:

- by (3) $Q = 1.429$;
- by (4) $Q = 1.525$;
- by (5) $Q = 1.146$.

For the same ω_0 value and for $\delta = 1$ s^{-1} we have $\omega_{res} \approx \omega_0$ and closely equal Q factor values calculated by different formulas:

- by (3) $Q = 250$;
- by (4) $Q = 250.001$;
- by (5) $Q = 249.999$.

Thereby, when $\delta \lll \omega_0$ it is possible to estimate the Q factor with the high accuracy by any formula.

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URGENT PROBLEMS OF DEVELOPMENT OF MODERN INFORMATION TECHNOLOGIES AND METHODS OF THEIR SOLUTION

In modern life, information has become an important component of economic processes. Recently it was difficult to provide information along with traditional resources such as energy, raw materials, etc., because of the difficulties associated with its collection, transmission and processing. Thanks to the rapid development of information technology as a means of information processing, it has become one of the most important components of social, economic and cultural development.

Information technology is present in many aspects of our lives. In addition, it doesn't stand still, but on the contrary constantly improve. According to the global report on information technologies for the 2016 by the World Economic Forum, the leaders in the development of information technologies today are Finland, Sweden, Switzerland, Singapore, Israel, the Netherlands and the United States.

Before considering the main problems of IT-sphere, we should clarify the concept and basic functions of information technology.

Information technology is a set of interconnected scientific and technical fields of knowledge that study and practice different methods of creating, processing, storing, protecting and transmitting information using computer technology.

The main functions of information technology are:

• Collection, preparation, analysis and storage of information;

• Creation of new information based on received and processed data;

• Solving optimization problems.

There are many problems that affect different areas and spheres of our life connected with the process of development of modern information technologies. These problems have a great influence on the economic state of our country.

One of the most important problems of information technologies in Ukraine is the lack of domestic developments and the predominance of foreign technologies. This process is related to the lack of proper interaction of individual information sectors (state, commercial, regional), which reduces the effectiveness of their work.

Another urgent problem is related to training of personnel. Today, staff training is a top priority for IT companies. To educate good specialists, it is necessary to form professional educational programs, centralize the learning process, organize it with attraction of teaching technologies with minimum human involvement, although it may be a problem of low quality of educational technologies.

Next problem is the vulnerability of information and networks. Malicious programs are developed as rapidly as any information technology, and every day there is an increasing number of viruses that can damage the information stored on computers. In addition, there is another threat to information – cybercrime. It includes the theft and dissemination of illegally obtained confidential information, cyber bullying, computer fraud, and so on. This is a very important problem and it causes great damage to the development of information technology.

The necessities for improving the efficiency of development of the IT-sector are:

• Appropriate financing of this sector by the state;

• Advanced training of IT professionals and using the latest technologies for it;

• Creation of an established system of interconnected information sectors;

• Improvement of legislation on information security;

• Development and creation of own domestic quality products in Ukraine;

Thus, information technology is an important element of economic and social development. Problems of this area entail corresponding problems in other aspects of our life. That is why analyzing and finding solutions to these complexities is an important issue that requires attention and action on the part of the state and society.

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HIERARCHY OF MATHEMATICAL MODELS OF HEAT AND MASS TRANSFER IN POROUS MEDIA

Different filtration flows of liquids and gases in porous media are widely used in a lot of modern technologies in many branches of industry. Because of that, importance of filtration flow research becomes completely evident. However, from the point of modern natural sciences, filtration flows in environmental natural media with correspondent heat and mass transfer is considered more important than, than industrial applications. Such flows take place in geology, ecology, agricultural sciences, and biology. There are a lot of physical phenomena in filtration flows, caused by interaction between filtration flow and rigid frame, including sorption/desorption of the transferred substances, their diffusions, pseudo-diffusion due to stochastic nature of capillary manifold, thermal conduction and convective transfer of heat, free convection and many other effects. Taking into account extremely complex geometrical shapes of domains specific for environment, any attempt of numerical simulation of full processes has to deal with huge computational difficulties. The present level of computational systems cannot provide necessary productivity. The only way to overcome the described difficulties is to build a hierarchy of mathematical models of the considered phenomena. Such approach proposes a set of simplified mathematical models instead one model, inducing all considered physical phenomena. Every introduced mathematical model considers one physical effect or two effects and their mutual interaction, for example, filtration flow in saturated porous media (one physical phenomena), filtration flow in unsaturated porous media (two physical effect), filtration flow with sorption/desorption of admixture (three physical phenomena), filtration flow with advective transfer of passive admixture (two physical effects) and other similar approximations. As the introduced mathematical models are simpler than general one, the correspondent initial-boundary-value problem can be solved numerically without extreme computational efforts. Besides of that, the physical effects, connected with the simplified mathematical models, can be numerically investigated carefully and in details. Such approach is very far from universal, but it

is simple, easy for calculations and it is full and exact enough for a lot of specific particular cases. However, part of cases of transfer in porous media remains unsatisfied by the proposed mathematical models. The following level of the considered hierarchy is destined for such complex cases. It is necessary to note, that the second and following levels of hierarchy requires a high art of researcher. Specific tricks are used to join different mathematical models, including asymptotic analyses, perturbation methods, combined numerical methods, qualitative analyses. There is not any universal approach for following levels, that is the disadvantage of this approach. Different mathematical models require completely different numerical algorithms. Starting from the first level of the considered hierarchy, boundary element, finite element and finite difference methods are applied in dependence on specific features of particular mathematical model. These three methods have completely different grids, approximation schemes and structures of the obtained results. Then, combining their numerical results is rather non-trivial computational problems. To overcome this difficulty, several combined numerical algorithms are proposed by the authors, in particular, combined boundary element and finite difference method, combined boundary element and particle method, combined boundary element and contour dynamics method (last two approaches are destined for passive admixture transfer case). Boundary element method is used in all developed combined methods, because it is the most effective approach for calculations in complex domains. Application of hierarchy of the mathematical models and the developed numerical algorithms to the considered problems is illustrated by several examples of numerical calculation.

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CLASSIFICATION OF MULTIPARAMETER OBJECTS

Nowadays, the scientific activity in engineering, medicine, biology, physics and other areas is closely connected with processing and analysis of data sets which contain information about objects in the domain.

The purpose of the study is to estimate the probabilities of erroneous solutions, as well as to analyze the efficiency of classification of multiparameter objects using entropy transformations and the complex criterion of nonparametric statistics, in the tasks of nondestructive testing and technical diagnostics.

We considered that the objects of classification are influenced by three factors that determine their condition.

Having a certain number of three-parameter objects with random parameters and samples of their measurements, it is necessary to select classes of objects with the same parameters. This problem can be solved by entropy transformations of sample measure-ents and by testing hypotheses about the equality of their math shift, scales and correlation links based on the criteria of Van der Waerden, Klotz and Bush-Wind [1].

Let us consider this problem with the example of the following two types of object difference. The first kind of differences: 1) objects differ only in the shift parameter; 2) objects differ only in the scale parameter; 3) objects differ only in statistical relationships (correlation coefficient).

The second kind of differences (shift, scales and correlations): 1) objects differ in one (unknown) parameter; 2) objects differ in two (unknown) parameters; 3) objects differ in all (three) parameters [2].

To test the possibility of using the Bush-Wind criterion to identify differences in the statistic patterns of entropy converters, we investigated the probabilities of making decisions on the identity of control objects in comparison with the standard, provided that the second object is different from the standard of the first and second class [3].

The usage of the complex criterion of non-parametric Bush-Wind statistics, together with the centrolineal transformations, allows us to classify objects of non-

destructive testing with high degrees of certainty (0.95). These methods help us not only to divide products into normal and defective, but also to establish the exact difference of each product from the "standard" [2].

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CLASSIFICATION ALGORITHM ON THE BASIS OF FUZZY LOGIC WITH EXTENDABLE NUMBER OF OUTPUTS

The main task is to map an object with specified characteristics in a set of other predefined objects. In the role of predefined objects, there will be some database that contains a lot of system outputs.

This algorithm is designed for case when it is not known in advance how many possible answers can be returned by the system. Or in the case when the system needs the property of extending the number of answers, while the rules of the system should remain unchanged. Such requirements allow to avoid additional checks of logical rules for the presence of contradictions, after adding new answers to the system.

The task is to identify the main characteristics of the object. The classification of the object passes according to these characteristics. Fuzzy rules are created for these characteristics. And then the fuzzy inference mechanism uses these rules[1].

Basically, the fuzzy logic system consists of the following objects [2; 3]:

1) Fuzzyfier – it is the mechanism that maps a crisp set to a fuzzy set.

2) Fuzzy inference mechanism – takes "fuzzy input data" – in fact the data created by the Fuzzyfier. Then, based on the basis of fuzzy logic rules, mechanism returns "Fuzzy output data" – data that is passed to the input of the defuzzyfier.

3) Defuzzyfier – it is the mechanism that maps a fuzzy set to a crisp set.

In this task, there is the addition of another object, the comparison mechanism. This mechanism compares each object that is entered into the system through a standard fuzzy logic algorithm and then we get some physical value that describes this object. Then all objects of the system outputs database also pass through the fuzzy logic algorithm. After that, the most similar object is searched.

Conclusions. The application of this algorithm can be seen on the website of the program, which classifies, maps an arbitrary user in a set of comic book characters database "CMD – Combat Marvel DC" [4].

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AUTOPHAGE LAUNCH VEHICLE – POCKET ROCKET FOR POCKET SATELLITE

The market of small satellites is arising nowadays. Small teams including student teams at universities can develop high quality, cheap and small (pico and nano) satellites. The technical process of assembling small satellites is very easy for experienced teamwork, because of microelectronic, microelectromechanical and microelectrooptical systems. Thousands and hundreds of thousands of personal satellites could be launched each year, according to experts and our estimation. Unfortunately, the activity in the market of micro satellites is low, because there are no dedicated launch vehicles [1].

Even space industry and global space market need dedicated rockets, for example the satellites. The properties of a dedicated launch vehicle will be: 1) $M_0 < 100$ kg,

2) $M_{pl} < 1$ kg, 3) launch cost < $0.1 m. According to today's situation, we can analyze that modern launch vehicles are far away from dedicated launch vehicles in terms of initial mass, payload mass and launch cost as well. At the same time, according to estimation of experts, in order to wake up the sleeping market of pico and femto satellites the cost of one launch will be less than $100 K. Such a cost corresponds to less than 1 ton – an initial mass of launch vehicle [1; 2].

It's impossible to estimate an exact figure for the number of micro satellites which were not built because of the launch problem [3].

The initial mass of a small launch vehicle is impossible to reach by means of conventional technology, even for zero payload mass [5].

Nowadays, it is impossible to develop a dedicated launch vehicle, because of a scale factor. Rocket structural mass rises disproportionally in respect to the total launch vehicle mass, while we try to design launch vehicle with smaller initial mass (smaller dimensions) [4].

We propose to produce a rocket which has a propellant, but no tank for it, and has an engine, but no feed system for it. Moreover, such a launch vehicle is a quasi-single stage rocket [5].

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THE MOST SUCCESSFUL DEVELOPMENTS BY UKRAINIAN DEVELOPERS AND ENGINEERS IN THE FIELD OF INFORMATION TECHNOLOGY

This report is a review of innovative developments and new devices which were made by our young talented programmers, developers and engineers during the previous year. The first development is a new image optimization service called Pixpie.

This service helps the web and mobile projects to keep and deliver images faster depending on the quality of Internet connection and reduces expenses on CDN (content delivery Network).

The next development is a device called EcoCitizens. This product helps to create the database of ecological information and makes this database accessible with the help of Internet, mobile application and API (application programming interface). All information about the conditions of environment has a geospatial peg. This means, the information shows specific problematic cities and regions.

The last device is called «Cardiomo». It is a portable device which can trace general parameters of a human organism and transmit analyzed data to a smartphone. This device also informs users and their relatives or a doctor about possible deviations in the functioning of an organism. In addition, which is very important, relatives can get push notifications from the device to their mobiles.

All the innovations described in the report have been introduced into many hackathons and displayed at the exhibitions of technologies. Ukrainian inventions were recognized as absolutely new developments which could make peoples' lives more secure, comfortable and efficient.

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SOME BASIC THINGS TO KNOW ABOUT GAMEDEV

Gamedev has never been too popular of a field in the World. Neither it was in Ukraine. Even less popular, in historical means which we are not to discuss now, I guess. But with current generation this might change. Many people, though, have this thought that working in gamedev is like becoming an astronaut. Well eventually not anymore. It isn't even necessary to be a part of a big company that just churns out a game after a game. Hundreds of indie projects keep crippling that common prejudice that guys like Ubisoft are the only ones who know how to make games out there. But eventually we are here for a little more technical details, so I'll get to the point.

So you are up to making a game of yours. Under any circumstances you'd need to pick a language. Sure thing, Python is moving, smashing everything on its way and I don't really mind that one, but for now we are to discuss some good old rivals. So, C#/C++.

AAA commercial projects:

C++ for the core game engine for optimal game loop performance and intimate control over resource usage which is important as games can often need to run in very resource constrained environments like on consoles or mobile devices. Its excellent performance also allows experienced developers to squeeze out more potential from hardware which is important when competing against many other developers trying to impress people with their games. The better the performance, the more likely you are to be able to fit extra graphical features in or more content on screen.

C#: Used to write tools to assist in processing assets or other misc work that allows both developers and non-developers to be productive. Tools often just need to perform well enough and you don't always care about memory leaks since the tools are rarely released to the public, so letting the runtime handle memory management rather than spending developer time on it is convenient. Increasingly being used for scripting the C++ game engine's behavior as even large studios are seeing off the shelf cross-platform solutions like Unity as optimal for business.

Indie games / less complex AAA projects:

C++: Occasionally used to write game engines, but due to the not-insignificant burden of porting the custom engine to a large number of different platforms which is

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important for smaller developers that need to maximize their reach, this is often done for the learning experience more than practicality. While it's possible for an indie developer to compete by writing a custom C++ engine that impresses customers not unlike AAA developers, it's a rare exception and considered unlikely to pay off in the end considering the number of high quality engines already available to use. Also sometimes used to write custom native libraries to call from C# code, so performance critical sections can still be written in C++.

C#: Often used to script against existing game engines and write tools, but has also been used to write game engines. For even fairly complex games the .NET runtime can perform well enough, but as there is some overhead it's even more important to know the ins and outs of how the runtime works in order to write optimal code that can compare to a C++ equivalent. While .NET in general doesn't require you to manage your own memory, for high performance scenarios like games it is a common mistake to assume you should mostly ignore it and let the garbage collector do its thing.

For the already available game engines: I'd love to say: "Here is engine "Alice", it is written on C++, here is how it performs, while here is engine Bob…" but unfortunately, it's never that easy. Two major engines which many beginners choose to begin to work with are Unreal Engine and Unity. While UE is written fully with C++, Unity combines C#, C++ and C. This of course doesn't mean members of one of those two generally pretty offensive camps are right, and the members of another one are wrong. Unity has a wider and more opened community which provides you with more good tutorials and useful information, while UE is deeper with its abilities and some experienced Unity developers switch to UE. But that's a long theme to discuss, so I guess we should stop here.

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CLOUD COMPUTING VULNERABILITIES

Each day, a fresh news item, blog entry, or other publication warn us about cloud computing's security risks and threats, and in most cases the problem of cloud computing security is set as the main roadblock for cloud computing. However,

sometimes it is really difficult to formulate an adequate assessment of the security itself for the two reasons. The first one is about using basic terms that refer to security, such as risk, threat, and actual vulnerability are commonly used as the interchangeable ones. And the second reason tells us that not every issue that is being discussed really is specific to cloud computing. A key factor here is security vulnerability. It is not about risks, it is not about threats, it is about vulnerability. So how can we define the word "vulnerability"?

Vulnerability is the probability of your "set up" not being able to resist the actions of some threat agent. Vulnerability appears when there is a difference between the pains being taken by the agent, and your "set up" ability to resist the forces being created. So, vulnerability must always be described in terms of resistance to a certain type of attack. As an example we could take a car's inability to protect the driver against injuries when it is hit by a truck. The resistance of the car's zone that is going to be crumpled is just too weak as we compare it to our truck's force. It is the actual vulnerability and it is specific to the actual object (the car).

Talking about the vulnerabilities that are specific to cloud computing we can create a model that can tell us how our cloud computing vulnerabilities could look like, and what vulnerabilities we can really name as cloud-specific. So, vulnerability is cold-specific if it:

- is intrinsic to or wide-spread in cloud computing technologies;

- has its main cause in one of NIST's (the US National Institute of Standards and Technology) essential cloud characteristics (on-demand self-service, ubiquitous network access, resource pooling, rapid elasticity, measured service);

- is wide-spread in established modern cloud computing.

The main three examples of such vulnerabilities are based on three core technologies that form the basis for cloud computing: web application and service technology (to implement the services that would be comfortable enough for customers to use), virtualization IaaS (infrastructure as a service) offerings, and cryptography. The first example is virtual machine escape. The attacker may successfully escape from a virtualized environment into the inner structure with the aim of changing and damaging it. Second, a lot of web application sessions are vulnerable to session riding and session hijacking. The third one – the ease of the ways that could be used for

analyzing the cryptographic techniques that are used to realize the cloud computing security requirement. Nowadays there are so many methods that have been discovered and this fact makes creating cryptography techniques more and more difficult and challenging. And the final problem is about provider actual inability to control other users' infrastructures as they are supposed to. The result flaws into stealing the data and DDOS (Distributed Denial-of-Service) attacks.

So, as cloud computing is evolving constantly new cloud-specific vulnerabilities emerge. Some of them become bigger and some become not been worthy of being called "vulnerabilities". However, control challenges typically highlight situations in which otherwise successful security controls are ineffective in a cloud setting, and as a result we get new way of controlling the vulnerabilities that can be commonly used in different situations.

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WHAT IS AUTOMATIC PROGRAMMING?

The meaning of «automatic programming» has shifted in time, reflecting the general evolution of human-computer communication and of programming methods.

Mildred Koss, an early UNIVAC programmer, explains: «Writing machine code involved several tedious steps – breaking down a process into discrete instructions, assigning specific memory locations to all the commands, and managing the I/O buffers. After following these steps to implement mathematical routines, a sub-routine library, and sorting programs our task was to look at the larger programming process. We needed to understand how we might reuse tested code and have the machine help in programming. As we programmed, we examined the process and tried to think of ways to abstract these steps to incorporate them into a higher-level language. This led to the development of interpreters, assemblers, compilers, and generators – programs designed to operate on or produce other programs, that is, automatic programming» [1].

Originally, automatic programming consisted in leaving it to the computer to produce a translation into machine code of the description of an algorithm for solving

some problem, expressed in some algorithmic language. Subsequently, automatic programming was understood to include a method for the directed synthesis of an algorithm from a compact problem description, restricted to some fixed class of problems [2].

In the 1970s the concept of automatic programming was extended to cover a comprehensive procedure for the synthesis of an algorithm in the framework of a much wider language for formulating problems, not limited to a specific class. Such a synthesis entails a correctness proof for the algorithm and employs formal approaches such as various models for the semantics of natural languages, predicate calculus and theorem-proving techniques.

So, automatic programming is a type of computer programming where program code is automatically generated by another program based on certain specifications.

A program that writes more code is written, which then goes on and creates more programs. In a way, translators may be considered as automatic programs and the high-level language they are translating into a lower-level language is the specification.

Automatic programming didn't always mean the generation of programs by another program. Its meaning evolved over time. In the 1940s, it meant the automation of the manual process of paper-tape punching which were the programs of punched card machines. Later it meant the translation of high-level programming languages such as Fortran and ALGOL into low-level machine code.

There are currently two types considered to be automatic programming:

Generative programming: This is what normally happens in today's programming where standard libraries are used to improve the efficiency and speed of programming. For example, in C++, the cout function is a part of the standard library, and the compiler simply supplies the code for cout during compile. The programmer does not need to re-implement it or even need to know how it works.

Source code generation: Source code is generated based on a model or template which is made through a programming tool or an integrated development environment (IDE) [3].

Thus, within the framework of this programming paradigm, the problem of specification and realization of complex behavior is formulated for the first time explicitly, it is proposed to use traditional programming methods in conjunction with the ideas of automata theory and automatic control theory.

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THE KEY POINTS IN SWIFT AND OBJECTIVE-C PROGRAMMING LANGUAGES

The programming language Swift appeared 3 years ago and received many feedbacks both positive and negative. Swift has stated itself as a popular new programming language for iOS applications as well as an excellent tool for writing software for various Apple products. However, there is also quite a dangerous competitor – the Objective-C programming language, which had coped well with the development of applications for Apple company devices before. So, there is a question which language is better to choose: Swift or Objective-C [3].

At the moment, Swift is a new programming language for iOS, macOS, watchOS and tvOS applications that are built on the best C and Objective-C, without C's compatibility limitations. Swift uses secure programming templates and ads advanced functions to make programming easier, funnier and more flexible. For a long time Objective-C has been the only main programming language used to create OS X and iOS applications. Essentially, Objective-C is a superset of regular C with added object-oriented functions and dynamic time execution. Objective-C++ is an Objective-C variation that adds support for C++ syntax, allowing you to compile source files that contain C++ [1].

I should say that the run time in Swift lags behind Objective-C and there is a good chance that it will not be able to catch up in this respect for years to come. Curently, Objective-C is being chosen when it comes to creation of the code that finds its benefits from reflection and deep introspection of types and objects. Such code is used more often for a complex SDK, but also it sometimes can be found in applications [2].

It is important to note that Swift is much ahead of Objective-C when it comes to the stability of the code itself. This is due to the strong text input system and the error

handling method. Just avoiding operators and the following idiom Swift – you can easily write code that takes into account all possible errors. There are, of course, some exceptions. One of the remarkable examples of an error that can hit both Swift and Objective-C code is a memory leak from the hold cycle. The main reason for this error is the fact that the Swift method automatically refers to the counting system, remaining unchanged with Objective-C. Objective-C also works much better with C++ libraries or C++ SDK cross patches, because every time you want to use another part of the C++ library with Swift, you need to add additional overhead [2; 4].

Besides, Swift supports all new versions of MacOS and iOS, as well as any iteration of tvOS and watchOS. Though, if you need to create a project for older systems (older than 10.9 for MacOS and 7 for iOS), you must use Objective-C, because Swift does not support them. Swift projects seem to be more prospective than the ones written with Objective-C. Nowadays, the use of Swift is increasingly spreading since its first appearance and it is used in 1/3 of all projects with open source Cocoa. If the rate remains unchanged, the number of such projects will be equal to the number of Objective-C objects [2].

In conclusion, I would like to say that you need to use Objective-C if you work with low-level applications or the ones that must support the old OS X 10.9 / IOS7 and software that require the use of C ++. As for Swift, it is best used in: applications oriented to OS X 10.9 / iOS 7 and later, because it has more modern code syntax, open source code and in the future it can be used on other operating systems, static runtime.

Thanks to modern syntax, Swift learning is simpler than Objective-C, but you must be ready that Swift does not support old operating systems, so if you know C or C ++ it will be easier for you to learn Objective-C.

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ALGORITHM FOR CONSTRUCTING THE SET OF ALL ORDERINGS GIVEN LENGTH, MATCHING PREDETERMINED CRITERIA

We have the graph $G = \{V, U\}$, where $V = \{1, 2, ..., n\}$ is the set of vertices and U is the set of arcs. Graph $G = \{V, U\}$ is a mathematical model of restrictions on the order of performance of works, where V is the set of works and U – is the set of technical limitations. And we have required length of the ordering $l(S)$. That is, the number of non-empty places of ordering S. We need to place the vertices of the graph on l places so that the technological requirements that are specified by this graph are not violated, and to construct all such orderings. This is relevant both from the theoretical and from the practical point of view. We present an algorithm with polynomial complexity in this paper. Even if we solve the optimization problem of finding the ordering of the minimum width, the problem is NP-complete [1].

Algorithm for constructing all orderings of vertices of the graph G which have the length l:

1. We build special orderings $\underline{S}$ and $\overline{S}$. If $l < l_0$ (l_0 is the length of the special orderings $\underline{S}$ and $\overline{S}$), it is impossible to build order.

2. For each vertex of the graph G we determine the interval of the number of places $[k, m]$ on which this vertex can be in the ordering:

2.1. If $l = l_0$, k is the number of place of the vertex in the ordering $\underline{S}$, and m is the number of place of the vertex in the ordering $\overline{S}$.

2.2. If $l > l_0$, k is the number of place of the vertex in the ordering $\underline{S}$, and m is the amount of the number of place in the ordering $\overline{S}$ and the difference $(l - l_0)$.

3. To the empty ordering S_0 we add to the corresponding places vertices for which $k = m$, if there are any (if $l = l_0$). These tops are marked as used.

4. We build an ordering tree:

4.1. As a root, we take the ordering S_0.

4.2. Among unused vertices we choose a vertex v_i for which the difference $(m - k)$ is minimal.

4.3. To each branch of the tree we add leaves, the number of which is equal $(m - k + 1)$ (each leaf corresponds to a certain part of the ordering), placing the vertex v_i in each leaf on one fixed place so that all places of the acceptable gap were used.

4.4. We check for each ordering whether the initial conditions are violated. If the conditions are violated, this ordering is removed from the tree.

4.5. The vertex v_i is marked as used. If not all vertices are used, go to step 4.2. In the other case, we have obtained the desired set of orderings.

The construction of the set of all orderings of length l can be used in the analysis of algorithms for some optimization problems on graphs, in particular the problem of constructing a parallel ordering of vertices of the graph of minimum width.

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DEEPCODER: LEARNING TO WRITE PROGRAMS

Our artificial intelligence systems are continuing to get smarter! Researchers at Microsoft and Cambridge University have built a highly sophisticated computer called DeepCoder that can now allow machines to write their own programs. This is aimed to make job easier for users who do not know programming languages well enough to use them efficiently, or even help people having no experience in writing simple coding programs. The authors said in their work that they were proposing two main ideas: "(1) learn to induce programs; that is, use a corpus of program induction problems to learn strategies that generalize across problems, and (2) integrate neural network architectures with search-based techniques rather than replace them".

DeepCoder uses a technique called Learning Inductive Program Synthesis: creating new programs by piecing together lines of code taken from existing software – just as a programmer might. Given a list of inputs and outputs for each code fragment, DeepCoder learned which pieces of code were needed to achieve the desired result

overall. It is important to keep in mind that DeepCoder uses the expressive power of their Domain Specific Language, programming language that is suitable for a specialized domain but is more restrictive than full-featured programming languages. It is inspired by query languages such as SQL or LINQ, where high-level functions are used in sequence to manipulate data. A program in DSL is a sequence of function calls, where the result of each call initializes a fresh variable that is either a singleton integer or an integer array. Functions can be applied to any of the inputs or previously computed (intermediate) variables. The output of the program is the return value of the last function call, i.e., the last variable. Overall, DSL contains the first-order functions HEAD, LAST, TAKE, DROP, ACCESS, MINIMUM, MAXIMUM, REVERSE, SORT, SUM, and the higher-order functions MAP, FILTER, COUNT, ZIPWITH, SCANL1.

For example, here is the solution to the problem about candies (left) with a text description (on the right) and incoming values (in the center):

| s ← [int]
p ← [int]
c ← SCANL1 (+) p
d ← ZIPWITH (*) s c
e ← SUM d | Input:
[4 7 2 3],
[2 1 3 1]
Output:
62 | Description:
Zack always promised his n friends to buy them candies, but never did. Now he won the lottery and counts how often and how many candies he promised to his friends, obtaining arrays p (number of promises) and s (number of promised sweets). He announces that to repay them, he will buy s[1]+s[2]+...+s[n] pieces of candy for the first p[1] days, then s[2]+s[3]+...+s[n] for p[2] days, and so on, until he has fulfilled all promises. How many candies will he buy in total? |

**Fig. 1. Example of the program in Domain Specific Language (DSL),
together with input-output example and short description**

One advantage of letting an AI loose in this way is that it can search more thoroughly and widely than a human coder, so could piece together source code in a way humans may not have thought of. What is more, DeepCoder uses machine learning to scour databases of source code and sort the fragments according to its view of their probable usefulness. All this makes the system much faster than its predecessors. For now, DeepCoder can only solve simple programming problems that require around five lines of code, but the researchers are hoping to scale up the system. As DeepCoder learns which combinations of source code work and which ones do not as it goes along, it improves every time it tries a new problem.

The technology could have many applications. In 2015, researchers at MIT created a program that automatically fixed software bugs by replacing faulty lines of code with working lines from other programs. Brockschmidt says that future versions could make it very easy to build routine programs that take information from websites, or automatically categorize Facebook photos, for example, without human coders having to lift a finger. We should point out that these systems will not put programmers out of a job. With program synthesis automating some of the most tedious parts of programming, he says, coders will be able to devote their time to more sophisticated work.

In conclusion, DeepCoder represents a promising direction forward, and we are optimistic about the future prospects of using machine learning to synthesize programs.

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COMPETITIVE PROGRAMMING

Competitive programming (olympiad on programming) – is a mind sport directed to solving problems using powers of computers. The general goal of participants is to write a fast and productive algorithm, which solves the given problem, either finding a path in the maze, or finding some pattern in sequence. A problem is marked as solved, when the program, developed by competitors, passes all prepared tests, which are initially unknown to developers.

A short excursion into the history:

The first olympiad was held in 1970s, and now it includes more than 80 countries as competitors. Initially it was held only in schools and institutes. Interest to the contest began to grow actively since 2000 due to dissemination of internet, which allowed to hold competitions online, which helps to avoid geographical problems.

The biggest olympiad is ACM International Collegiate Programming Contest [3], sponsored by the companies such as Microsoft and IBM. The first contest was held in 1977, and was finished with the victory of the team of University of Michigan. Most titles belong to the teams from USA – 17.

Initially competitions on programming were named olympiad, but with the increasing of popularity received a new name – "competitive programming". New competitions have appeared, which aren't connected in any way with the sphere of education, i. e. even professional developers can participate in them. For example, portal TopCoder[2] is one of the most popular sites of competitive programming. The rounds are held very often, as a result of which competitors receive points, the number of which determines their location in rating. On the territory of the CIS a similar site exists – CodeForces [4].

Also, many of biggest IT-companies hold their own competitions:

Google – Google Code Jam [5]

Facebook – Facebook Hacker Cup [6]

Yandex – Yandex.Algorithm (since 2011)

VK – VK Cup (since 2012)

Winners are very often invited to the company-organizers.

Competitive programming is a fast-growing discipline, which increases not only software development skills, but also logical thinking, that in 21th century is a very important quality for the successful promotion on the career ladder.

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THE FUTURE OF THE .NET TECHNOLOGIES

Announced by Microsoft in 2002, .NET has become one of the most used and mainstream platforms of software development. Even at the very beginning .NET was famous for its type-safety, automatic memory management and object-orientation. But back then the application support was still limited. Today .NET provides endless possibilities to build a required app.

There are multiple implementations of .NET available now, so the developers can choose the most convenient one for their needs. These implementations are optimized for specific operational systems (Windows/Linux/MacOS/iOS/Android) and workload types (server/desktop/mobile). All of them are based on .NET Standards which describe the fundamental ideas of the platform.

Three main elements of .NET ecosystem are .NET Framework, .NET Core and Xamarin. All of them support same languages, compilers and runtime components. However they are designed to solve different tasks.

.NET Framework is a platform for .NET applications on Windows with a huge class library known as the .NET Class Library, which supports a variety of applications and solutions on Windows, which includes ASP.NET, WCF, WPF and Windows Forms. All this has brought a worldwide popularity to the platform. New features are added constantly. The latest version as of March 2017 is .NET Framework 4.6.2, released in August 2016. This gives us the reason to believe that Microsoft will continue to work on it.

.NET Core is a new cross-platform version of .NET designed to create web apps, console applications, microservices and libraries which are able to run on Windows, Linux and MacOS. Instead of using a single class library, like its predecessor .NET Framework does, .NET Core has a modular collection of libraries, which allows developers to include only those libraries that are needed in a particular project. In addition .NET Core is open source and currently available on GitHub.

Xamarin Platform is designed to create mobile apps on Android, iOS and Windows phone. The base of Xamarin is Mono, which is an open source cross-platform implementation of .NET from Mono Project community.

There has been 15 years since the release of .NET Framework. For all its history has been provided a great platform for web and native development, appreciated by millions of programmers worldwide. A lot of capabilities have been added during the evolution from .NET Framework 1.0 to .NET Framework 4.6.

However, the IT industry is changing all the time and even technologies that are at the peak of popularity now will eventually lose their positions. So even though .NET Framework is a very mature and rich framework, its successors .NET Core and Xamarin are likely to become way more popular in the nearest future.

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PROBLEM OF VITAMIN C DEFICIENCY IN PRESCHOOLERS AND WAYS TO OVERCOME IT

According to the SES of Dnipropetrovsk region, in February, 2017, there was an increase in the epidemic of influenza and ARI among children under 17 [4]. Only a group of children aged 4-6 who attend kindergartens will be considered. According to the norms of the Ministry of Health of Ukraine, the content of vitamin C in the diet of children aged 4-6 years should be 50 mg per day [2]. In our opinion, the lack of vitamin C in the diet of preschoolers is due to a number of reasons:

- technical: with sufficient content of vitamin C in raw materials, its content is lower than the calculated one. Most often this is due to violations in the technology of cooking;

- organizational: during the period of maximum demand for vitamin C (the period of worsening of the epidemiological situation in ARI and ARVI), children receive it in usual or in insufficient quantities;

- informational: ignorance of parents about the importance of a full-fledged diet containing enough vitamins, in particular vitamin C.

The Ministry of Health of Ukraine has developed detailed recommendations on the organization of nutrition for preschool children in educational institutions in accordance with the Instruction [3]. But it is necessary to place emphasis on increasing the level of informatization of parents about the benefits of vitamins, the principles of proper nutrition and the need for vitaminization. In addition, it is necessary to develop the approach to this problem from a technical point of view. Namely, the following dishes should be introduced into the diet of preschool children:

- compote of apples and / or dried fruits should be replaced with acid or compote of black currant;

- tea with sugar should be replaced with tea with lemon;

- an infusion of dog rose (with lemon, with kalina, with currant) should be added;

- vegetable salads should be with vegetable oil and lemon fresh;

- instead of fruit juice a lemon drink should be given to children.

Thus, the task of providing children of preschool age with the necessary amount of vitamin C in children's nutrition is to organize the implementation of these recommendations, taking into account the individual characteristics of the child and the children's collective as a whole, the financial situation of the family, living conditions in a specific locality, epidemiological situation and time of the year.

The main sources of vitamin C are fruits, vegetables and dairy products.

However, the loss of vitamin C will be inevitable when cooking. Therefore, in the finished dish, the content of vitamin C will be less.

Based on the above material, we can draw the following conclusions. The elimination of the shortage of vitamin C is advisable in the nutrition of preschool children:

- constant educational work with parents in terms of organizing rational nutrition of children;

- observation of the technological process of cooking at the food unit and exercising control by the production managers.

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TRINARY CALCULATIONS

Progress cannot be stopped. It is believed that quantum computers will become revolutionaries in the IT. The main principle of their work is connected with the phenomena of quantum superposition and quantum entanglement. Current electronic devices use electrical voltage. They are based on binary computations, but with the arrival of quantum computers, trinary calculations are becoming a reality.

What are they remarkable about? Trinitarian logic and arithmetic are interesting for their properties. According to the statement, expressed and proven by one of the founders of computer science John von Neumann, the «ideality» of the number system can be determined by the arrangement to the Euler number. Indeed, the ternary number system is closer to the number «e» than the binary one [2]. But this is not a determining factor. One of the advantages is the natural representation of numbers with a sign. That is, you do not need to use forward, backward, or additional code [1]. There is no need for a special signed bit, because the sign of the number is determined by the sign of the highest non-zero digit. Tables of multiplication and division are also simple, as in the binary system – multiplication by -1 inverts the contents. In addition, the three-level signal is more resistant to interference in transmission lines [2].

It would seem that there are many benefits, but there are difficulties. One of the most serious is the development of integral elements with three states. It is very difficult to improve one without worsening the other. We are talking about transistors – important elements of current computers, with the help of which binary is realized: they must be either open or closed. Being in a semi-open state causes a strong overheating. And in order to prevent this: signal levels – high and low – should be well distinguished and fully open / close transistors. Of course, you can realize triplicity with existing methods, but this requires an increase in the number of transistors, at least twice, which is not good. A possible solution is the development of purely «triple» elements. Here comes the turn of quantum mechanics. The basic ideas will be realized at the atomic level, where the principle of superposition rules: a subatomic particle is in several states simultaneously. For example, an electron can be in states – «spin up» and «spin down». Until we find out which state it is in, the electron is at once in both, or in one of two. Is not this a triplicity? However, in practice everything is more complicated.

Despite the fact that the first computer working on ternary logic was «Setun», built in the Soviet Union in 1961, this topic did not take root [1]. Abroad, for example, PDP-8 was developed, but domestic development produced better indicators and was cheaper at cost. But for unknown reasons, «Setun» was frozen. Interestingly, Bill Gates programmed on the PDP-8 [1]. Then the world chose a dual vector of development, because it seemed more logical and correct. Now many

people see the future behind the ternary logic. So it remains for us to wait for the invention of this working version of a quantum computer.

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QUANTUM COMPUTERS

A huge number of devices surrounding us are created on the basic rules of Quantum Mechanics. These rules are completely different from the Classical Mechanics ones, due to the fact that all objects and phenomena in Quantum Mechanics are considered as the elements of microcosm.

A quantum computer is a contemporary generation of the quantum world. Despite the fact that the power and speed of modern computers is constantly growing, quantum ones can be used to solve all computational problems. It is believed that quantum computers could help to overcome some of the limitations that occur during the using of standard ones.

So what the quantum computer is? A quantum computer is a mechanism, which is a medium that links Computer Science and Quantum Physics, where the last is the most complex section of theoretical physics. Richard Feynman, a prominent physicist of the twentieth century, once said: "If you think you understand Quantum Mechanics, you don't understand Quantum Mechanics".

Quantum Physics deals with elementary particles which are smaller than an atom. How these particles look and how they behave is contrary to many of the standard beliefs about the Universe. Normally (in the everyday sense) quantum particles behave only in case when we are constantly "spying" on them, or, in other words, continuously measuring their conditions. But if we stop the observation,

quantum particles start changing their well-defined state into several different ones. An electron (or any other quantum object) appears to be partially located in one point partly in the other and etc. This does not mean that it is divided. If it were, it would be possible to isolate any part of the electron and measure its charge or mass. But experience shows that after the measurement the electron is always "unharmed" in one single point, despite the fact that it had been almost everywhere at the same time. To illustrate this phenomenon, we suggest an example. Imagine that we flip a coin. While it is in the air, we can't tell whether it's heads or tails. That is to say that this coin is heads and tails simultaneously. Quantum particles behave like that. This is called the principle of superposition.

A quantum computer is a hypothetical device that will use the principle of superposition (and other quantum properties) for calculations. A standard computational device works by using transistors, which perceive any information as ones and zeros. That is classic bit can take values either "1" or "0". Quantum bit or qubit does not have in fact any particular value before measurement. But it has "state": $|1\rangle$ and $|0\rangle$ (those weird parentheses scientists have agreed to use to distinguish the condition from ordinary numbers 1 and 0). So in a general case the qubit is in a superposition of these states. Due to this a quantum computer will be more powerful than a standard one and will allow us to solve unexpected problems that other computers are not able to manage.

However, the principle of superposition is not the only thing on which the quantum computers will be based. Considering the fact that quantum computers exist only in theory, scientists are still dwelling on how they will work. For example, it is supposed that quantum computers will use quantum entanglement. Albert Einstein this phenomenon called "spooky". The essence of the phenomenon is that two particles in the Universe can be linked. That is, if we say that charge of the first part is positive, then the charge of the second one will always be negative, and vice versa. This phenomenon is called "spooky" for two reasons. The first: this relationship works instantly, faster than the speed of light. The second: the linked particles can be at any distance from each other (for example, at different ends of the Milky Way).

Unfortunately nowadays the creation of quantum computers is only a dream. But just imagine what our life would be like thanks to them. It is believed that quantum

computer will be able to solve tasks that an ordinary computer is simply not able to, or which would take thousands years of computing. A quantum computer will be able to work with complex simulations. For example, to calculate whether there are intelligent beings in the Universe, besides humans. It is possible that the creation of quantum computers will lead to the creation of artificial intelligence.

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MODERN STANDARDS OF VIDEO DATA COMPRESSION IN THE INTERNET

Introduction. The appearance of the Internet has immediately changed people's lifestyle. 20 years of its development gives us an opportunity to establish new communications. Now we can get information any moment from any point in the world. Thus, the Internet has become an important and multifaceted area of new research.

Since its appearance and until today, the internet has changed noticeably. The development of technologies has made it possible to transmit not only texts with images, but also large video streams, using intricated dynamic web technologies. All of them are designed to simplify, accelerate, expand the interaction between a computer and a human.

We did this research to present the most popular technology of data compression. The next part briefly introduces main methods and technologies of media compression. Namely we consider the standard H.264. In the conclusion of the report we discuss the efficiency of new technologies and their future improvement.

To begin with, let's decide what do we compress the video for. Uncompressed video file is a three-dimensional array of bytes. Each pixel consists of 3 bytes (red, green, blue). It's not difficult to count the amount of information. $1980*1080*60*3 = 374$ megabyte per 1 second! It's worth compressing.

Experiment. Let's save a screenshot of a web page into a file of PNG format. Then we transform this image into a movie of 5 seconds' length. As a result, the PNG image takes about 1000 kb, and the video does only 200 kb! Why does one frame in

PNG format takes up to five times more space than 60 * 5 frames compressed by the H.264 standard? The thing is that the H.264 standard uses more advanced technologies of information compression. Of course, it's a compression with losses, but the results are still impressive.

Consider new compression technologies. As usual, entropy coding is used, which provides basic and minimal compression. It's minimal due to the complexity of encoding 3D data. 2D corresponds to pixels and 1D to time. In this standard, data is encrypted with an algorithm "Huffman coding" type.

Next comes the transformation into a frequency space with quantization. This method changes the basis of coordinates with the change in the system of calculus (from binary to hexadecimal and vice versa).

Color processing. Colors are converted from three colors' palette (RGB) into two colors one with an additional coefficient of brightness. In this way, we can compress colors with minimal loss of hues.

Now we come to the most interesting thing. The methods mentioned above have been used before in other formats (PNG, JPEG, GIF). In H.264 due to monitoring of similar frames appearance, it became possible to anticipate the next frames. For example, suppose that in the video there was a light scene of 4 seconds' length. Why storing 100 video frames of information with pixels of maximum brightness? That's right, let's declare all the frames the same! Here again entropy coding helps us. But the one aimed at working not with a matrix, but with a set of same matrices. It is here that this kind of coding realizes itself in full force. And if a bird appears on our white background, then we will be able to predict its movement across the screen. Rather, we "compensate" the movement of the pixel block.

Conclusion. As we see, there is no revolution: H.264 uses the same algorithms as the photo compression. But due to H.264 we managed to compress video more effectively – up to a bandwidth required. Yes, the algorithm of compression implies losses, but they are difficult to discern. The disadvantages are in the dependence on the encoder and decoder capabilities. But the development of CPUs makes it a weak drawback. Nowadays, H.264 copes with HD video. The H.265 is drawing near, with an improved prediction algorithm optimized for 4k video. So, HDR and VR will become a common place in the nearest future.

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GREEN CAR TECHNOLOGIES

Full Self-Driving Hardware On All Cars

All Tesla vehicles produced in our factory, including Model 3, have the hardware needed for full self-driving capability at a safety level substantially greater than that of a human driver.

Advanced Sensor Coverage

Eight surround cameras provide 360 degrees of visibility around the car at up to 250 meters of range. Twelve updated ultrasonic sensors complement this vision, allowing for detection of both hard and soft objects at nearly twice the distance of the prior system. A forward-facing radar with enhanced processing provides additional data about the world on a redundant wavelength that is able to see through heavy rain, fog, dust and even the car ahead.

Processing Power Increased 40x

To make sense of all of this data, a new onboard computer with over 40 times the computing power of the previous generation runs the new Tesla-developed neural net for vision, sonar and radar processing software. Together, this system provides a view of the world that a driver alone cannot access, seeing in every direction simultaneously, and on wavelengths that go far beyond the human senses.

Enhanced Autopilot

Enhanced Autopilot adds these new capabilities to the Tesla Autopilot driving experience. Your Tesla will match speed to traffic conditions, keep within a lane, automatically change lanes without requiring driver input, transition from one freeway to another, exit the freeway when your destination is near, self-park when near a parking spot and be summoned to and from your garage.

Tesla's Enhanced Autopilot software has begun rolling out and features will continue to be introduced as validation is completed, subject to regulatory approval [1].

On-Ramp To Off-Ramp

Once on the freeway, your Tesla will determine which lane you need to be in and when. In addition to ensuring you reach your intended exit, Autopilot will watch for opportunities to move to a faster lane when you're caught behind slower traffic. When you reach your exit, your Tesla will depart the freeway, slow down and transition control back to you.

Autosteer+

With the new Tesla Vision cameras, sensors and computing power, your Tesla will navigate tighter, more complex roads.

Smart Summon

With Smart Summon, your car will navigate more complex environments and parking spaces, maneuvering around objects as necessary to come find you.

From Home

All you will need to do is get in and tell your car where to go. If you don't say anything, your car will look at your calendar and take you there as the assumed destination. Your Tesla will figure out the optimal route, navigating urban streets, complex intersections and freeways.

To your Destination

When you arrive at your destination, simply step out at the entrance and your car will enter park seek mode, automatically search for a spot and park itself. A tap on your phone summons it back to you [2].

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THE DEMAND FOR HIGHER MATHEMATICS
IN INFORMATION TECHNOLOGY

Today you can see that the demand for higher mathematics in the amount taught by higher education institutions in information technology is a big question. This conclusion can be drawn from the reviews of many successful programmers, numerous topics with questions about this, the loss of interest of students in technical specialties in the study of mathematics. Developers identify several reasons for this:

- More and more powerful machines that produce all the necessary calculations without human intervention.

- In some ways, narrow specializations for programmers who do not require the full breadth of knowledge provided at the university.

- Excessive deepening into higher mathematics, the practical application of which is difficult to find for an ordinary developer.

Due to these reasons, we observe a general trend of loss of interest in higher mathematics in most students. Most programmers on the forums note that they benefited hardly a tenth of what they studied at the university, namely, discrete mathematics and the basics of statistics.

But there is a downside of the coin. There are certain tasks that require the highest knowledge of the developers in the field of calculus, differential equations, numerical methods, etc. However, the range of these problems is rather narrow, and the prevalence is extremely low. Similarly, developers specializing in 3-D modeling note the need for knowledge of geometry and mechanics. In general, the necessary knowledge of mathematics depends entirely on the subject area in which the programmer is going to work. And if the student already knows in which direction he will move, he can pay more attention to those subjects that he needs. In many European universities, there is a system in which students choose only those subjects that they need, and this approach speeds up learning and raises interest in it.

That is, the problem of demand for such a volume of higher mathematics in the educational process of our country does exist. But there are also positive aspects.

The University provides a general base, from which students can choose for themselves in what field they want to work, regardless of the mathematical knowledge required for this. They have the opportunity to test themselves from different sides, and to conclude that it is given to them easier. In addition, many programmers say that mathematics may not be useful at all, but the very fact of its study develops algorithmic and abstract thinking, gives the basis for analysis. Nobody will deny that "mathematics brings order to the mind".

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FORMATION OF THE MOST POPULAR PROGRAMMING LANGUAGE IN THE WORLD

Nowadays it is almost impossible to find a specialist in IT-industry, who would not have heard of the C programming language. This language gained incredible popularity all over the world and made a significant impact on many programming languages. It is the forerunner of such languages as C++, C#, Java. And one of the most powerful companies, well-known as Microsoft, has chosen C as the key syntax of their own language for .Net platform [4]. The C language has seriously changed a programmer's life of the last century and has become the kind of de-facto in the sphere of low-level programming, leaving the Assembler only at those positions where the high performance had the pivotal role.

A great number of people remember the language authors' names – Ken Thompson and Denis Ritchie, but not all know the history of C creation and evolving. Thus, the main aim of our study was to find out some more "ancient" information about the roots of the C.

The C goes back to the language ALGOL (stands for ALGorithmic Language), which was created in 1958, by the Committee of European and American scientists in the sphere of computer science at the meeting at Swiss Higher Technical School in Zurich in 1958. The language was a response to some cons of the FORTRAN language and an attempt to fix them.

Inspired by the ALGOL-60, the Mathematical Laboratory of Cambridge University together with the Computer science department of London University has created The CPL (Combined Programming Language).

The CPL was considered to be difficult, and as a response to this fact, Martin Richardson created the language BCPL in 1966. The main purpose was to write compilers. Nowadays, it is practically not used, but in due time it played an important role because of good portability.

BCPL served as an ancestor for the B language, developed in 1969 by the AT & T Bell Telephone Laboratories [1].

The B language [2] was used to write the earliest versions of UNIX, created as an alternative to the Multics project, being developed in the same Bell Laboratories [3]. It was the language that served as the immediate predecessor of the C language.

C programming language was developed within the walls of Bell Labs during the period from 1969 to 1973. Throughout the whole time of its existence, the C language has become legendary in terms of reasons of its creation. According to one of the legends, Kernigan and Ritchie loved one computer game, which they ran on the company's main server. Later they decided to transfer it to the computer that was standing in the office. Unfortunately, the machine did not have the operating system to run the game, which inspired Kernighan and Ritchie to write it. When they wanted to transfer the system to another computer, it turned out to be a dramatic problem because the program code was written in Assembler. Then they got an idea to re-write it in a top-level language. At first, it was planned to use the B language for these purposes, but due to its inability to utilize new computer features to their full capacity, the developers decided to create their own language.

The success of the C is mainly due to the fact that a significant part of the operating system UNIX [5], which eventually became very popular, was written in it. In addition, the C language, being approximated to the hardware implementation of the computer, makes it possible to use much more of its functions than of many other programming languages. Thus, if other programming languages can disappear over time, giving way to new technologies, the C language will live as long as different OS's are alive.

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USING THE DATE OBJECT OF THE JAVASCRIPT LANGUAGE ON WEBSITES

The Javascript is a programming language with the help of which web pages receive their interactivity. It creates applications that are included in HTML-code (for example, questionnaires or registration forms that are filled in by the user). Lately, this language interests programmers more often that is why it seems to be necessary to introduce some of its key features, exactly – its object. Object is constantly being modernized and developed, and, generally, each of us has come across it on the websites for several times, so it is interesting to know how it works.

In order to create a new Date object, we need to use one of the syntaxes: new Date (), because it creates a Date object with a current date and time:

var now = new Date();

alert(now);

Also, we can create a date using the components of the local time zone. For this format only the first two arguments are required. Missing parameters, starting with hours, are considered to be equal to zero, and date – to one:

new Date(year, month, date, hours, minutes, seconds, ms)

Important:

1.The year must be 4 digits.

2.The month count starts from zero

For example:

var date = new Date(2011, 0, 1, 2, 3, 4, 567);

alert(date); // 1.01.2011, 02:03:04.567

To access the date-time components of a Date object, the following methods are used: *getFullYear(), getMonth(), getDate(), getHours(), etc.*

The autocorrection is a very convenient property for Date objects. It lies in the fact that you can install deliberately incorrect components (for example, January 32), and the object will correct this error itself, for example:

var d = new Date(2013, 0, 32); // 32 January 2013 ?!?

alert(d); //… it's 1 January 2013!

Incorrect date components are automatically distributed to the rest. For example, you need to increase the date "February 28, 2011" by 2 days. It may be that it will be the 2nd or the 1st of March if it is a leap year. But we do not need to think about all this – we just add two days and the rest will do Date. An important side effect is that dates can be subtracted and the result of Date objects subtraction is their time difference in milliseconds. It is used to measure the time spent on the program:

var start = new Date; // start

for (vari = 0; i< 100000; i++) {

*vardoSomething = i * i * i;}*

var end = new Date; // end

alert("Циклзанял " + (end – start) + " ms");

Summing up all stated above, we can conclude that the Date object provides basic options for saving and retrieving dates and time. Also, I would like to add that work on this object continues nowadays and new methods of extending this object's possibilities for web pages use are still appearing.

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INITIAL STAGES OF GAME DEVELOPMENT

The ever-expanding market of personal electronics, and with it the entertainment market, are indisputable arguments in favor of implementing projects to create new games.

The development of the game consists of a considerable number of clearly separated stages. The game begins with the birth of the idea (conception). At this point, the genre of the game is determined, since games of a completely different orientation can be created on one idea.

The concept defines a setting – the description of the game universe: the history of the world, the description of the characters, rules and regularities of the game universe [1].

Next, to create the game, you need to select a budget that can be allocated for development, because without this, no major project can be implemented [2].

The next important step is to identify the audience. As a rule, the age and social groups are determined. Small changes in the direction of the project can lead to a drastic change in the potential audience of the game.

Separately it is necessary to think over the features – the basic elements that should make the game unique.

Another point worth noting is the focus on the platform that users will use. The choice of the platform determines the choice of system requirements, which the development will depend on in the future. Classic desktop computers are a proven but slightly tapering market. Mobile platforms are the most promising, but at the same time, certain platform limitations are imposed. Consoles are another classic market for games, which is now again in the growth zone due to the release of consoles of a new generation. But here you also need to be prepared for a number of limitations. The last available market is browser-based games that do not require installation. They have the greatest amount of limitations among all [3].

Also one of the main components is the game engine, but before you choose it, you need to decide on the world in which we want to immerse the user. It can be an

immersion in the real world (a view from the first or third person), a top view, a side view or a platform [2].

Next, a design document is created. It is needed for developers, since it contains a formalized representation of ideas; for project managers, as it allows you to manage the costs and a development workflow; for testers, who will need to know in what form the operation of various aspects is expected; for designers and artists to create a single directivity of graphic content.

There are some established points that should be present in the design document: a brief description of the game project; platform and system requirements; sounds and music; the list of tools to be used in the project; architecture of AI, physical modeling, network interaction; the intended user interface; graphics engine capabilities; list of specific capabilities, their implementation; requirements for models, levels, textures. After the design document is finalized, it becomes possible to implement the project in practice [4].

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ACTUAL ANTI-THEFT SYSTEMS OF THE ELECTRONIC SURVEILLANCE OF PRODUCT

EAS system (Electronic Article Surveillance) was developed to protect the product from shop-lifting.

There are many security systems: security guards, a video surveillance system, sensors (infrared, movement, opening), EAS, wickets and fences, panoramic spherical mirrors, product protection system on shelves, visitors counter in the store.

EAS system of antennas is installed at the entrances / exits from trading halls, as well as on the attached labels, tags, hard sensors, deactivators of labels and special pullers for hard sensors.

The main aim of our study is to compare modern anti-theft systems and to choose which of them are the most effective and economical systems.

Table 1. Comparative characteristics of anti-theft systems

	Radio-frequency anti-theft system (RF) [1]	Acoustomagnetic antitheft system (AM) [2]	Electromagnetic antitheft system (EM) [3]
Principle of operation	Detection of LC-oscillatory circuit which has the same resonant frequency as the transmitting antenna	The magnetostrictive property of the material from which the transponder has been made	Detection of changes of the electromagnetic field when they contact with metal labels/tags
Operating frequency	1,9 MHz – 10 MHz	58 kHz	16 Hz – 12,5 kHz
Advantages	•a wide variety; •low cost protective elements; •protection for almost all product groups; •the response factor is up to 70 %; •compatible with CCTV; •high sensitivity due to digital signal processing	•the response factor is over 95 %, noise proof; •ability to set labels on small items; •AM sensors are not shielded by the human body; •AM sensors work on foil, metallized surfaces (not ferromagnets)	•protection of the product by unobtrusive transparent labels; •effective work with the metal product; •response factor is up to 85 %
Disadvantages	inability to detect a protective circuit near the metal surfaces	•higher cost of labels; •adhering to accurate power frequency (50 Hz); •these labels are harder to hide in the product packaging; •electronics is more expensive than in RF systems; •security system is controversial regarding health	•high price of the systems; •deactivation of metal strips is made by the contact method; •the influence of antennas on the nearly cash register monitors with cathode-ray tube
The price	1. RF system – 9800 UAH. 2. The sensor – 2,52 UAH. 3. Label 1000 – 308 UAH. 4. Bottle sensor – 9,8 UAH 5. Deactivator – 800 UAH	1. Acoustomagnetic system – 16 800 UAH. 2. The sensor 2.8 UAH. 3. Etiquette (5000) – 200 UAH. 4. Deactivator – 800 UAH	1. The system – 65000 UAH. 2. Label – 400 UAH. 3. EM label– 936 UAH/packing. 4. Deactivator– 800 UAH.

The solution of the problem: it is cheaper and more reliable to use the antitheft systems in the long-term perspective, instead of having to pay the wages for a large number of people who will do the work during the same amount of time, but on a less reliable level. The most efficient and frequently used system is the acoustomagnetic antitheft system. To increase the level of security in the outlet, the antitheft system must be applied in combination with other systems.

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SMART HOUSE

The term "smart house" is quite often mentioned recently. Technology, denoting this word, can also be called "connected home", "intelligent house", "smart home", etc. But a lot of people who have known this term do not have a sufficient understanding of the technologies associated with it.

A smart home is a home that uses advanced electronic technologies and computerisation to automation of daily household tasks. For example, a smart home may control lighting, temperature, multi-media, security, window and door operations, as well as many other functions [1].

Now, intelligent home technology is a part of a new emerging trend named Internet of Things (IOT). In a few words, this is the concept of connecting devices to the Internet and / or to each other. According to research from the analytical company Gartner, there will be more than 26 billion connected devices by 2020 [2]. The term "Internet of Things" was first mentioned by Peter T. Lewis in a speech given at a U.S. Federal Communications Commission in 1985 [3], but the history of smart homes began earlier. Back in the 50`s there were attempts to create smart houses.

The most famous house was "Push-button house" in 1950, but smart home technology was too futuristic and strange for that time.

In fact, the technology was recognized only at the present time, due to the emergence of a large number of devices with the ability to access the Internet, in particular, the iPhone in 2007 and smartphones in the following years.

Usually the system includes three types of devices:

- hub, which connects all the elements of the system and connects them with the outside world;
- sensors that receive information about external conditions;
- actuators – actuating devices.

The third largest group contains smart (automatic) switches, sockets, valves for pipes, sirens, climate controllers, etc.

Modern technologies need modern protection. One of the most important tasks of technology development at this stage is the creation of reliable protection of smart homes. There is a risk of hacking the network into which the devices are connected. A quiz conducted by Intel revealed that over 92 percent of potential consumers are worried that their personal data could be stolen by cybercriminals, yet at the same time to have all their IOT devices [4]. Also, devices do not have a single standard in software and hardware.

However, problems with standard will be solved. Companies will be able to create general norms for devices or will create devices running on different platforms. The problem of the standard has already been encountered in information technology. It was solved for many technologies, such as Internet browsers.

Smart home is gaining popularity. In the future, technology will be able to enter people`s lives. In Ukraine, there are already companies that sell houses with technology. For example, three-bedroom apartment with IOT devices costs from 2000 euros [5].

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ANALYSIS OF EJECTOR-AUGMENTED CRYOGENIC DETONATION ENGINE CHARACTERISTICS

At present transportation of payloads to space orbits is performed by launch vehicles. Reusable aerospace vehicles of horizontal start and landing are more profitable economically. But their use is possible only on condition of essential engine specific impulse thrust increase.

The detonation engine with the ejector is capable to increase the level thrust and specific impulse thrust significantly [1]. Various ejector nozzles design and methods of realization of the interaction between detonation products and airflow are known. Ejector nozzles with a large degree of expansion are expected to be used in prospective hypersonic aerospace aircrafts [2].

The choice of liquid natural gas (LNG) as fuel is based on several important assumptions. LNG has the highest possible heat of combustion of all the other carbohydrate fuels and is able to cool the engine chamber efficiently. In addition, residual combustion products are quickly purged from the chamber to prevent auto-ignition of the fresh fuel/oxidizer charge and the chamber is ready for the next engine cycle.

The possibility of increasing the impulse characteristics of the detonation engine which operates on fuel components $LO_2 + LNG$ is proved by using an ejector nozzle by computer simulation. The main calculations were made for the starting conditions, at normal temperature ($T_0 = 300$ K), sea level pressure ($p_0 = 10^5$ Pa) and Mach number $M_\infty = 0$. The coefficient of increase in the impulse thrust is increased by more than 1,5 times. There is an optimal flight speed M_∞, at which the ejector nozzle capabilities are used in the best way [3]. Therefore, the prospects for further research are related to the definition of the optimal ejector nozzle design scheme, which allows efficiency to organize the energy exchange process between the reactive flow of the detonation engine and atmospheric air with the maximum efficiency.

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INNOVATIONS IN INFORMATION TECHNOLOGY SPHERE:

DNA DATA STORAGE

Soon, humanity will generate so much data that habitual storage will stop coping. To solve this problem, scientists turned to an almost limitless natural container of information – DNA. According to the researchers, DNA is an ideal storage medium, because it is ultra-compact and can retain its properties for hundreds of thousands of years, provided the proper storage conditions are ensured.

In a new study, scientists from Columbia University and the New York Genome Center (NYGC) demonstrated that analgorithm designed for streaming video on a smartphone can almost fully open the potential of DNA in storing and compressing additional information in four nucleotide bases [1].

The idea and general considerations on the possibilities of recording, storing and searching information in DNA molecules belong to Mikhail Neiman, a Soviet physics scientist.

In 2012, geneticists from Harvard University managed to code a draft of a book of 53,400 words, 11 images and one program. They found out that in each cubic millimeter of DNA it is possible to store 5.5 petabytes of data. A year later, there searchers of the European Institute of Bioinformatics managed to save and then completely extract and reproduce about 0.6 megabytes of text and video files. All DNA files were reproduced with an accuracy ranging between 99.99 % and 100 %.

The scientists collected these files into one, and then divided the data into short binary codelines. With the help of fountain codes, they randomly packed the lines into the "drops" of the fountain-blocks and converted combinations 00, 01, 10, 11 into four nucleotide bases: adenine (A), cytosine (C), guanine (G) andthymine (T). To collect these blocks together, the team of scientists added labels for each "drop".

In total, researchers generated about 72,000 such DNA strings, each containing about 200 bases. They collected this information in a text file and sent it to San Francisco, where the start-up Twist Bioscience, engaged in the synthesis of DNA, turned digital data into biological. Two weeks later Erlich's team received a tube with DNA molecules [2].

However, the most impressive features of the algorithm "fountain DGC" was the ability to place 215 petabytes of data in one gram of DNA – 100 times more than could be achieved with the help of other methods and algorithms.

The storage capacity of DNA data is theoretically limited to two digits for each nucleotide, as well as a biological DNA device. In addition, to collect and read the recorded fragments, it is required to include additional information, which subsequently reduces the capacity to 1.8 binary symbols in the nucleotide.

The algorithm "fountainof DNA" allows to place an average of 1.6 bits in each nucleotide – it is 60 % more than it was possible before, and also close to the limit of 1.8 bits.The main obstacle to the widespread of technology is its cost. Researchers spent 7 thousand dollars to synthesize DNA and archive 2 megabytes of data, and 2 thousand more to decipher it.

Perhaps, instead of a huge number of servers, one day all the Internet can fit in a shoe box. This is what scientists from Microsoft and Washington University proved in July 2016, when they encoded 200 MB of digital data into the structural link of DNA, including War and Peace and 99 other literary classics, breaking the previous record of 20 MB. They did this with an enzyme called polymerase, which allows you to create programmable copies of DNA and read data from any part of the DNA tree [3].

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ACTUAL PROBLEMS OF ENGINEERING SCIENCES AND NEW INFORMATION TECHNOLOGIES

At present, the general world trend is to increase the level of informatization of society. Ukraine does not stand apart from this trend – in fact, it is quite successful in this process. There are good conditions for the creation and successful development of the information society in our country, namely:

• A sufficiently high level of specialists' training in the field of IT technologies;

• a certain amount of outsourcing companies working in the field of software development;

• a relatively low cost of mobile communication and Internet services;

• a large number of IT professionals and a high level of competition between them;

• a large number of breakthrough technologies that are at the stage of full readiness for use but not involved yet [3].

Only in the first half of 2016 Ukrainian IT-companies received orders for $ 1.5 billion. Against the backdrop of the economic downturn, the number of orders continues to grow [1].

Last year, the export of IT outsourcing services reached $ 2.5 billion. And according to the forecasts of the international consulting company IDC, the IT market in Ukraine could grow by 5–10 % in 2016. At the same time, Ukraine's share in the global volume of the information technology market is only 1 % [2].

In Ukraine, there are objective prerequisites for the sustainable growth of the IT industry. Annually new jobs are generated with a large payment by Ukrainian standards.

However, despite the relatively high wages that Ukrainian programmers get in the Ukraine, they are massively leaving the country as they want to enter the international level. So, according to the information of the company "SmartMe University", up to 9 thousand of IT professionals went from Ukraine to Europe and the US over the past two years. Specialists leave in search of professional advancement, more comfortable living conditions, normal legal working conditions. At the same time, experts with

seven or more years of experience leave the country en masse – those that generate the largest revenue to outsourcing companies.. This problem in Ukraine became mass in 2008 and by 2017 it remained relevant. At present, the IT sector has a large deficit of high-level specialists [4].

To solve the problem of a "brain drain" it is necessary:

- A set of measures, allowing a new level of functioning of the industry, focused on the domestic market. The main consumers of IT services in developed and developing countries are state-owned companies, financial institutions, telecommunication operators.

- The policy of the state to support the work of Ukrainian developers.

- The priority of the local product, developed by Ukrainian companies in the public sector, local authorities [5].

- The state-controlled stimulation of the local product purchases by private enterprises by applying partially subsidizing or reducing the tax burden for working with Ukrainian companies-developers.

- A support for start-up movement, which creates the basis for the emergence of new approaches and trends.

- The creating of an environment for the physical comfort of the IT market players location [6].

This approach is not new and is widely used by developed and developing countries all over the world.

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A CONCEPT OF THE GRAPHS COLORING ALGORITHM: SCHEDULING

We subconsciously face with the graphs every day. A graph coloring is considered to be a computationally complex task. L. Y. Berezina [1] states in her works that familiarizing students with the graph theory promotes the development of logical thinking skills as well as the skills of information structuring during the problem solving. Thus, it is considered to be necessary to give a definition of a graph. So, a graph is a set of points, some of which are related [2]. One of the most interesting problems inthe graph theory is a problem of thegraph vertexcoloring. Practically, the problem of making up a typical school schedule is reduced to this task.

The difficulties in scheduling exist since the middle of the XX century and they still draw the attention of many scientists. The whole educational process as well as how well students learn the material, the teachers'productivity and the optimal energy consumption depends on scheduling. Nowadays each higher education institution has some problems with the scheduling process. This is due to the fact that teachers' preferences, time managementfor moving between the educational buildings, minimizing gaps between classes for students and teachers has to be taken into account.

One of the methods of solving this problem is an application of the algorithm for coloring graphs. The main advantages of this method are high accuracy and its practical use. This method is based on a network model, which involves the process of building schedules via coloring of thegraph vertices with restrictions tothe multiple colors. The graph, where vertices are marked by classes,is a schedule. The process of finding schedules means to find a proper coloring of the resulting graph byminimum number of colors [3].

The value of the graph theory can hardly be overestimated. It helps to simplify the information search, to optimize the performance of programs, to change and distribute the data. The graph theory is actively developing today, that is why it has found the application not only in mathematics but also in many other spheres of human activity. It is the fact that the area of human needs is growing rapidly, therefore more and more modern problems associated with the graph theory appear

nowadays.This theory allows us to solve many practical problems, such as: scheduling, coloring the cards, finding the shortest paths, making the circuits of the underground systems and designing of the integrated circuits [4].

Thus, the introduction of graph theory into the system of universities scheduling solves the problem of scheduling for the educational processand allows to increase the level of education and to automate the whole process of class scheduling.

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FILTERING METHODS OF MEMS SENSOR DATA IN THE SPACECRAFT ORIENTATION AND STABILIZATION SYSTEM

Using microelectromechanical system (MEMS) sensors in the spacecraft orientation and stabilization system (SOSS) we must reduce noises which value is significant when the spacecraft angle velocity isn't high relative to the useful signal. Therefore, there is an important question to use data filters that could reduce influence from the noises.

There are three methods of filtrations: Kalman filter, Butterworth adaptive filter and integral filter.

Kalman filter consists of the set of mathematical equations providing affective recursive instruments for assessment of the process state in a way of minimization root-mean-square errors.

SOSS was modelled due to Matlab software for comparisons and assessing filters considered above. The model is including: model of rotation based on quaternions, model

of angular rate sensor (ARS) and accelerometer sensor (MPU-6050), model of magnetometer sensor (HMC5883L), attitude and heading reference system (AHRS) based on PD-controller.

Modelling of data filtration processes with sensors which were selected and using above-mentioned filters has shown that:

– The most effective filter is the second-order integral filter with the inclusion of an additional aperiodic link;

– The offered integral filter gives a filtered derivative by input signal which can be used at the control system (CS).

The work of filtration algorithms was tested in the laboratory of Oles Honchar Dnipro National University at the stand of orientation and stabilization. The program was written in C++ language. The coefficients of PD-controller were corrected relative to the initial mathematical model.

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STATISTICAL ANALYSIS OF ENTROPIC TRANSFORMATIONS OF EXPERIMENTAL MEASUREMENTS WITH UNKNOWN PROBABILITY DISTRIBUTION LAWS

In defectoscopic problems, the basis for making a decision upon the status of the controlled object is model sampling of measurements. Subsequent to the results of theoretic factor analysis, it is known that entropic transformations are sensitive to changes in the statistic characteristics of model samplings, therefore, they can be used to make decisions on the status of the controlled object [1].

If the distribution law is unknown, but there is a model sampling of measurements $|x| = x_1, x_2, ..., x_i, ..., x_n$, it is possible to reproduce the probability distribution law by the process of smoothed delta functions, using Gaussian approximation [2], as well as its entropic transformation

$$L^*(x) = ln\left(\frac{n\sqrt{2\pi}}{\alpha}\right) - ln\left[\sum_{i=1}^{n} exp\left(-\frac{\alpha^2(x - x_i)^2}{2}\right)\right],$$

where α – smoothing parameter.

In actual practice, the controlled object can be characterized by several parameters, and they can be mutually dependent. For two statistically dependent parameters $|x_1| = x_{11}, x_{12}, ..., x_{1i}, ..., x_{1n}$ and $|x_2| = x_{21}, x_{22}, ..., x_{2i}, ..., x_{2n}$, the evaluation of entropic transformation using the suggested method herein is as follows:

$$L^*(x_1, x_2) = ln\left(\frac{n2\pi\sqrt{1 - r^2}}{\alpha_1 \alpha_2}\right) -$$

$$- ln\left[\sum_{i=1}^{n} exp\left(-\frac{\alpha_1^2(x_1 - x_{1i})^2 - 2r\alpha_1\alpha_2(x_1 - x_{1i})(x_2 - x_{2i}) + \alpha_2^2(x_2 - x_{2i})^2}{2(1 - r^2)}\right)\right],$$

where r – correlation coefficient.

This paper has studied the statistical characteristics of the proposed assessments of entropic transformations. We have carried out the research and comparison of estimations of one-dimensional and two-dimensional entropic transformations with different parameters and distribution laws, as well as found out its application in defectoscopic problems. We have also assessed the effect of size of model samplings and correlation coefficients upon the effectiveness of the method. The results have been obtained through computational experiments.

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ЗМІСТ

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АКТУАЛЬНІ ПРОБЛЕМИ ІНЖЕНЕРНО-ТЕХНІЧНИХ НАУК ТА НОВІТНІХ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ