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Кафедра іноземних мов для інженерно-технічних та природничих спеціальностей

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OBTAINING OF CEMENTATION COPPER POWDERS BY ZINC FROM THE SOLUTIONS CONTAINING NONSATURATED ORGANIC COMPOUNDS

Among actively developing areas of modern research in the field of nanotechnologies a specific place is held by nanodimensional materials. The unique microstructure of nanodimensional powders gives them a number of new properties in comparison with usual materials [1]. In this regard, the development and study of regularities of synthesis of various types of nanodimensional substances are especially relevant.

The study of the cementation process has considerable production value in both nonferrous metallurgy, and galvanotechnics, therefore, a number of works are dedicated to it. Thus, cementation purification of impure solutions with zinc dust finds application in zinc hydrometallurgy by preparation of solutions for zinc electrolysis. Purification of solutions with cementation (metal zinc powder – zinc dust) is based on the principle, similar to the work of galvanic cells and electrochemical corrosion of the technical metals containing impurity with a low overstrain of hydrogen. At the same time in the general chemical reaction oxidation (anode process) and restoration (cathode process) proceed on different sites of the same particle of metal, energetically more favorable for this purpose, which is possible because of existence of the carrying-out environment. Therefore, the speed of replacement reaction of the type $CuSO_4 + Zn \rightarrow Cu + ZnSO_4$ is defined by the speeds of anode ($Zn \rightarrow Zn^{2+} + 2e$) and cathode ($Cu^{2+} + 2e \rightarrow Cu$) processes, which depend on the potential and other factors characterizing any electrochemical process [3].

Now nanodimensional powders of copper and its oxides are of great interest [2]. Properties of copper powders, their activity, as well as physical and chemical state, depend on the ways of their obtaining.

For carrying out the research of restoration of copper zinc dust, the following reactants and substances were used: cuprum (II) sulfate pentahydrate ($CuSO4 \cdot 5H_2O$) of the “chemically clean” brand which is additionally cleaned by a technique [4], zinc dust with the content of metal zinc of 95-99%.

For obtaining powders, 6 g of $CuSO4 \cdot 5H_2O$ were dissolved in 15 ml of H_2O (saturated CuSO4 solution) at inconsiderable heating, then it was hashed on the magnetic mixer. The sifted powder of pure zinc (1.56 g) was poured in small portions at active hashing and inconsiderable heating to weak coloring of solution. The obtained copper powder of brown color was filtered on Buchner funnel, washed with the distilled water and alcohol with petroltriazole.

The technique described above was also applied to obtaining copper powder in the presence of additive – acrylic acid (1.7 ml). At the same time we observed that the small layer of acrylic acid which wasn't dissolved gathered over the solution. The solution was muddy, there was no blue color, at inconsiderable heating of a deposit. The obtained black powder was filtered and washed out. The color differed from the obtained one without additives, it was much darker, which allowed us to specify its various properties. At the same time the filtrate was greenish by color and there were no powder particles in it.

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STUDY OF PRONY METHOD IMPLEMENTATION ALGORITHMS

This paper reviews Prony's method in relation to signal filtering and approximation, provides the MATLAB code needed to implement the classic, LSand MPM methods, and tests their performance insignal filtering and function approximation. It emphasizes the importance of improving the computational methods used to implement the various methods described above.

Prony's method approximates a sequence of $N = 2p$ equally spaced samples to a linear combination of p complex exponential functions with differing amplitudes, damping factors, frequencies and phase angles. The main contribution of this classic method is that it converts a non-linear approximation of exponential sums by solving a set of linear equations and a root-finding problem.

The conventional or polynomial Prony method consists of setting out an autoregressive model of order p that assumes that the value of sampled data $x[n]$ depends linearly on the preceding p values in$x$. Solving this linear system of equations obtains the coefficients of the characteristic or Prony polynomial $\varphi(z)$. The roots of this polynomial yield two of the parameters of the solution (damping factors and frequency) and provide a second system of equations to calculate the amplitude and phase of the p functions.

Prony's original method exactly matched the curve of p exponential terms to a dataset of $N = 2p$ elements. When $N > 2p$, the linear systems of equations are overdetermined and can be approximated by the least squares (LS) method. The least-squares method considers that in the linear system($A.x \approx b$), only b (observation vector) is contaminated by noise, while A is noise-free.

Another alternative is to use the matrix pencil method (MPM). Although similar to Prony's method, it consists of solving an eigenvalue problem rather than following the conventional two-step Prony method. It has been found through perturbation analysis and simulation that for signals with unknown damping factors the MPM is less sensitive to noise than the polynomial method.

None of the methods implemented works 100% correctly ($G \geq 0.60$ for the 1000 $gi[n]$ functions in all the situations tested). If the mean number of functions well-approximated by each method is considered, the best result is obtained with MPM ($\overline{MPM} = 999.5$). The LS method yields the correct approximation in 60.52% of cases and the MPM method in 92.10% of cases tested in this experiment.

In general, the results obtained using LS and MPM are very similar, as the MATLAB roots function generates the companion matrix of the polynomial and uses the QR-algorithm to obtain its eigenvalues.

In this paper we have used general MATLAB functions to implement the principal methods of function approximation based on the linear combination of exponentials: the polynomial Prony method (classic and LS) and the matrix pencil method. In the polynomial method, signal poles (frequencies and damping factors) are found as roots of a polynomial while the MPM obtains the poles by finding the eigenvalues of a matrix pencil. Currently, the most common method is Fourier analysis, which represents a signal as a summation of continuous undamped sinusoidal functions with frequency and integer times the fundamental frequency (harmonics). In contrast, the p components of a Prony series may be complex exponentials. In general, the Prony spectrum will be non-uniformly spaced in the frequency scale (as it is one of the estimated parameters), depending on the observed data. Prony modeling produces higher frequency resolution than DFT methods due to its reliance on autoregressive modeling. Another advantage is that it is a natural

transformation for impulse responses since it uses damped sinusoids as a basis and therefore representation is efficient in terms of the number of coefficients required.

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DETERMINATION OF RHODIUM (III) USING 3-PHENYL-2,6-DIMERCAPTO-1,4-THIOPYRONE IMMOBILIZED IN GELATINOUS MATRIX

Rhodium metal is known for its stability in corrosive environments, physical attraction and unique physical and chemical properties [1]. In the course of work with recycled products, it is often necessary to deal with rhodium (III) sulfate complexes. At the same time, they are poorly sorbed by various sorbents, compared with the corresponding chloride complexes. The use of sorbents of different nature in routine analysis is largely due to the development of low-cost methods for analyte determination. Organic reagents in the role of modifiers of various matrices contribute to the development of sensitive chemical-analytical systems for the determination of rhodium ions. The features of the interaction of rhodium(III) sulfate and chloride complexes with 3-methyl-2,6-dimercapto-1,4-thiopyrone (MDT) in the wide range of acidity from pH 5 to 2 M H_2SO_4 (4 M HCl) have been theoretically substantiated and described [2].

This paper proposes a test method based on the complexes of Rh(III) with 3-phenyl-2,6-dimercapto-1,4-thiopyrone (PhDT), immobilized into hardened layers of gelatin gel of photographic films for offset printing, from which silver halides were previously removed. Cross-scanning of a photographic film with a scanning electron microscope showed that PhDT was immobilized only in gelatinous matrix (GM), whose thickness is 21 μм. The heterogeneity of the microstructure of the cured gelatin gel is not an interfering factor for the use of photographic films in photometric and visual-test analysis. After contact with Rh (III) solutions on the background of HCl solution (2 mol/L), the films changed their color from yellow to bright orange.

The most sensitive was the definition of Rh (III) in the case of contact of GM with its sulfate complexes, which had been aged for 6 months in 0.1 M H_2SO_4. A test method has been proposed for the visual determination of Rh (III) in the concentration range 0.5–10 mg/L in aqueous solutions, including rhodium electrolytes. The developed test scale was tested for the rapid determination of Rh (III) in a sample of wash water, electroplating after rhodium by electrographic method.

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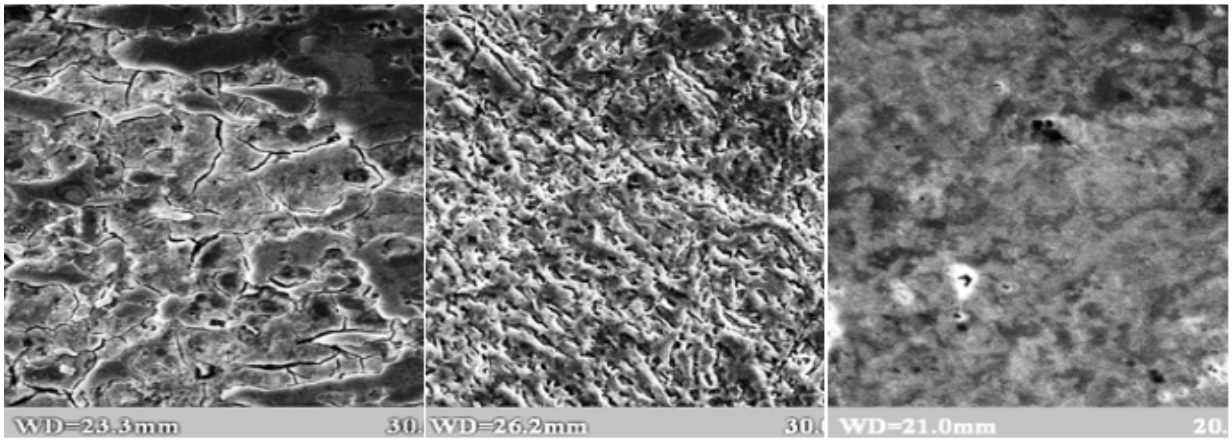
CORROSIVE BEHAVIOR OF QUASICRYSTALLINE ALLOYS AL – CU – FE AND AL – NI – FE IN NEUTRAL AND ACIDIC ENVIRONMENTS

Due to unique physical and mechanical properties of quasicrystals, the Al – Cu-Fe and Al – Ni – Fe alloys can be applied as coatings for parts of the devices working under friction, abrasive wear etc. During the performance most of the coatings are affected by corrosion, which makes it necessary to study their behavior in acidic solutions. The structure of the Al-Cu–Fe and Al-Ni-Fe alloys has been investigated by the methods of quantitative metallographic, X-ray fluorescent an X-ray analyses. Corrosion behavior of the alloys has been studied at 20±2 ºC by gravimetric method in HCl, H_2SO_4, HNO_3, H_3PO_4 acidic solutions (pH = 1.0) during 1 – 4 hours. pH of corrosion media has been controlled by the ion meter EB – 74 [1]. The surface of the samples, exposed to acidic solutions, has been investigated by scanning electron microscopy.

The alloying of Si and B or the introduction of Ni into the alloy leads to inhibition of the anode reaction and the corrosion process as a whole.

In a neutral solution of NaCl, the alloys are corroded according to the electrochemical mechanism with oxygen depolarization. In the process of corrosion, a precipitate forms on their surfaces, which consists mainly of insoluble Fe^{3+} compounds.



$Al_{65}Cu_{24}Fe_{11}$ $Al_{55}Cu_{25}Fe_{12}Si_7B$ $Al_{71}Fe_5Ni_{24}$

Fig. 1. Microphotographs of the samples lasted for 4 hours in the solutions of 0.5 M H_2SO_4

In acidic medium (1.0 M HCl, pH = 1.0), corrosion occurs through an electrochemical mechanism with hydrogen depolarization.

$Al_{55}Cu_{25}Fe_{12}Si_7B$ and $Al_{71}Fe_5Ni_{24}$ [2] have a wider zone of electrochemical passivity due to inhibition of the anode process. With the help of SEM it was established that doping of Si and B leads to a sharp decrease in the microstructure of the number of cracks and maturation, and in fact, the introduction of Ni into the alloy makes it impassive to the action of the acid.

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THE INFLUENCE OF TEMPERATURE FACTOR ON THE FORMATION OF THE EPIDEMIC THRESHOLD AND EPIDEMIC OF VIRAL HEMORRHAGE DISEASE AND MIXOMATOSIS OF RABBITS

Due to the global warming of the climate, the terms of the massive appearance of mosquitoes, which are the main carriers of rabbits' diseases, such as myxomatosis and viral hemorrhage disease of rabbits, restrain the development of rabbit at large and small agricultural enterprises and private farms, are changing.

Relevance of the research: in the scientific literature there is not enough information about the beginning of epidemics of rabbits in the spring and summer period, related to the change of climatic conditions associated with global warming.

The object of the study is the European crown.

The purpose of the work is to establish the maximum effective period for the vaccination of rabbits associated with the massive mosquito release and to study the effects of pregnancy-free female vaccination and its impact on the viability and resistance of rabbits to diseases. The subject of the research is the influence of the temperature factor on the development of mosquitoes.

Tasks of the work:

- to establish the dependence of the development of a mosquito on the temperature parameters of the air;
- to study the effects of pregnancy-free female vaccination and its impact on the viability of the rabbits and the resistance of rabbits to diseases;
- to establish optimal terms for the vaccination of rabbits in the spring-summer period;
- to study the phenomenon of heterosis on the indices of ontogenesis of non-native, thoroughbred and interspecific (hybrid) rabbits.

As a result of research, it was established that with increasing air temperature, the ontogenesis of mosquitoes is accelerated and the beginning of the epidemic of myxomatosis and viral hemorrhagic disease of rabbits changes. Intergenital rabbits have the best phenotypic characteristics in ontogenesis compared to non-pterygotic and purebred rabbits. Vaccination of pregnant females improves the immunity and resistance of rabbits to myxomatosis, viral hemorrhagic disease of rabbits, even during the epidemic.

To solve this problem, the temperature of air and water was monitored at the pond in the center of the village Magdalinovka. The air temperature was fixed at an altitude of two meters from the soil surface three times a day: 6.00; 14.00; 18.00. From these indicators, the average daily and average monthly temperature was deduced.

The water temperature was measured at the depth of 1m three times a day: about 8.00; 15.15; 18.00, starting from 01.04. According to the results of these measurements, the minimum water temperature was 12 degrees, at which the development of mosquito larvae begins, advancing in different years in different periods, which is due to different climatic conditions in the studied years. According to the results of the research, it is possible to establish the approximate mass output of the mosquito and the maximum date of the vaccination of rabbits. Given that the immunity comes in 10-12 days after vaccination, it should be carried out for this period earlier than the approximate date of the mass mosquito release.

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PROSPECTS FOR THE USE OF MICROORGANISMS TO PROTECT PLANTS FROM DISEASES

Ukraine is a big agrarian state because the territory of our country is characterized by an extremely high rate of agricultural development (agricultural land makes up 72.1% of the total area of the country) [1]. Therefore, the development and efficient use of the agricultural sector of Ukraine is an important factor in economic and social sectors. Drawbacks that can significantly reduce the production of agricultural products are the damage to plants by fungal pathogens and harmful insects.

Preferably, chemical pesticides are used to protect agricultural plants against mycoses. But it should be noted that chemical products are potentially ecologically not safe because they slowly decay. Moreover, products of their decay fall into the soil and negatively affect biota [2].

For this reason, biological protection, which involves the use of living organisms or products of their life while being eco-friendly is promising in order to reduce the number and harmfulness of pathogen organisms and create favorable conditions for the activities of useful types of agricultural processes.

Antagonistic activity of 23 strains of *Bacillus spp*. against phytopathogenic fungi *Fusarium oxysporum*, *F. culmorum, F. moniliforme, Cladosporium herbarum, Alternaria alternata and Aspergillus niger* was investigated. The high level of bacilli's antagonistic qualities is owing to synthesize a wide range of different external metabolites, including antibiotics agent, for example, cyclic lipopeptides: iturins, sulfactines, fengizins and so on.

Antagonistic activity was tested by agar diffusion (the method of blocks). For determining the influence of bacteria on barley plants, ardent seeds were treated by

cultural liquid (dilution 1:10) for 2 hours and germinated in Petri dishes on moist filter paper. The fungistatic effect of *Bacillus spp*. separately and in combination with entomopathogens (in equal ratio) was determined by the level of inhibition of the fungi *Fusarium spp*. on a solid nutrient medium with 5% of the culture liquid. Insecticidal activity of microorganisms was determined in the model experiments by the percentage of death of the caterpillar *Archips podana Scop*. Strains of *Bacillus sp*. KMB-3 and *Bacillus sp*. KMB-6 inhibited the growth of all test cultures (zones of growth inhibition 11.4–30.6 and 11.5–29.4 mm, respectively). Absence of antagonism was established between selected strains and entomopathogenic bacteria *Bacillus thuringiensis* IMB-7186, fungi *Beauveria bassiana* IMB-F-100043. We found that treatment of barley seeds with culture liquids of *Bacillus sp*. KMB-3 and *Bacillus sp.* KMB-6 didn't have a negative effect on the morphometric indices and dry weight of seedlings. The highest percentage of growth inhibition of *F. culmorum* IMB-F-50716 was provided by a complex of *Bacillus sp*. KMB-3, *B. bassiana* IMB-F-100043 and *B. thuringiensis* IMB-7186, whose action was at the same level as the action of monoculture *Bacillus sp*. KMB-3 (85.4% and 84.7%, respectively). The highest percentage inhibition of growth of *F. oxysporum* IMB-F-54201 was provided by a complex of strains of *Bacillus sp.* KMB-3 and *B. bassiana* IMB-F-100043, whose effect was slightly inferior to that of the monoculture *Bacillus sp.* KMB-3 (68.4% and 75.1%, respectively). The insecticidal activity of complexes *Bacillus sp.* KMB-3, *B. assiana* IMB-F-100043, *B. thuringiensis* IMB-7186 or *Bacillus sp*. KMB-6, *B. bassiana* IMB-F-100043, *B. thuringiensis* IMB-7186 insignificantly differed from that of the complex entomopathogens *B. bassiana* IMB-F-100043 and *B. thuringiensis* IMB-7186 (71.1%, 73.3% death versus 80.0%).

The selected microbial complexes can be considered as promising for the development of a preparation for the protection of plants against fungal diseases and harmful insects [3].

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MODERN STUDIES IN GEOGRAPHICAL RESEARCH

When all the continents were discovered and marked on the maps, the study of the Earth continued. New expedition went to the poles of the Earth, to the bottom of the deepest ocean basin and to the highest peak.

Study of the polar regions

Achieving the North and South Poles was the purpose of the lives of many researchers. American Robert Peary made three attempts to conquer the North Pole and reached it in 1909. Upon learning of the success of Robert Peary, the Norwegian Roald Amundsen decided to conquer the South Pole. In 1911, having reached the Antarctic coast by ship "Fram", he, along with four comrades, set out on a sleigh pulled by dogs. Brave explorers reached the South Pole, raising over it the Norwegian flag. Since 1959 in Antarctica began to place permanent research stations. They belong to different countries, so Antarctica is called the continent of the world. Studies of Antarctica are very important because it has a significant impact on the climate of even far from it parts of the Earth. And continuing research in the Arctic. The countries whose territories are washed by the Arctic Ocean are particularly active in them. The advantage in research belongs to Russia. For almost a century, it has been equipping polar expeditions to the Arctic. Very large studies were conducted in 2007 on the vessel “AkademikFedorov” with the support of the atomic icebreaker “Russia”. Scientists were studied the atmosphere, sea currents, the thickness of the ice, the depth of the ocean. At the bottom of the ocean near the North Pole the “Mir” submersibles were lowered.

Ocean exploration

As a result of special expeditions at the bottom of the oceans in the 20th century huge mountain ranges, many submarine volcanoes and deep valleys were discovered. Volcanoes in the oceans was much greater than on land. In 1960 explorers Jacques Piccard and Don Walsh in a special apparatus submersible sank to the bottom of the deepest in the world Mariana Trench at a depth of 11,022 meters. It turned out that even at the bottom of the deepest troughs there is life. French oceanographer Jacques Cousteau invented scuba gear with which you can freely swim underwater.

Other studies

In 1953 New Zealander Edmund Hillary and Nepal's representative NorgheiTenseng for the first time conquered the highest point on Earth – Mount Jomolungma. Climbing to the top, they hoisted the flags of their countries and the UN flag on it,

dedicating their victory to all the people of Earth. The most important achievement in the study of the Earth in the 20th century was the study of the upper atmosphere. From the second half of the 20th century spacecraft with astronauts on board participated in the study of the Earth from space. Since then new space research methods have appeared in geography with the help of which scientists receive information about our planet today. Earth studies are not completed yet. Until now the source of the Amazon River has not been precisely established, many plants and animals that are widespread in the forests along the banks of this river remain unexplored. Only at a depth of 12 kilometers scientists penetrated into the earth's firmament having drilled a ultradeep well on the Kola Peninsula. Research continues into the ice of Antarctica and the depths of the World Ocean.

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Educational association № 28

THE USE OF LOW MOLECULAR WEIGHT ACIDS PEPTIDS TO PRODUCE A LIFE-SUSTAINING YOUNG CRAYFISH

Marbled crayfish is a promising representative of aquaculture and water area. Therefore, it is important to clarify biological aspects of its breeding as well as the influence of biological additives ‘Albuvir’ on the young generation`s vitality.

Marbled crayfish is reproduced by means of parthenogenesis – that is a reproductive strategy which means growth and development embryos without fertilization. As a result, their offspring is genetically identical, which makes this species is the best research object.

In order to determine the most optimal conditions of marbled crayfish breeding, a number of experiments were carried out and the following results were obtained:

1. The water temperature in the tank is 21^{o}C.
2. The water is changed of necessity but at least once a week.
3. The compressor maintains oxygen supply in the water.
4. Decorative water plants, including plastic ones, must not be placed into the tanks as crayfish is very active and can eat them up.

5. The feeding of the species is carried out once a day. The amount of food should equal 5% of the total mass of the population.

6. The bioactive additive “Albuvir” in the dose of 0,01% of the tank’s volume is added once a week.

Based on the experiments, the following conclusions have been made:

✓ the mass of the experimental group has increased in 4,6 times in comparison with the control group within 10 weeks;

✓ following the recommended ways of rearing, the rate of hatched offspring amounts to 90%-95%, whereas in the wild their population reaches 50% due to cannibalism;

✓ the breeding population in the experimental group is 20 % higher than that in the control group;

✓ “Albuvir” can be used not only as a medicine for fowl but also as food supplement for hydrobionts.

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MODERN GEOGRAPHICAL RESEARCH

In fact, the time for the discovery of new lands had expired, but not all the mysteries of the Earth are unravel. From the second half of the XX century. geographers not only know the laws of nature, but also find out the relationship between phenomena and processes occurring on our planet. Understanding the phenomenon and processes makes it possible for people to use the riches of nature. So geography from expository science has become an explanatory one.

Nowadays, scientists are more focused on the study of land, oceans, atmosphere. The works are carried out at scientific stations, in expeditions, in space with the help of complex modern devices.

Research of the ocean.

Water spaces explore scientific expeditions. Expedition participants discovered previously unknown underwater mountain ranges, islands and deep-water depressions. In

1957, an expedition to the Pacific Ocean revealed the deepest point of our planet – the Mariana Trench (10,994 m). Later, Swiss Jacques Picard and the american Donald Walsh step down in the bathyscaphe at the bottom of the hollow and conducted a research.

Famous researcher of the depths of the sea, Frenchman Jacques-Yves Cousteau spent a considerable part of his life under water, studying the living world of seas and oceans. Many countries around the world are now exploring the oceans in order to use their wealth.

In our time, thousands of ships float through the oceans and seas, and large cities have appeared on their coasts. Despite this, the water spaces remain poorly explored.

Antarctide exploration.

The continent stayed outside the research for a long time. Do not promote its study and extremely difficult natural conditions: frost to -80 ° C and strong winds.

Regular research in Antarctica has been conducted for half a century. On the mainland and the surrounding islands, different countries of the world equipped scientific stations. One of them – the station "Academician Vernadsky" – since 1996, conducts research and Ukraine.

What can we see on the Earth from space?

In 1957, earthlings launched into space the first artificial satellite. The Earth and then the ship with the first man on board. Open the initial space age in the study of the globe. Ukraine is a cosmic state. It implements the launch of two spacecraft. In 1997 citizen of Ukraine Leonid Kadenyuk flew in space of the international crew of the American spacecraft "Colombia".

Astronauts for a fantastically short time (90 minutes) make a space journey around the Earth, to which humanity has spent thousands of years learning. There are thousands of satellites on Earth's orbit at any one time.

The spacecraft are equipped with special equipment for taking pictures of the day. People seemed to have the eyes of the interplanetary space overlooking the Earth.

Domestic scientists and geographers.

A significant contribution to the development of geography in the XX century was made by Ukrainian scientists: Rudnytsky, Tutkovsky and Vobliy.

Rudnitsky considered the founder of Ukrainian national geography. The scientist was the organizer and the first director of the Ukrainian Institute of Geography and Cartography in Kharkiv.

Academician Tutkovsky P.A. is the founder of Ukrainian geographic studies. The scientist discovered many geographic and geological objects. He researched the rocks and forms of the earth's surface, underground waters of Ukraine.

Valery member and vice president of the Academy of Sciences of Ukraine K.Vobliy studied the economy and population of Ukraine. In 1922 he wrote one of the first books on economic geography of Ukraine.

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ELECTRICAL PROPERTIES OF Li_2O-x·GeO_2 GLASSES DOPED WITH 3d- IONS

One of the most pressing issues of modern electronics and energy is the limited lifespan of electrolytes in autonomous power supplies. The most promising solution to this problem is the replacement of organic electrolytes with inorganic solids since the last ones are more electrically stable. Naturally, the ionic conductivity is determined by the atomic, micro, and nanometer structures of a solid. The study of ion charge-transfer in ordered and disordered solids is of particular interest.

The family of lithium-germanium oxides Li2O-x-GeO2 includes about ten stable compounds, some of which are considered as the perspective matrixes for the creation of new superionic conductors. Doping with heterovalent impurities can be an effective approach to increase ionic conductivity. The earlier electrical conductivity of pure and doped with Cr, Mn lithium heptagermanate Li2Ge7O15 single crystals were studied in special researches [1, 2]. In our research, we would like to present the results of AC electrical conductivity measurements in the Li2O-7GeO2 glasses doped with Cr, Mn.

Lithium heptagermanate $Li_2Ge_7O_{15}$ glasses doped with Cr and Mn were prepared by the melts tempering. Electrical conductivity σ of pure and doped glasses was measured in AC field (f=1 kHz) within the temperature range 300-700 K. It is shown that both impurities change the conductivity of the glasses. The influence of Cr doping was very subtle whereas the maximum effect was observed for the $Li_2Ge_7O_{15}$: Mn glass. The obtained data were compared to the results of measuring σ in the $Li_2Ge_7O_{15}$: Cr, Mn single crystals [1, 2]. It was noted that doping affected σ of the glasses and the single crystals in different ways. In particular, the conductivity of the single crystals can be controlled by doping in a wide range: introducing Cr impurity strongly increased σ and vice versa; doping with Mn sufficiently decreased σ value. Doping effect was interpreted on the basis of the previous EPR data giving information on the Cr and Mn centers located in the $Li_2Ge_7O_{15}$

structure. Cr ions substitute for Ge ions and are fixed within oxygen octahedra. On the other hand, Mn ions are located within the cavities formed by Ge-O structural framework and are assumed to be mobile enough to contribute to charge transfer.

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MECHANISMS OF BACTERIAL RESISTANCE TO ANTIBIOTICS

Antibiotic resistance (ABR or AR) is the ability of bacteria to resist once successfully working drug medication, specifically – antibiotics [1]. We need to describe a “bacterium” in order to understand this term.

Bacterium is a prokaryotic microorganism that can survive almost in any type of environment and can be found anywhere on the planet Earth. The number of prokaryotes on the earth is estimated to be $4\text{-}6\times10^{30}$ cells.

The main mechanisms by which bacteria resist antibiotics are:

1. Intercepting and inactivation of antibiotic molecules by releasing enzymes that deactivate a drug.

2. Active efflux of the antibiotics. Efflux is a mechanism that is responsible for moving compounds out of the cell by using special pumps (for example, sodium-potassium pumps). These pumps within the cellular membrane of certain bacterial species are used to pump antibiotics out of the cell before they can do any damage [2].

The development of the resistance to antibiotics lies in bacterial genetics and transferring genetic material between cells. Because of evolution, they can find new ways of outliving harsh conditions one of which might be antibiotics. That is called “stress-directed mutation” and because bacteria are short-lived organisms that reproduce by multiplying themselves this process is much faster than in normal-sized organism as the human body.

Gene transfer mechanisms have peculiar traits specific to microorganisms. There are 3 main ways of genetic transfer between cells:

First one is that bacteria can pick up DNA from the environment and implement it to their system. That process is called transformation [3] or “the funeral grab”. This

process happens when the bacteria are in a special physiological state called "competence". They can even scavenge bits of DNA from the other fallen bacteria.

The second one is the transduction. This way of gene transfer is rather a random one and doesn't rely on the bacteria itself, instead, bacteriophages are the ones that do all the transfer [4]. When a bacterium is attacked by a bacteriophage (a special kind of virus that targets microorganisms) the DNA and RNA of the bacteria can be transferred by the same bacteriophage from one bacterium to the other.

The third way bacteria exchange traits is through conjugation that is a process of direct cell contact conjugation [5]. They connect through special piluses and transfer DNA polymerase bonds. The process when the genetic transfer occurs between different bacterial species is called horizontal gene transfer.

Importance and possible solutions to the problem. With the increasing numbers of ABR, bacteria humanity needs a new way of defending itself.

First and foremost, humanity needs to stop using antibiotics so freely. In developed countries, antibiotics are used to cure even a minor illness as a fast and reliable method and sometimes prescribed wrongly to patients with the flu or other virus-based diseases. They are added to the livestock and crops to boost their resistance to microbes and pump up the production rate of food. Subsequently, this leads to a hastening of ABR.

Another solution might be phage therapy. Phages destroy bacterial cell walls by implementing lytic proteins in the bacterium which kill bacteria. The natural adaptation of the viruses will be a real benefit of this method. Because viruses and bacteria are in a constant state of the "biological warfare" they adapt to each other, unlike antibiotics that are artificial and require human intervention.

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PYROPHOSPATE ELECTROLYTE FOR ELECTRODEPOSITION OF COBALT AND ITS COMPOSITE COATINGS

The rapid development of radio electronics, construction of equipment, automation and communication mean that ever more stringent requirements should be applied to the operational characteristics, and the service life of the equipment should be increased. Cobalt has a unique set of properties, which makes this metal indispensable in some areas of the new technology [3]. Recently, cobalt-based composite metal coatings have been most often used in electroplating. Pyrophosphate electrolytes are used to obtain such coatings [1].

From the results of the research, conducted by the scientists of the chemical department of Oles Honchar Dnipro National University, it was found that during the electroplating of tin from the solutions containing titanate (IV) additives of alkali metals, precipitates contained TiO_2 in their composition. Therefore, the possibility of obtaining a composite Co-TiO_2 that would contain a soluble titanium salt was investigated. To obtain Co-Ti composite coatings, an electrolyte should be developed, in which it would be stable, and the Co (II) and Ti (IV) compounds would not precipitate.

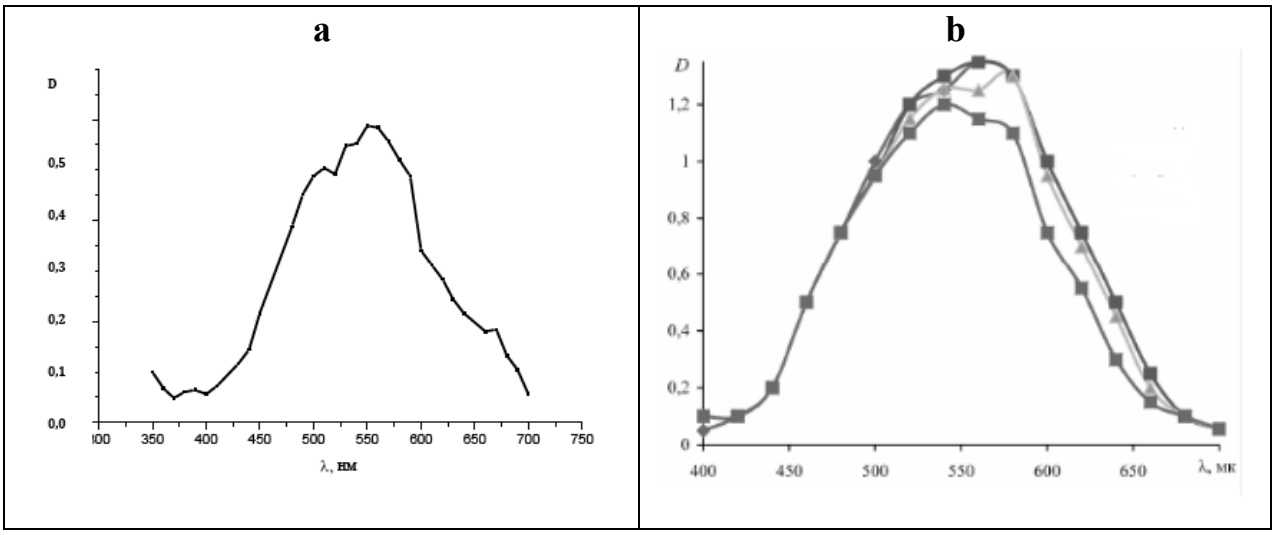

Fig.1:
a) absorption spectrum of the solution containing 0.08 mol/l $[Co(P_2O_7)_2]^{6-}$ and 0.13 mol/l $K_4P_2O_7$; b) absorption spectra of electrolyte solutions ($g \cdot l^{-1}$): 1 – $CoSO_4 \cdot 7H_2O$ – 23,6, $K_4P_2O_7 \cdot 3H_2O$ – 300; pH=9,7; 2 – the same as in 1 with NH_4Cl – 10, pH = 9.23; 3 – the same as in 1 with sodium citrate – 30 pH = 9.6; 4 – the same as in 1 of sodium-potassium citrate – 15; pH = 9.7 [2]

We made a solution of cobalt (II) pyrophosphate. For this purpose we prepared saturated solutions of potassium pyrophosphate and cobalt (II) sulfate and measured

the absorption spectrum of the obtained solution (Fig. 1). Comparing its character with the literature data, we found that the manufactured solution actually contains a cobalt pyrophosphate complex (II) The maximum absorption corresponds to the wavelength of 567 nm.

The stability of the resulting solution of cobalt (II) pyrophosphate was investigated depending on the acidity of the medium. For this, potentiometric titration of the background (0.87 mol/l of $K_4P_2O_7$) and of the working electrolyte of 0.08 mol/l $[Co\ (P_2O_7)_2]^{6-}$ and 0.13 mol/l of $K_4P_2O_7$) was carried out. It was shown that the pH values of the stable existence of pyrophosphate complexes in the prepared solution lies in the range of 8.7 – 11.6.

The introduction of the solution of potassium titanate (IV) into the solution of the pyrophosphate complex of Co (II) leads to its instability. In further studies, it is necessary to select the conditions, under which a stable solution can be obtained that would simultaneously contain cobalt and titanium pyrophosphate complexes.

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WAYS OF EXPRESS-STAINING OF FISH BLOOD SMEARS

It is known that fish blood system is a convenient experimental model for solving the problems of assessing the ecological state of the aquatic environment. The morpho-physiological indices of red fish blood act as a sensitive objective indicator of the state of the internal and external environment [1]. Therefore, there is a need for a quick and reliable method of staining fish blood cells both in laboratory, and in field conditions.

Nowadays, there exist several methods of staining blood cells [2]. However, they have disadvantages, such as a significant amount of time spent on staining smears, or they are inconvenient in field conditions, when it is necessary to investigate fish blood during ichthyological research.

Our aim was to develop an alternative way of staining fish smears, which would be faster and more comfortable to perform, and, therefore, more effective, without degrading the quality of staining.

This method is based on the classic Papenheim's staining method, but differs by the interval of time allocated for staining in Romanovsky's dye solution.

The declared method of staining fish blood smears was tested on the basis of the laboratory of the department of general biology and water bioresources of Oles Honchar Dnipro National University.

The object of research was the young carp fish (Cyprinidae). Blood was taken from the tail vein. A small drop of blood taken from the fish was applied to the slide at a distance of 1-1.5 cm from its end. The big and index fingers of the right hand were used to take the grinding glass behind the edge, set it to the surface of the object glass at an angle of 30-45 ° and gently tilt back to the drop of blood, resulting in the latter's spread. Then the sliding motion of polished glass forward evenly distributed the blood in the form of a smear on the object glass. The finished smear was dried up in the air. Then the smears were fixed in the May-Grunwald fixer (2-3 seconds). Fixed smears were placed on 2 bridges, which consisted of two glass sticks each, placed on two opposite edges of the cuvette. Then the smears were poured with a Romanovsky's solution with distilled water (1: 9), which was poured over a higher layer. Staining lasted 5 minutes on one bridge and 15 min on the other.

At the end of the specified time, the paint was washed with a strong jet of distilled water (pH 6.6-6.7) and strokes were left vertically in a tripod for drying. At the end of drying, blood smears were examined under a microscope (40X lens enhancement), using a microscope with the Sciencelab T500 5.17 M digital camera. We observed 100 fields of vision of blood cells. As a result, it was found that the smears that were in the dye for 5 minutes. had a high quality of color, even better than that of the smears that were in the dye for 15 minutes. The above-mentioned method of staining was repeated 5 times.

Thus, the reduction of time for staining fish blood smears did not affect the quality of staining, and, therefore, it is a reliable and fast way of staining.

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EINE NEUE ENTWICKLUNG DER ANTIMATERIE

Alles in unserem Weltall besteht aus Materie. Aber in der Natur gibt es noch etwas Anderes. Nein, das ist keine Dunkle Materie oder Dunkle Energie. Es geht um Antimaterie. Viele weltbekannte Physiker darunter auch Paul Dirac und Nobelpreisträger Carl Anderson haben einen großen Beitrag [4, 5] für die Erforschung der Antimaterie geleistet.

Antimaterie ist Materie mit einer gegenüberliegenden elektrischen Ladung. Antimaterie sollte im Weltall nach dem Urknall im Weltall alle Materien vernichten. Gemäß der Theorie ruft der Urknall Materie und Antimaterie in gleichen Mengen hervor. Wenn sie begegnen, passiert eine gegenseitige Zerstörung und dann bleibt nur saubere Energie. Das heißt Annihilation [1].

Soviel die Physiker heutzutage wissen, war die Antimaterie vor Milliarden Jahren ein überflüssiges Teilchen der Materie. Seit langem versuchen Physiker mit allen Mitteln diese Asymmetrie zu beseitigen [2]. Antimaterie ist näher als wir denken: die Wissenschaftler vermuten, dass Antimaterie bei einem Gewitter geboren ist, unser Körper strahlt Positronen aus und das Positron ist das Antimaterie-Äquivalent des Elektrons. Aber die Teilchen der Antimaterie leben nicht lange, weil die Antimaterie mit der Materie annihiliert [3].

Die Annihilation der Antimaterie löst eine riesige Menge von Energie frei. Ein Gramm der Antimaterie kann die Explosion, wie Kernbombe hervorrufen. Übrigens stellen die Leute nicht so viel Antimaterie her, so können wir uns nicht stören. Wir wissen aber noch nicht, wie wir Antimaterie sammeln können. Die Wissenschaftler haben insgesamt nur 18 Nanogramm Antimaterie gewonnen. Diese Menge ist nicht genug sogar für Erwärmung einer Tasse Tee. Die Erschaffung eines Gramms der Antimaterie fordert 25 Millionen Milliarden Kilowattstunden der Energie und kostet mehr als ein Million Milliarden Dollars. Die Antimaterie gehört zu der Liste der teuersten Stoffe in der Welt [1]. Eine nicht so große Menge der Antimaterie kann sehr viel Energie erzeugen. Darum ist sie ein sehr guter Brennstoff für zukünftige Raumschiffe. Die Bewegung der Rakete mit Brennstoff aus Antimaterie ist möglich.

Antimaterie ist vor allem für die Grundlagenforschung interessant, aber sie hat auch einen praktischen Nutzen. Antimaterie kann man in Medizin benutzen. Wissenschaftler denken, dass die Antimaterie Krebs behandeln kann. Radioaktiv markierte Moleküle werden ins Blut gespritzt, wo sie viele Millionen Positronen emittieren (positiver Beta-Zerfall). Damit kann man zum Beispiel Tumore lokalisieren oder molekulare Andockstellen für chemische Botenstoffe im Nervensystem. Seit 2003

erforschen Wissenschaftler aus zehn verschiedenen Instituten weltweit im Antiproton Cell Experiment (ACE) am CERN die biologischen Auswirkungen von Antiprotonen. Verglichen mit Protonenstrahlen haben Antiprotonenstrahlen die vierfache Zerstörungskraft bei Tumorzellen. Das ergaben Experimente mit Kulturen von Hamsterzellen.

Man verwendet die Antimaterie auch zur Messung von Stoffwechselprozessen. Dafür haben Wissenschaftler und Ingenieure die Methoden SPECT (Single-Photon Emission Computed Tomography) und PET (Positronen-Emissions- Tomographie) entwickelt.

Auch Blutfluss und Sauerstoffverbrauch im Gehirn lassen sich verfolgen. Neurowissenschaftler haben mit PET-Scans zahlreiche Hirnfunktionen und deren Wechselspiel lokalisiert.

Antimaterie ist für Wissenschaftler heute etwas Gewöhnliches, denn sie können die künstlich erzeugen und verwenden. Bei ihrer Entdeckung am 2. August 1932 durch Carl David Anderson war das eine echte Sensation.

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CHEMICAL ADDITIVES IN THE FOOD INDUSTRY

As is well-known, about 10 thousand chemicals or their combinations are added to food during processing, packaging or storage. Some additives are unintentional, for example, the residues of pesticides, which are used to preserve the crops, as well as small amounts of drugs that animals were treated with (hormones, antibiotics) and chemicals released from plastics and other packaging materials.

Why are chemicals added to products? Supplements are usually used to solve the problem of storage, cleaning, processing, heating and packaging of finished foods. Some additives are used to preserve the natural color of products (for example, nitrates are added to meat in order to preserve the natural pink color) [1].

Some scientists argued that, in addition, some substances are used as food additives to increase the nutritional value of products, such as potassium iodide and vitamins. Before use, all chemicals are tested on experimental animals.

However, chemical additives have side effects, as the human digestive tract receives many chemicals on a daily basis. It is impossible to predict what general effects of chemical compounds will manifest in the body; which substances are toxic or carcinogenic due to interactions with other substances, which are derived by the body, and which of them are accumulated. For example, nitrates added to meat turn into carcinogenic nitrosamines that interact with the amino acids in the stomach. In various countries, most supplements are considered to be safe, but the safety of some compounds remains controversial [2].

The examples of additives are:

1. Bottled anisole hydroxide and bottled toluene hydroxide, used as antioxidants.
2. Carboxymethylcellulose as a stabilizer.
3. Aspartame, sucralose and saccharin as artificial sweeteners.
4. Glutamate sodium (another name *Chinese salt*) is the most well-known taste-enhancing agent, which is widely used in various products. Previously, monosodium glutamate was used in baby food, but currently its use is prohibited after scientific studies have shown that large amounts of monosodium glutamate destroy brain cells of young mice [3].

Therefore, the product labels should be studied carefully and products containing the minimum amount of artificial additives should be selected.

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BLUE LIGHT CAN REDUCE BLOOD PRESSURE

Exposure to blue light decreases blood pressure, reducing the risk of developing cardiovascular disease that is the conclusion made in the study at the University of Surrey and Heinrich Heine University Dusseldorf in collaboration with Philips.

This study was published in the European Journal of Preventative Cardiology.

These researches wanted to examine whether exposure to blue light (tree or ultraviolet radiation) could positively influence blood pressure. They recruited

fourteen healthy men and randomly assigned each subject to be exposed to either 30 minutes of monochromatic blue light or to 30 minutes of blue light with a filter fail separately at 450 nanometers each that is a dose comparable to daily sunlight. Recruits should lay down wearing only swim shorts and safety glasses. The researchers measured:

- change in blood pressure after 30 minutes of light exposure;
- changes in forearm vascular resistance, forearm blood flow and pulse wave velocity;
- concentrations of plasma nitric oxide species and nitroso compounds, during and up to 2 hours after light exposure [1].

The authors claim that results were similar to the clinical trials of new drugs to reduce pressure. Here is what the researchers found:

1. Blue light exposure significantly decreased systolic blood pressure. It dropped by almost 8 mmHg on average.

2. Blue light exposure reduced the stiffness of the artery. The experimental group experienced decreased forearm vascular resistance and decreased pulse wave velocity.

3. Blue light increased blood flow. The experimental group showed measured forearm blood flow.

4. Blue light-induced release of nitric oxide. Reductions in systolic blood pressure after 30 minutes of light exposure were correlated with changes in plasma nitroso species [2].

The authors are convinced that their research supports evidence that light could be used to prevent and reduce instances of cardiovascular disease.

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NEW APPROACHES IN VACCINE DEVELOPMENT

Vaccines play an important role in preventive medicine and in the fight against infectious diseases. The development of new vaccines began at the beginning of the XX century when the methods of attenuation of viruses were discovered. Because

of that, the goal of new approaches is to create a more efficient and reliable vaccine that will be created with the help of such sciences like molecular biology, immunology, and biotechnology.

Over the past 10 years, a new direction of scientific researches has occurred that is called genetic immunization. It is also called DNA-vaccination because of the nucleic acids (DNA or RNA) that are injected into the body. And we know that the information about the protein is encoded in the nucleic acids. Nowadays relatively safe systems that ensure efficient delivery of nucleic acids to tissues have been developed. Needed gen is inserted into a plasmid or into a safe virus. This carrier vector enters the cell and synthesizes the necessary proteins. The transformed cell becomes a "factory" of producing the vaccine inside the organism. DNA vaccination leads to a complete immune response and provides a high level of protection against viral infection. Drugs of DNA vaccines don't require special storage and delivery conditions; they are stable for a long time even at room temperature. Some concerns about the safety of DNA vaccines are also discussed in the scientific community. One problem is the integration of plasmid DNA into cellular DNA. However, it has now been argued that integrated DNA vaccines cause insertion mutations that can trigger the activation of oncogenes. Before DNA vaccination will enter medical practice, it is necessary to ensure the safety of such drugs, to study the duration of immunity induced by them and the implications for the immune system [1].

The rapid development of genomics, bioinformatics, and proteomics have led to an entirely new approach to the development of vaccines, that is called "reverse vaccine". This term clearly expresses the essence of the new technological approach. If earlier scientists used to work from the whole microorganism to its components creating vaccines, then now they try the opposite path: from the genome to its products. This approach is based on the fact that most of the protective antigens are protein molecules.

It is important not only to create a vaccine but also to find the best way to deliver it into the body. Now there are so-called mucosal vaccines, which are introduced through the mucous membranes of the mouth, nose or through the skin. The advantages of such drugs are that the vaccine enters the site of infection and stimulates local immunity in those organs that first were attacked by microorganisms [2].

Vector (recombinant) vaccines are vaccines that were obtained by genetic engineering. The essence of the method we can describe as following: the genes of the virulent microorganism which are responsible for the synthesis of antigens are inserted into the genome of the non-pathogenic microorganism. It produces and accumulates the corresponding antigen during cultivation. For example, genetic material is embedded in yeast cells. And after cultivation, the necessary antigen is isolated, purified and then the vaccine can be prepared. There are some positive

results for the use of vector vaccines. If on a live recombinant vaccinia virus put surface proteins of two viruses: glycoprotein B of the herpes simplex virus and influenza A hemagglutinin virus. In that case, an unrestricted replication of the vector occurs, and an adequate immune response develops against the viral infection of both types. One of the main problems faced by the development of vaccines is the problem of cultivating the microorganism and immunizing it with live, weakened vaccine and a possible reversion of the mutation [3].

We described above some new approaches in the development of vaccines that are able to overcome some disadvantages of existing vaccines. They can not only promote the production of safer and more effective vaccines but also contribute to the development of vaccines against diseases for which there is no vaccine yet.

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ADAPTIVE HUMAN POSSIBILITIES IN EXTREME CONDITIONS OF EDUCATIONAL PROCESS

Nowadays great attention is paid to studying the adaptation of human beings to stressful conditions by both doctors and psychologists. Every person who often finds himself in a difficult situation is able to develop skills of suitable responses and the most appropriate mobilization of his functions. For example, a student may to a much greater degree feel fear and confusion while performing his duties in an educational institution, which leads to a decrease in the quality of the training process he undergoes.

The development of a world educational space requires that Ukrainian schools should have a better educational process. This will create favorable conditions for studying and also it will give an opportunity to take into account the individual peculiarities, interests, and level of adaptation of students.

There are many materials that characterize human readiness to stay in extreme situations in the psychology of sport, social, engineering, pedagogical and military psychology. Recently, the interest of both professional psychologists and non-specialists in the concepts of “adaptation possibilities”, “control of consciousness”, “the influence of the educational process”, etc. has been increasing.

Adaptation is understood as the active interaction of the human with the environment in order to achieve optimal levels. The following types of adaptation are distinguished depending on what external conditions and what human interaction level with the environment are carried out: biological, physiological, psychological, and social [2].

Adaptive opportunities are at the core of the formation of psychological readiness of human being to work in extreme conditions. Adaptive opportunities are the most important factor that provides high emotional and neuro-psychological stability of any person.

As you know, the program of school education in the senior classes is quite complex, enriched with a large amount of information. At the forefront are the following qualities of a student: a high level of intelligence and intellectual development, cognitive motivation, moral self-regulation, self-esteem, stress resistance, high performance, etc. [3]. Those students who have a high level of psychological readiness to study are much faster and more adaptable in high school. There are also students who are experiencing some difficulties. In that case, the required quality of training is not well-established, which tends to lead to a decline in performance, loss of interest in gaining new knowledge and, and even to school unsuitability.

Another important problem for tenth and ninth grade students is the problem of adapting to new teachers and establishing cooperation with them. At this age, the attitude of senior pupils to teachers becomes more complex. We would like to point out that the individual human qualities of the teacher such as benevolence, understanding, compassion, etc. are very important [1]. From this point of view, it is very important for teachers to adhere to a democratic communication style that most closely corresponds with the requirements of age-related student development. How successful the adaptation between the teacher and the senior pupil depends on further training and the formation of the student's personality.

Therefore, the adaptive possibility of the personality depends on various psychological factors (self-esteem, level of school and intellectual development, level of educational motivation, etc.).

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ANODIC PROCESSES IN SUSPENSION ACID SOLUTIONS CONTAINING Sn^{2+}

The issue of direct obtention of thin transparent tin oxides, especially SnO2, has aroused a lot of practical interest recently. SnO_2 is a non-conventional material for the creation of sensor control systems for various gas environments, and it is widely used in the electronic industry [1; 2]. Furthermore, the interest in these processes is associated with the technology of electroplating, as well as the technology of refining tin to high purity etc.

We have studied the behavior of platinum electrode in acid solutions and in the solutions containing Sn^{2+}-ions in order to obtain transparent films of tin (IV) oxide on the surface of this electrode. Voltametric methods proved that if the hydrolysis of tin salts in solution was suppressed by acidic environment, it was impossible to obtain tin (IV) oxide, regardless of the type of the acid.

But in suspension solutions with high concentration of Sn^{2+} and pH > 1.1 the maximum anode current is found on the i,E-curves recorded on the platinum electrode at E = 0.5 V (silver chloride electrode). When the chemical oxidation of Sn^{2+} to Sn^{4+} takes place, the specified maximum disappears. According to the Pourbaix diagram, this maximum can correspond to the transition $SnOH^+ \rightarrow SnO_2$. To verify this assumption, the chronoamperometric research was conducted. According to its result, the amount of electricity consumed for electrooxidation of Sn^{+2} to Sn^{+4} at E = 0.5 V corresponds to the amount of substance Sn^{4+} $3{,}9 \cdot 10^{-7}$ Eq/cm^2, which is more than 20 times higher than the same value obtained through the passivation of tin in alkaline solutions.

Thus, it can be concluded that in the suspension electrolytes with the increased concentration of Sn^{2+} at pH > 1.1, there is a number of signs showing that a passive layer of tin compounds is formed on the surface of the electrode.

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CANCER THERAPY

Cancer is a disease when a cell in an organism grows or divides uncontrollably. Normal cells of the body with a working mechanism work according to the internal clock. The internal clock regulates at what point the cell divides, grows, matures, ages or dies. In a cancer cell, this mechanism is damaged.

With the help of scientific discoveries, cancer has ceased to be a sentence. The American James Allison and the Japanese Tasuko Honjo received the Nobel Prize in Medicine for an innovative approach to cancer treatment. They received an award "for the discovery of therapy by suppressing immune regulation".

Allison studies the protein, which functions as an "inhibitor" of the immune system. He found that weakening of the brakes allows immune cells to attack tumors. Thus, Allison's method was the first treatment for melanomas at a later stage. T cells are a part of the immune system and help to protect the body from infection.

Allison highlighted the advantages of immunotherapy over traditional methods of cancer treatment:

1) a properly tuned immune system can fight serious cancer cells with minimal side effects;

2) tumors change, the immune system, with proper management, is able to adapt to these changes;

3) If the body stimulates the production of antibodies against cancer, then these antibodies will remain with the person for life.

In 1992, Hongjo discovered the protein PD-1, which acts on the activated T-cells of the immune system. He conducted a series of experiments on mice with cells responsible for the formation of PD-1. Experimental animals began to suffer from autoimmune diseases.

It turned out that this protein can also work as a "brake". The therapy based on his method also proved effective in the fight against cancer.

These are the methods of treating various types of cancer that are spread throughout the world. Currently, researchers use therapy for other tumors or combination therapy.

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GEOCHEMICAL FEATURES OF THE SNOW COVER OF THE DNIPRO CITY

On the area of Dnipro in 396.8 km2 with a population about 1 million people are located 159 industrial enterprises and organizations. They throw out pollutants through 17.2 thousand sources of emissions [1]. The basis of the industrial complex of the city of Dnipro are enterprises of ferrous and non-ferrous metallurgy, mechanical engineering, chemical industry and energy. These industrial complexes are characterized by significant gas and dust emissions containing large amounts of heavy metals (Pb, Zn, Cu, Cd, Cr, Fe, Ni, Mn). Analysis of climatic conditions shows that the highest potential for pollution is observed in winter, when the frequency of retention layers exceeds 60%, with the inversions having the biggest power and intensity. This leads to a weakening of the turbulent exchange between the lower and higher layers of air [2]. Atmospheric precipitation is a sensitive indicator of the atmospheric pollution. An integral assessment of the pollution of the underlying surface by anthropogenic emissions allows us to give snow cover. It serves as a natural plane for the accumulation of pollutants that fall out as a result of wet and dry sedimentation.

Since the enterprises are located throughout the city, almost the entire territory of Dnipro falls into the zone of air pollution by them. An analysis of snow pollution showed a gradual areal decrease in their concentration from emission sources (industrial enterprises, areas of influence of highways) to more remote areas (residential and park areas). The western region of the right-bank part of the city is characterized by a concentration of a large number of industrial enterprises, to whose territory residential quarters adjoin the east, west and south-west. Highways with heavy traffic pass through the specified area. The highest concentrations of heavy metals (Fe, Mn, Cu, Zn, Ni, Pb, Cd) are noted in this territory. The basis of this group of factories are the giants of the metallurgical and chemical industry of Ukraine. The highest values of the content of the investigated ingredients in the snow cover are confined to large metallurgical enterprises, in whose territory iron concentrations range from 9297, 99 μg /l to 2551.0 μg /l. The amount of Mn in the snow varies from 513.81 μg /l to 1321.156 μg /l. The concentration of copper in the samples taken is also high (from 840.87 μg /l to 1063.385 μg /l). At some sampling points, near metallurgical plants, the concentration of zinc reaches 450 μg /l. The nickel content is generally up to 130 μg /l. The lead concentration reaches rather large values (from 50 to 300 μg /l) only in some research points, and the concentration of cadmium, in general, is within 1 μg /l.

The concentration of all studied heavy metals in the chemical industry is somewhat lower. The concentration of iron here does not exceed 2000 μg /l, manganese – 126 μg /l,

copper – 42 μg /l, zinc – 450 μg /l, nickel – 30 μg /l and also relatively low concentrations of lead and cadmium (5.4 μg /l and 1.0 μg /l, accordingly).

At a distance of several kilometers from the western industrial zone is a park. The territory of this park area is covered by emissions from the western group of factories. As a result, the concentration of the entire research group of heavy metals here is high and amounts to 2916 μg /l for iron, 25.25 μg /l for manganese, 50 μg /l for copper, 122 μg /l for zinc, 14 μg /l for nickel, lead – 36.3 μg /l; cadmium – 8.25 μg /l.

The concentration of major pollutants in the green areas of the city, located at a considerable distance from any sources of technogenic emission, decreases by almost two orders of magnitude.

The central part of the city is among the relatively polluted areas of Dnipro, since it is the central regions that are polluted by emissions of one or another industrial zone in any wind direction: in the western – western group of factories, in the northern – northeast group, in the eastern – TES, etc. In addition, in the centre of the most intense traffic. Near the busiest highways of this part of the city, iron concentration reaches 3500 μg /l, manganese and copper – 250 μg /l, zinc – 150 μg /l, nickel – 30 μg /l, lead – up to 25 μg /l, cadmium up to 9 μg /l.

On the left-bank part of Dnipro, one can trace the influence of emissions of large industrial enterprises located in the southeastern part of the region, and vehicle emissions from one of the most loaded roads of the city. The concentration of iron in snow samples reached almost 3000 μg /l, manganese – 427.25 μg /l, copper – 121 μg / l, zinc – 140 μg /l, nickel – 33 μg /l, lead – 326 μg /l, cadmium – 2.2 μg /l.

The eastern part of the city (Pridneprovsk) is characterized by a relatively low level of contamination of the snow cover with heavy metals, since the emissions of the TES located here are relatively low-toxic pollutants and are carried out through high pipes.

In general, the above high concentrations of all the studied ingredients in snow samples taken throughout the city can be explained by the characteristics of the planning structure of Dnipro, which results in the imposition of emissions from industrial enterprises on vehicle emissions from almost any wind direction.

Thus, in large industrial centers, most of the emissions enter the atmosphere and under the action of wind flows spread over long distances, thereby polluting the air environment of the city. It is maximum in the conditions of the roadside geosystem and extreme in the industrial zone. Recreation zone can be conditionally attributed to the background areas of urbanized areas.

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ALGAL BLOOMS IN THE ZAPORISKE RESERVOIR

Algal blooms are a wide-spread phenomenon that significantly affects the state of water and the possibility of its use [1]. In fact, water blooming is a common natural phenomenon. However, with the massive development of cyanobacteria, biotic self-cleaning complex of water bodies degrades, massive fish blockages are observed, an unpleasant smell appears and the concentration of especially dangerous natural poisons in water increases.

Harmful algal blooms (HABs) have become a severe worldwide problem in aquacultural industry and in the ecosystem of inland and coastal waters. For the inland waters, cyanobacteria blooms are the main concern of drinking water contamination by cyanotoxin production, as well as of the death of fish [8].

For the first time, the problem of water blooming in the Zaporiske reservoir was considered during the period of its secondary impoundment (1946), when the number of algae in its upper layers became several million cl/dm^3 during the summer-autumn period. In the early years blooming was observed only in the upper layers of the reservoir, mainly due to the representatives of genus *Anabena*, then it spreaded to the other parts of the reservoir, where geni *Aphanizomenon* and *Microcystis* played the leading role, although the representatives of the *Diatomocea* dominated by biomass [2, 3, 4].

Massive development of the *Cyanophyceae* was observed in Dnipro in August, 1947, mainly due to the *Anabena flos-aque* and *Anabena flos-aque f. spiroides*, which causes blooming of water, reaching 1 million cells/dm^3[2].

In the subsequent years it was noted that the “blooming” of water occurs mainly due to the blue-green algae, which is the most striking feature of phytoplankton of the reservoir in summer. The areas covered by the “bloom” change from year to year, descending lower along the reservoir.

Since 1963, the *Cyanophyceae* has made 90–95% of the entire phytoplankton in the summer period, while the *Diatomocea* and *Protococaceae* dominate in spring and late autumn.

After the construction of the Dneprodzerzhinsk and Kremenchug rowings, the role of the *Anabena* in the total mass of blue-green algae has diminished, and the number of the *Microcystis aeruginosa* has increased dramatically [6, 7].

There are two peaks of water blooming at the present stage of functioning of the reservoir. The first minor peak of phytoplankton vegetation was observed in March-April due to the representatives of the *Diatomocea*, however the second one, which is much larger, is registered from July to early October due to the *Microcystys aeruginosa* with the biomass maximum of 75 mg / dm^3.

The above-mentioned data justify the need for systematic monitoring studies of phytoplankton of the Zaporiske reservoir, as well as providing recommendations for coping with the mass reproduction of the *Microcystys aeruginosa* [5, 9].

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QUANTUM-CHEMICAL MODELING OF DIMERIZATION OF COPPER ATOMS WITH PARTICIPATION OF MALEIC ACID IN THE PROCESS OF ELECTROREDUCTION

One of the promising areas in electroplating is obtaining nanodisperse organo-metallic coatings which have a number of valuable properties [5]. Among them, copper nanodisperse coatings with an intercalated fraction of the organic component [3, 1] should be isolated, which, due to dπ-pπ-binding, can form stable compounds with Cu^0 and Cu^+.

The energy of formation of copper clusters was studied in the process of electrodeposition of copper ions from an aqueous solution in the presence or absence

of functionally substituted unsaturated alkenes, in particular, acrylic acid (HAA) [6]. It was established that its introduction into the internal coordination sphere leads to a decrease in the energy effects of the dimerization reactions:

$2[Cu^0(H_2O)] \rightarrow [Cu^0{}_2(H_2O)_2]$ −240,6 kJ/mol

$2[Cu^0(H_2O)\pi HAA] \rightarrow [Cu^0{}_2(H_2O)_2\ (\pi HAA)_2]$ −62,6 kJ/mol

$2[Cu^0(H_2O)\pi HAA] \rightarrow [Cu^0{}_2(H_2O)_2] + 2HAA$ −45,1 kJ/mol

It was also experimentally investigated that nanodisperse copper coatings are formed in the presence of acrylic or maleic acid (H_2MA) in the course of electroreduction of copper ions [2]. But the initial stages of nucleation with the involvement of maleic acid are not sufficiently studied. Therefore, the purpose of this work was to conduct quantum-chemical modeling of influence of maleic acid on the dimerization of copper atoms.

Modeling of copper clusters was performed using B3LYP functional. Solvation effects were taken into account using polarization continuum model. Wachters+f basis set was used for copper atoms and 6-311G(d,p) basis set was used for carbon, hydrogen and oxygen atoms. Using Bader method [4], a topological analysis of functions of the distribution of electronic density ρ(r) was carried out, which allowed calculating the coupling energy of atoms of the L_j−Cu-Cu−L_i cluster, where L is H_2MA and/or H_2O. Calculations were made using the Gaussian and AIM2000 program.

According to the simulation results, the energetics of the formation of dimers of copper atoms from their π-complexes with maleic acid in the molecular form was calculated:

$2[Cu^0(H_2O)\pi H_2MA] \rightarrow [Cu^0{}_2(H_2O)_2\ ] + 2H_2MA$ −1,64 kJ/mol (1)

$2[Cu^0(H_2O)\pi H_2MA] \rightarrow [Cu^0{}_2(H_2O)\pi H_2MA] + H_2MA + H_2O$ 15,39 kJ/mol (2)

$2[Cu^0(H_2O)\pi H_2MA] \rightarrow [Cu^0{}_2(\pi H_2MA)_2] + 2H_2O$ 47,97 kJ/mol (3)

$2[Cu^0(H_2O)\pi H_2MA] \rightarrow [Cu^0{}_2(\sigma_{mono}H_2MA)_2] + 2H_2O$ 32,56 kJ/mol (4)

$2[Cu^0(H_2O)\pi H_2MA] \rightarrow [Cu^0{}_2(H_2O)_2(\sigma_{mono}H_2MA)_2]$ 11,70 kJ/mol (5)

$2[Cu^0(H_2O)\pi H_2MA] \rightarrow [Cu^0{}_2(H_2O)_2(\sigma_{bi}H_2MA)_2]$ −66,44 kJ/mol(6)

According to the reaction of dimerization, it can be observed that the introduction of H_2MA leads to a more significant decrease in the energy effects of dimerization than the introduction of HAA. At the same time, as the investigated reactions show, the best energy characteristics are performed in the reaction (6).

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CHANGES IN THE DEGREE OF AGAR SWELLING UNDER THE INFLUENCE OF MICROWAVE FIELD

Agar belongs to jellifying substances obtained from crimson algae. It is a natural vegetative polymer. It contains about 1,5–4 % of mineral salts, 10–20 % of water and 70–80 % of polysaccharides. Agar in its chemical nature is a compound mixture of polysaccharides which have similar structure of the main chain, but differ by the degree of charged groups [1]. It is a yellowish-white powder (or plates). Agar does not dissolve in cold water, but it swells significantly.

The use of agar is conditioned by its unique properties to form gels. Agarose is the major material in chromatography and is used to evolve and refine biological macromolecules. Agar and agarose are used in electrophoresis, immunoelectrophoresis and immunodiffusion. Agar and agarose can also be used in biochemical research. In pharmacology they are used to produce pills and slowly dissolved capsules, and they are a part of hydrogels. In the confectionery industry they are used in the production of marmalade, marshmallow and jellies, juice settling and baking bread [2].

It is known from scientific data that the impact of physical fields of different nature can lead to the changes in the properties of biopolymers [2; 3].

The purpose of our work was to research the impact of microwave field on the swelling of agar.

The samples of alimentary agar-agar (State Standard 16280) were rayed in a microwave oven. The power and time of microwave impact varied. With the help of volumetric method, the evaluation of biopolymer swelling degree in the solution of sodium chloride was done. For comparison, the evaluation of non-rayed agar swelling degree was done, which made 260 %.

It is shown that depending on the parameters of microwave impact, the degree of agar swelling changes. Under minimal power of the microwave field within 3 min the swelling degree makes 340 %. While increasing the irradiation time, the degree of agar swelling grows (to 420 % under 5 min) and then reduces (to 320 % under 7 min of impact). The increase in the power of microwave impact leads to the sharp reduction of the swelling degree. While increasing the power to 300 Hz under the irradiation time of 5 min, the value of swelling degree reduces to 220 %.

It was found out that additional microwave impact makes it possible to influence one of the major characteristics of agar as a natural polymer – the degree of its swelling.

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BIOINFORMATICS AS MODERN INTERDISCIPLINARY RESEARCH FIELD

Bioinformatics is an interdisciplinary field that involves arranging and understanding large-scale biological data that comes from experiments: modeling biological processes, prediction of three-dimensional structure of biological macromolecules. It uses the combination of computers, software tools, and databases in an effort to address biological questions. It is not an independent science, it is often defined as the application of tools of computation and analysis to the interpretation of biological data, thus, answering most biological questions. Bioinformatics has emerged on an intersection of different sciences, such as molecular biology and genetics, computer science, mathematics, and statistics. It depends on particular tasks which of these applied above all. There are two main branches of bioinformatics: “omics” – refers to a field of study in biology ending in *-omics*, such as genomics, proteomics or metabolomics, and another branch of bioinformatics is structural bioinformatics, which rationalizes and classifies information contained in the three-dimensional structures of molecules, in terms of their functional capabilities, such as proteins, RNA, and DNA. It is obvious that without bioinformatics it is impossible to make sense of

the huge data produced in Omics research. If we look at the increase of the EMBL Nucleotide Sequence Database (EMBL-Bank), the Release 105 on 27-AUG-2010 contained 195,241,608 sequence entries comprising 292,078,866,691 nucleotides. This translated to a total of 128 GB compressed and 831 GB uncompressed data. Bioinformatics does not only have to provide the structures in which to store the information, but also store it in such a way that is retrievable, and comparable not only to similar data but also to other types of information. Where available, protein structures provide much better functional insight than their sequences alone. The reasons are that: as compared to the sequences, twofold structures provide (a) a much higher resolution of information about the protein molecules and (b) a much more sensitive approach for detecting similarities among proteins. As opposed to *in vitro*, most of the studies in bioinformatics have been done using *in silico* approach, which means that analyses are done on a computer-generated mathematical model which contains all the parameters of physical model. The reason for this is that some of the proteins are impossible to crystallize due to their hydrophobic nature. The challenges and concepts bioinformatics as a discipline currently encompasses are: predictive model of RNA splicing/alternative splicing, the ability to predict the splicing pattern, protein structure prediction, mechanistic understanding of speciation. There are key factors which led to the development of bioinformatics: human genome sequencing project, called "The Human Genome Project" – one of the largest international science project that generated a vast amount of data, the use of next-generation sequencing approaches, development of drug discovery, need for high throughput phenotyping tools that would help for efficiently determining biologically meaningful associations between genomic and phenotypic data, advancing the translational sciences, personal genomics, and personalized medicine, and/or agriculture. As the demand for bioinformatics increases, the global bioinformatics market is expected to reach USD 13.50 billion in 2023 from USD 7.73 billion in 2018, at CAGR of 14.5%. On the basis of sector, the global bioinformatics market is divided into biotechnology and academics. It is highly commercializated and competitive field: few of the major companies in bioinformatics market are Thermo Fisher Scientific (US), Illumina Inc (US). There are also bioinformatics institutes, such as Swiss Institute of Bioinformatics (SIB), European Molecular Biology Laboratory (EMBL) located in EU, some of them based in Eastern Europe as well, such as *Bioinformatics Institute, Skoltech*. In Ukraine we have companies such as MyHeritage, that work in the field of personalised DNA tests. Major factors driving the growth of the market are: growing applications of bioinformatics; initiatives from government and private organizations. Starting it's way in 2000's bioinformatics has become an essential interdisciplinary scientific field, which made contribution to discoveries in different areas, transforming modern biology and uniting it with IT-technologies.

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RING OPENING OF EPOXIDES BY AMINO ACID ESTERS

Epoxides are a universal building component in organic synthesis, which can be opened up with a wide range of C,O,N,S-containing nucleophiles. Opening an epoxy cycle with glycine enolates produces γ-hydroxy α-amino acids – structures that are widespread in nature, e.g. in glidobactins [1], arborcandins [2] or biphenomycins [3]. Suitable C-nucleophiles are isocyanoacetates, aminomalonates, or amino esters.

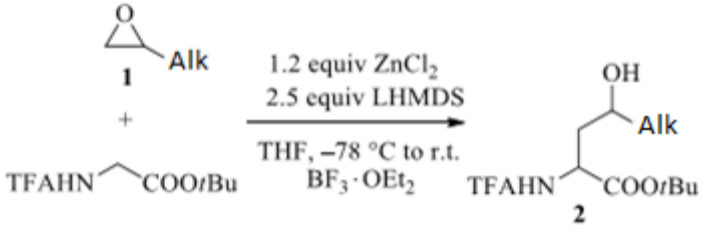

Fig. 1

With aliphatic epoxides (Fig. 1) of structure (1), the product (2) of the S_N2-reaction is formed exclusively in high yield as a diastereomeric mixture. The same was found for glycidyl ethers.

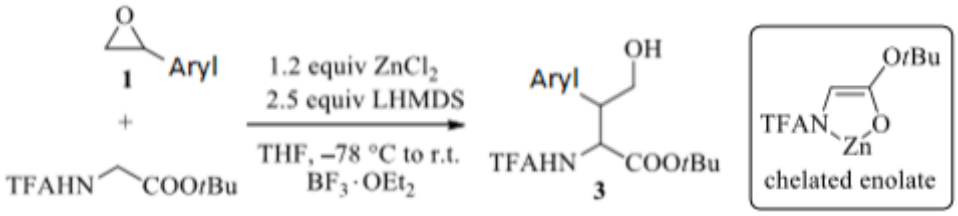

Fig. 2

For aryl-substituted (Fig. 2) epoxides, only the formation of S_N1-product (3) – substituted phenylalanines is observed. Under the mild reaction conditions the nucleophilic attack on the *in situ* formed benzylic carbenium ion, which is significantly faster than the S_N2-attack. To prove if this concept is also suitable for the modification of peptides, a phenylalanine dipeptide was exposed to analogous

reaction conditions. The amount of base had to be increased to 3.5 equiv. LHMDS (lithium hexamethyldisilazide) [4]. To make the NMR spectra clearer by reducing the number of stereoisomers, the ring opening products (4, 5) were directly oxidized to the corresponding ketones (6). Two-stage process with a dipeptide leads to a decrease in the yield of ketones (6).

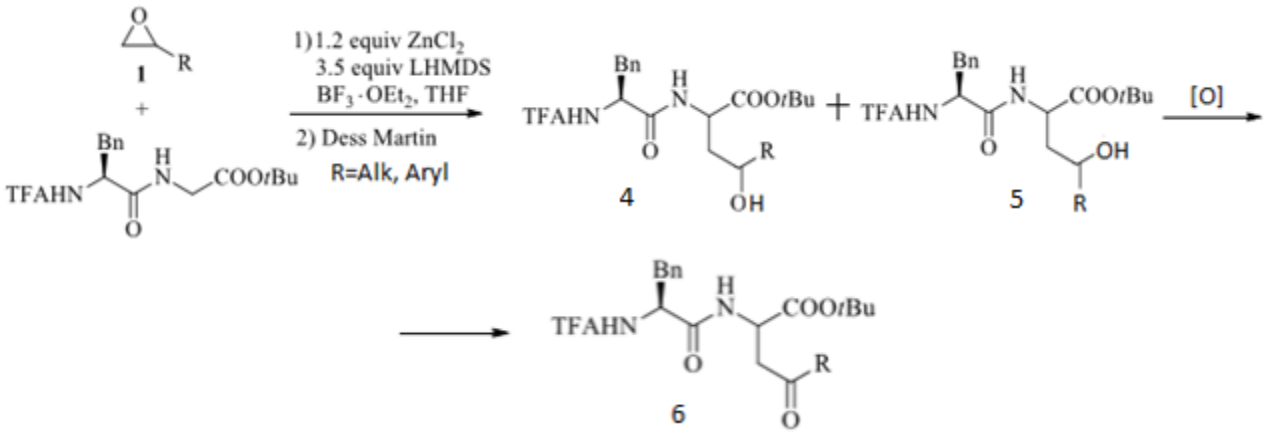

Fig. 3

In conclusion, it is possible to say that chelated α-amino acid and peptide enolates are suitable nucleophiles for regioselective opening of epoxides. Depending on the nature of the substitution in the oxirane molecule, the reaction proceeds either in the type of S_N1 (arylepoxides) or in the type of S_N2 (alkylepoxides). Attempts to increase the stereoselectivity of these processes, as well as synthetic applications, are currently under investigation.

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SYNTHESIS OF FORMIL AND DIAZONIL 10,11-DIHYDRO-5H-DIBENZO[B, F]AZEPINE DERIVANTS

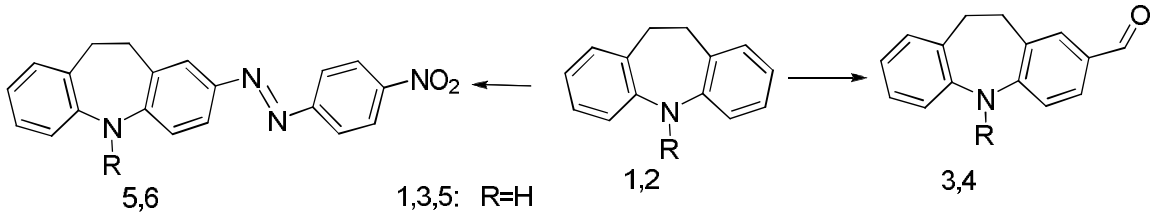
Reactivity of 10,11-dihydro-5H-dibenzo[b,f]azepine-2-carbaldehyde (imino-dibenzil) and their derivants has been studied intensely. A large number of publications were dedicated to the study of N-subsitilude derivants of 10,11-dihydro-

5H-dibenzo[b,f]azepine-2-carbaldehyde and dibenz[b,f]azepine derivants, which are widely used as antidepressants, thymoleptics, antiepileptic drugs, psychostimulants, for treating alcohol withdrawal syndrome (carbamazepine). This medicines normalize metabolism, activate choline and adrenergic mediatorial systems, have very high antidepressant action, reduce the activity of Na+, K+ -AT phase, as well as, the elevated level of cAMP [1-3]. It is stated that the antidepressant imipramine evokes the death of auto-phase and glioma U-87MG cells, thus revealing anti-tumor effect on humans cells [4]. The information about the structure, spectral characteristics, method of synthesis and reactivity of these substances, was systematized in the survey of L.J. Kricka, and A. Ledwiht [5]. Therefore, the research of reactivity and synthesis of iminodibenzyl derivant is vital.

After analyzing the publications we can assert that the reactions of electrophilic substitution in 10,11-dihydro-5H-dibenzo[b,f]azepine are directed according to the carbon atom. The direction of electrophilic substitutional reactions is defined by the character of the substituent near the hydrogen atom. In the case of N-alkylated derivatives and unsubstituted 10,11-dihydro-5H-dibenzo[b,f]azepine, substitution products are preferably formed in the positions 2 and 8, and in the case of N-acylated derivants 3 and 7 substituted derivants are formed.

This article is devoted to the research of reactivity of 10,11-dihydro-5H-dibenzo[b,f]azepine (1) and N-methylated 5-methyl-10,11-dihydro-5H-dibenzo[b,f]azepine (2) in the formylation reaction and azo combination.

We studied the conditions of Vilsmeier-Haack's formylation reactions with DMF in the presence of $POCl_3$ at room temperature. Benzol or dimethylformamide were used as a solvent. It was established that the conversion of compound (1) is carried out during 7 days at room temperature with double surplus of formulating agent. The reaction ends after 4 days in similar conditions in case of N-methylated derivant (2). Using DMF as a solvent, the complete conversion of compounds (1) and (2) into the corresponding aldehydes is carried out with the excess $POCl_3$, which is 4 times larger; the reaction time should be increased significantly as well. The products are aldehydes (3,4). Methyl group is introduced to atom N, so the formylation reaction is accelerated.



We can assume that in the case of 10,11-dihydro-5H-dibenzo[b,f]azepine (1) the attack of formylating agent was directed to the N atom, but the product was not precipitated. In the case of benzene, the reaction is primarily directed to the nitrogen

atom, and when the second equivalent of the formylating agent is added, the formylation is passed in the benzene ring, and therefore, the product (3) is obtained by treatment of the reaction mixture. The introduction of the methyl group makes the attack impossible and directs it to the benzene fragments, which helps to reduce the reaction time.

Azo combination of dihydroazepines (1, 2) is conducted in icy acetic acid with 4-nitrobenzenediazonium chloride. Azo-dyes (5, 6) are obtained. The time of conversion of the compound (1) is one hour, the time of conversion of the compound (2) is 7 days in the similar conditions. The speed of the azo combination reaction is reduced, because of introducing a methyl group into the azepine molecule. It is appropriate to assume that it happens due to the change in the conformation of the seven-membered heterocyclic ring, which results in the partial liberation of the undivided pair of nitrogen electrons from the union with the benzene fragment, which is not associated with the benzene fragment.

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TWISTRON

This invention may be exactly what we need to steal environmental energy that would otherwise have been wasted.

Twistron is a new fiber that was developed by researchers at the University of Texas at Dallas and Hanyang University in South Korea. A grid of carbon atoms rolled up into tubes, which are 10,000 times thinner than the width of a human hair, makes up the main fibers of the entire thread. Carbon nanotube yarn can convert mechanical energy into electrical energy due to chemical interactions.

Laboratory studies have shown that a piece of twistron of the size of a couple of millimeters is enough to light up a small light bulb!

When one fiber moves along another, ZnO crystals bend, which leads to the appearance of a potential difference on their faces. Under the action of an electric voltage, an electron sinks from the gold coating into the bulk of zinc oxide nanocrystals through a metal-semiconductor contact.

To produce electricity, nanotubes are first immersed in the electrolyte (for example, a simple mixture of salt and water). The water in the electrolyte creates a very thin barrier between the electrons on the surface of the yarn and the ions in the electrolyte, and thus a capacitor is formed that does not require an external charge. When twisting or stretching this yarn, its volume decreases, as a result of which the electric charges approach each other, and this increases the voltage with the subsequent production of electricity. When stretching a twistron spiral, twisted 30 times a second, 250 watts per kilogram of yarn can be obtained. In laboratory tests from a twistron weighing several grams with each stretch, it was possible to light a small LED. Pieces of carbon nanotube yarn were also implanted in the fabric of the undershirt, which began to generate an electrical signal, stretching and contracting during the human breathing cycle.

Twistron can be used in our devices, where it is difficult to replace the battery. It can find application in making clothes that constantly produce energy using the movements or breathing of the person who wears it. Research has proved that twistron woven into clothing can fuel a breathing apparatus.

At the moment, the technology of creating twistron fabric is quite complicated and expensive. But this is a big step towards recharging gadgets using clothes with inserts of nanofibres.

Perhaps one day in the near future people will recharge their smartphones by performing several l movements in a new twistron suit.

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STUDY ON THE ACTION OF SURFACTANT SUPPLEMENTS ON ELECTRODE PROCESSES

An important task of modern technologies, based on the use of nanosystems in the design and production of promising functional materials, is obtaining and stabilizing nanodispersions of the metal phase. The unique structure of ultramicro- and nano-disperse powders gives them a number of new properties compared to conventional materials. In particular, it has been found that microparticulate metal powders exhibit greater microbiological activity compared with compact metals [1-2].

The perspective for solving this problem is the property of organic substances, capable of forming by dπ-pπ binding of d-metals atoms, which can be used as a stabilizing medium, as well as chemically stable structures, in a wide range of degrees of oxidation of the central atom, first of all, in the zero degree of oxidation, thus acting as stabilizers of nanosized particles in the metal phase elements, which is important for the purposeful formation of ultramicro dispersion of metals.

The team of scientists of the department of physical and inorganic chemistry of Oles Honchar Dnipro National University carried out numerous studies on the action of surfactant supplements on electrode processes and on the mechanism of their influence on the initial stages of electrodeposition of metals [3-4].

Acrylic acid and acrylamide, known as the organic components of copper electrolytes, can form π-complexes with Cu atoms in low oxidation stages. In the authors' studies [5] it was found that copper electroplating, obtained from the solutions containing organic ligands in an amount corresponding to the concentration of cations of cuprum (II), may be included as π-complexes of Cu from acrylic acid and acrylamide and their polymer forms. The number and composition of these compounds depends on the content of organic components in the electrolyte and the conditions of deposition. As a result, the sediments have a more fine-grained structure; they are tense and poorly bonded to the surface of the substrate. Such sediments can be easily transformed into a powder-like state. It was also found that composite metallurgical sediment is characterized by a developed and energy heterogeneous structure [6].

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FLOW INJECTION ON-LINE SORPTION PRECONCENTRATION USING NOVEL HIGH DENSITY POLYETHYLENE POLYMER PACKED MICRO-COLUMN FOR ULTRA-TRACE DETERMINATION OF LEAD

Since the discovery of solid phase extraction (SPE), there has been a significant progress in the field of sample preparation, mostly focused on automation, miniaturization, as well as on simplification of the overall analytical procedure. Sample contamination and analyte loss are avoided by using on-line SPE, leading to the improved reproducibility and sensitivity of the analytical method. The time of analysis is also reduced owing to automation of sample and reagent manipulation. Moreover, on-line SPE can be considered as an environmentally friendly technique, as it fulfils the green analytical chemistry criteria [1,2].

Lead is intensively used in industry, which results in the increase of contamination of environmental and biological systems. Even if lead toxicity is well known, complete control and prevention of lead exposure is still far from being achieved.

A novel high density polyethylene (HDPE) polymer in the form of beads was prepared and used as a sorbent for on-line flow injection (FI)-SPE preconcentration and subsequent determination of lead (II) by flame atomic absorption spectroscopy (FAAS) technique. The developed on-line FI-SPE system provides improved sensitivity and flexibility. The accuracy of the developed method was evaluated by the analysis of certified reference materials.

The method is based on the formation of a low-soluble complex between Pb (II) and diethyldithiocarbamate (DDTC), its preconcentration on HDPE polymer, elution of precipitate with methyl isobutyl ketone, and finally FAAS determination of lead (Fig. 1).

The detection limit of the method was estimated to be 2.6 μg L^{-1} for Pb (II), the relative standard deviation, enrichment factor and sampling frequency were 3.7%, 129 times, and 45 h^{-1}, respectively. It was found that the extraction efficiency of the HDPE microcolumn remained unaffected even after more than 600 sorption/elution

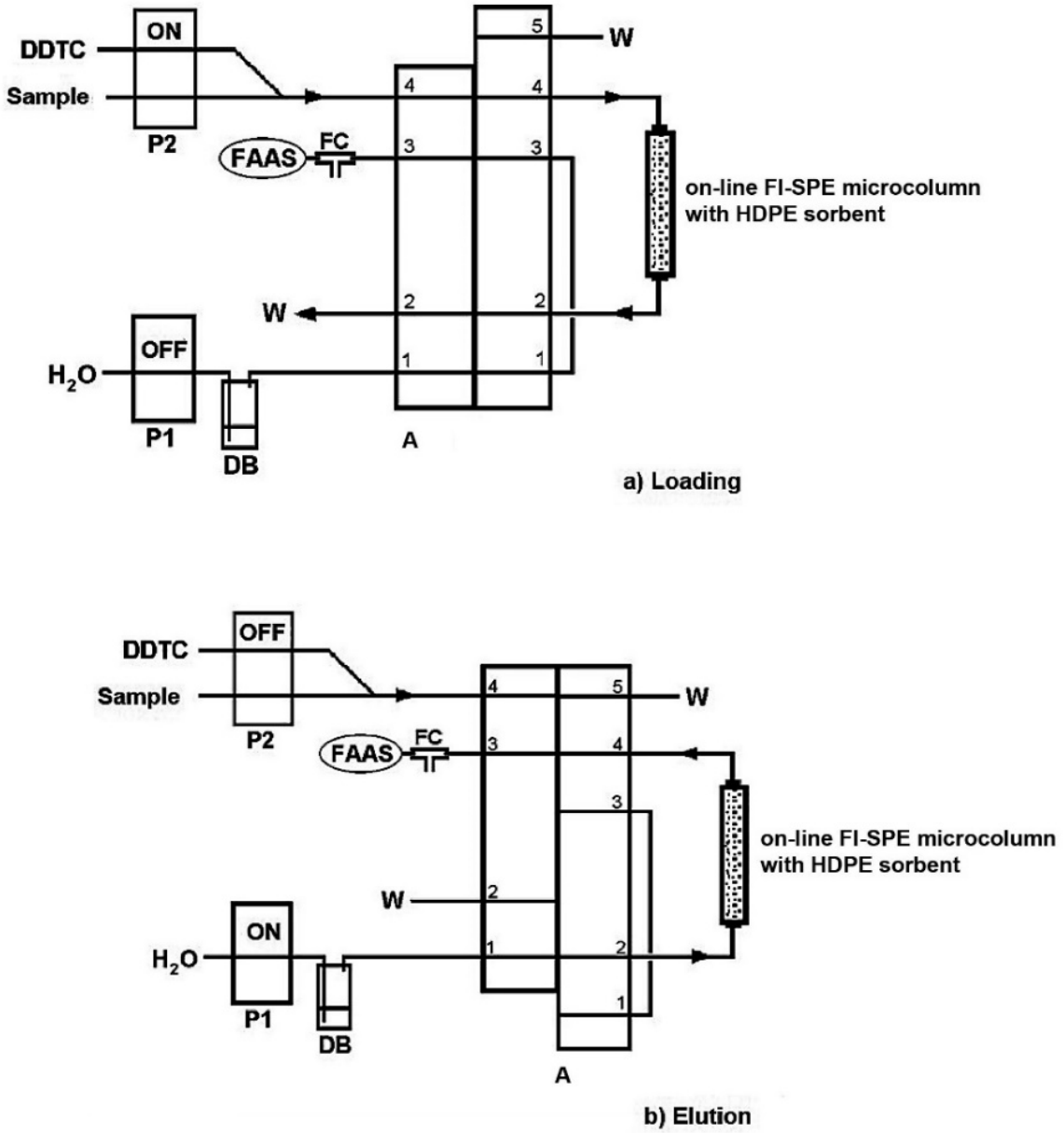

Fig. 1. Schematic diagram of the on-line FI-SPE system for metal determination by FAAS: (a) loading/preconcentration and (b) elution/measurement steps. DDTC, 0.05% (m/v) DDTC aqueous solution; FC, flow compensation unit; P1, P2, peristaltic pumps; A, injection valve; DB, displacement bottle for MIBK delivery; W, waste

analytical cycles, which convincingly demonstrates its high chemical and mechanical stability.

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THE USE OF IONIC LIQUIDS IN EXPERIMENTAL AND POLYMER CHEMISTRY

In recent years the volume of chemical, pharmaceutical, varnish and other industries, as well as their product range, has significantly increased. All these processes, as a rule, require the use of large quantities of volatile organic solvents, which cause serious harm to the environment, along with high costs for the purchase of products. Therefore, it is quite clear that at this time most of the developments are aimed at the implementation of new processes using alternative solvents that satisfy the principles of "green chemistry" [1].

Such solvents include ionic liquids (IL), which possess such unique properties as practically zero saturated vapor pressure, thermal stability, non-flammability etc. [2].

The peculiarity of these compounds consists in the possibility of obtaining IL, corresponding to a specific chemical talk, by varying the combinations of cation-anion pairs. It is equally important that, in practical terms, multiple use of IL can be possible, and this opens up new ways of implementing closed technological cycles.

Ionic liquids are organic salts, the melting point of which is below a certain conventional value, usually taken as 100 °C. Although some salts were synthesized as early as the 1920s, an increased interest in them has recently arisen; the reason for this was environmental pollution and unsustainable use of natural resources [1].

The first stage of the synthesis of IL, as a rule, is the so-called quaternization, when the starting amine NR_3 is alkylated using alkyl halides or alkyl sulfates R'X, and in this way the ionic liquid $[R'R_3N]^+ X^-$ is obtained. The quaternization reaction is simple in performance: a mixture of alkyl halide and amine in a solvent (ethyl acetate, toluene etc) is heated in an inert gas atmosphere, and the temperature of process and reaction time are determined by reactivity of the alkylating agent. In addition, it depends on the nature of the halide, for example, iodides are more active than bromides and chlorides. Further, the anion of the obtained IL can be replaced by another anion – through the reaction of metathesis with salt, Bronsted acid or Lewis acid, as well as with ion-exchange resin. The thermal stability of IL, which is essential for high-temperature catalytic processes, is determined by the strength of the carbon-heteroatom bond and the stability of the resulting ions. Thus, imidazole IL decompose at above 200 ° C, and phosphonium – at above 300 ° C [2].

The nature of the anion also affects significantly the stability of the IL: the more its nucleophilicity is, the easier it undergoes retroquaternization and the less stable the IL is at elevated temperatures. From the point of view of practical use of IL as solvents, their behavior during the contact with water, which is determined by

the nature of the IL itself, is very important. Thus, halogen-containing IL completely mix with water, and some do not mix at all. Most IL contain a small amount of residual water, acquired by them in the process of synthesis; in addition, some IL are hygroscopic [3].

These properties are due to the use of IL in many areas, as well as the implementation of environmentally and economically acceptable technologies with their application. In particular, IL have found application in experimental chemistry. For example, in refractometry IL are used as immersion media for determining refractive indices in refractometric analysis, in the creation of touch devices, as well as creating sensors for potentiometers, gas sensors and biosensors. In addition, they are used in electrochemistry in the devices where IL play the role of electrolyte components in lithium and solar batteries, as well as capacitors.

The most promising area of practical application of IL is homogeneous and heterogeneous catalysis: they are used as catalytic systems and components of catalysts, as well as solvents in polymer synthesis processes [4].

The use of IL in polymerization processes ensures their high speed, creates the possibility of directional modification of the properties of polymers, and also affects the structure, imparts electrical conductivity to functional polymeric materials. In numerous studies it was found that the use of IL, due to the diversity of cation-anion combinations in them, ensures selectivity and high yield of products.

Free radical polymerization is the main industrial method for the production of a variety of polymers. IL as solvents were first used in the free radical polymerization of vinyl monomers for introduction of simple electrolytes into polymers in order to obtain ion-conducting polymers.

The fact of the growth rate of radical polymerization in the IL medium is of practical importance, especially in the processes of controlled radical atom transfer polymerization (ATRP). This process is one of the effective ways to control the growth of the polymer chain, which allows us to obtain polymers with a given molecular weight and a narrow molecular weight distribution [5].

In the ATRP heterophase system, the reaction system is self-regulated and, as a result, the probability of side reactions is reduced. In this case, the limited solubility of monomers in IL does not interfere with their polymerization. Another important advantage of using IL as a solvent in radical polymerization is the possibility of synthesizing block copolymers by usual radical, sequential polymerization of monomers due to their low solubility in IL [6].

Thus, the analysis of bibliographical data shows that ionic liquids are widely used in organic synthesis as "green" solvents and as catalytic media for the production of various classes of organic compounds. Moreover, the possibility of multiple reuse of IL opens up grand prospects for the application of this new class of substances in the chemistry of high-molecular compounds.

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THE EFFECT OF MICROWAVE FIELD ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF COLLAGEN

Collagen is known for its necessity for normal functioning of the human motor system. It is one of the most important proteins, as it constitutes one third of all proteins of the mass of the human body. This protein is increasingly used as a functional foodstuff and as the basis for medicinal and blood substitutes [1].

To develop new foodstuff and medicinal forms that contain collagen, it is necessary to take into account its physical and chemical properties, especially its reactivity, which depends on the structure of the protein molecule, its qualitative and quantitative composition, thermal characteristics, surface charge etc. From the scientific data it is known that the collagen molecule is electrically neutral at the isoelectric point [2]. It has minimal reactionary ability. The process of self-ordering of macromolecules in the solution, which is accompanied by structural and conformational conversions, proceeds most effectively near the isoelectric point. Above this pH, the main groups of the protein are blocked and the collagen molecule acquires an anionic charge; below this pH, acidic groups are blocked, and the charge of the molecule is cationic [3]. The pH values of the isoelectric point and the quantity of surface charge of the protein molecule have a great influence on the reactivity of collagen.

The work objective was to study the effect of the microwave field on the physico-chemical properties of collagen, particularly on the value of its isoelectric point.

We determined the pH values of collagen samples without and with the impact of the microwave field.

The determination of the isoelectric points of collagen samples was carried out by a graphical method: extremes of dependence of the magnitude of swelling degree

of the studied samples from pH were associated, along with minimizing the total surface charge on protein molecules, and the isoelectric point of the protein was determined. It was found that the data of the collagen sample before and after the microwave impact are 5 and 6, respectively.

It is shown that during microwave handling of collagen substitutes, protein isoelectric point value shifts to the alkaline range, which is accompanied by ionization of the protein molecule, and may be accompanied by an increase in its reactivity when interacting with cationic reagents. From academic sources it is known that the shift of pH of medium away from the isoelectric point of protein also encourages an increase of its moisture binding ability. Also, changing isoelectric point position influences protein hydration. Thus, it can be assumed that a change in the structure of a protein by impact of the microwave field leads to a change in its reactivity.

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SHINING PLANTS

Imagine a plant that shines like a flashlight, allowing you to read in the dark without spending a dime on electricity. These plants can be grown everywhere in order to provide soft night lighting without bulky lanterns and wires. This wonderful fantasy can become a reality in the near future: a team of researchers from the Massachusetts Institute of Technology (MIT) wants to bring it to life. But how can you make the plant glow?

Biological luminescence (bioluminescence) is often found in the wild. Scientists at MIT managed to make some plants glow with the help of a firefly enzyme called luciferase. In insects it binds to another chemical, luciferin, which causes a light-emitting reaction. The researchers found out how to implant both of these components into the leaves of plants, which in fact caused them to emit a dull glow.

The scientists believe that they will be able to improve this reaction to such an extent that the plants will be able to light entire rooms. They think that after some time luminous trees will be able to replace street lights, which will save energy and

money. This is not the first attempt of such a project: a few years ago, a startup named Glowing Plants launched a campaign on Kickstarter to create plants that could glow in the dark using the same luciferase reaction. After 4 years and 500,000 of collected dollars, the scientists found out that, in fact, it is much more difficult to bring out luminous plants than it seemed in theory, and, therefore, the project was closed. Although the researchers managed to force the plants to emit light, it was too weak to be used for practical purposes.

At MIT, the technique is completely different. If the Glowing Plants team relied on genetic modifications, in this case, the scientists just want to integrate luminiferous proteins directly into the plants. According to their forecasts, in the near future they will be able to increase the brightness of plants and improve the current method of protein implantation. Now proteins fall into the foliage after soaking in a solution full of nanoparticles under high pressure, as well as after sputtering and special staining.

Of course, at present, luminous plants can't compete with the huge market of lighting technologies. However, in future, if the project succeeds and enters the market, many lovers of environmentally friendly technologies (and just those who don't like to pay for the light) will be able to appreciate the plant lighting.

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ARVI – A DISEASE OF CHILDREN AND ADULTS

ARVI (acute respiratory viral infection) is a complex of inflammatory processes of the upper airways. It is called a complex because this infection can be caused by different types of viruses: influenza, parainfluenza, respiratory syncytial, adeno-and rhinovirus. Generally, they appear equally unpleasant for people and last (continue) for 5-7 days. But there are also differences between infections in both symptoms and consequences. If you do not understand in time how to treat the disease, a viral infection weakens the body so much so that bacteria can enter the body and severe pneumonia, bronchitis, tracheitis and other diseases will progress. In most cases, a cold passes in a week without any consequences.

Causes of ARVI

There are thousands of types of viruses which can cause diseases of ARVI. The source of infection is a sick person during the entire period of the disease. ARVI is the most frequent disease on the globe, during periods of pandemics, more than 30% of all mankind may have a chance to get sick during a year. This disease is transmitted by airborne way. The probability of catching a cold depends on the strength of the immune system. Most often, children are ill with ARVI because their immune system is not sufficiently resistant to viruses.

Signs and symptoms of ARVI include:

1. First symptoms

Colds begin within a few hours. Person feels some discomfort: weakness, drowsiness, desire to have a rest. Sometimes she/he may feel pain in her/his arms and legs, neck, backache, a burning sensation in the eyes. A sore throat often signals the beginning of a cold.

2. Temperature

The temperature does not rise above 38 degrees with a cold.

3. Obvious signs of a cold

Coughing is not characteristic of the common cold, but it can appear with the first symptoms as a protective reflex. Runny nose is a typically manifestation of a cold and nose can be stuffed. Headache can be a reaction to temperature rise in both adults and children.

4. Possible symptoms of ARVI and colds

Sometimes the virus gets to other organs and systems. Then signs may appear that are not characteristic of a common cold or ARVI: nausea, dizziness, diarrhea, swelling of the body.

Treatment of ARVI

The treatment of acute respiratory viral infections should be comprehensive. It is very important for recovery to have a strong immune system, that is why person must use different methods to maintain it. The patient must comply with bed rest. From drugs, she/he can use antipyretic drugs (paracetamol and ibuprofen) and it is advisable to drink a lot of fluids for detoxification of the body (broth hips, tea with lemon, raspberries and honey). However, treatment must be prescribed by the patient's doctor.

Prevention of ARVI

The most effective way to prevent our body from viral infections is maintaining our own immune system in tone for all year. There are various ways to strengthen the immune system. They include active lifestyle, proper and balanced nutrition. During the period of the epidemic the most important thing is to perform anti-

epidemic rules. For example, isolation of patients from healthy people, wearing masks in public places etc.

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ORIGIN OF LIFE: CHEMICAL REACTION?

The origin of life on our planet is one of the greatest mysteries for all scientists, which has existed for centuries. The discovery made by chemists, can give an answer to one of these questions: what chemical reaction contributed to the origin of life?

Earlier the scientists, considering the hypothesis of the origin of the world, based their theories on phospholyration – reaction, which can combine three different elements, thereby creating something new. It is carried out by short nucleotide strands for the storage of genetic information; short fragments of amino acids which perform most of the basic cell program; and also the lipids that form the walls of intracellular structures. However, so far no compound has been found capable of forming all three components during the reaction. Now it is found: diamidophosphate (DAP), according to chemists, was present on the Earth during the birth of life and can be the key to many mysteries of its chemical nature. However, this hypothesis failed because when the scientists repeated this reaction, nothing new was created.

Ramanarayanan Krishnamurthy – the scientist from the SCRIPPS Institute in La JOLLA (USA) who introduced this idea, stated that phosphorylation, as a result of some reaction, created the first basic structures which gave impulse to the origin of life. This theory explains the appearance of other important chemical processes that could not exist because of the youth of our planet.

We can't say that other reactions were unable to phospholyrate molecules. They simply demanded special environment, which appeared somewhat later; as well as the special agents that would transfer the result of a chemical reaction. Krishnamurthy was able to find out how the origin of life could occur as a result of complex biochemical reactions, which nobody could do before that.

The discovery breaks the framework through which the scientists could not pass, and gives rise to difficult research. This hypothesis only allows us to state that there is a new variant of creation of the world – biochemical reaction. Chemists were able

to show people how our lives could be "built" as a result of the interaction of sugar and carbohydrates.

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MODERN IDEAS ABOUT THE MECHANISMS OF BLOOD COAGULATION

There are 12 factors involved in the coagulation mechanism of a healthy person: 12 proteins, which are indicated in Latin numerals from I to XII. The absence or reduction of one of them in the blood leads to a violation of blood clotting.

Previously three types of hereditary haemophilia were identified:

- *haemophilia A (classic – lack of factor VIII – antihaemophilic globulin);*
- *haemophilia B (Christmas disease – deficiency of factor IX – plasma thromboplastin);*
- *haemophilia C (very rare form – lack of component XI of the factor – the precursor of blood plasma thromboplastin).*

Due to the fact that the symptoms of haemophilia C and the mode of inheritance are significantly different from the first two types, it was excluded from the classification and attributed to rare coagulopathies: a group of diseases with bleeding disorders caused by various causes.

Diagnosis of the disease is carried out in three stages:

- collection of anamnesis: information about the manifestation of similar symptoms in the family and mother's complaints about the child condition;
- laboratory blood tests, where the leading indicator is an increased blood clotting time, as well as a plasma sample in which at least one clotting factor is absent or reduced;
- clinical symptoms of the disease.

When making a diagnosis, a doctor should make a differential diagnosis with thrombocytopenic purpura, von Willebrand disease and Glanzmann thrombasthenia.

Currently, there has been a considerable progress in understanding the mechanisms of thrombus growth. The process occurs in three stages: initiation, growth, stop. In the first phase, the formation of a platelet aggregate from non-activated platelets plays a crucial

role. Recently it has become clear that non-activated platelets form the primary platelet clot. Such a clot is unstable, and platelets and their small aggregates are constantly disconnected from it. In the next phase – the growth phase – these non-activated platelets are activated, which leads to their strong binding to each other. Plasma link plays a crucial role in activation: thrombin wave, propagating in space from the place of activation, moves inside the platelet clot and, in essence, it forms a true thrombus, converting the platelets into an active, tightly bound form. The role of this process used to be greatly underestimated. Next is the formation of a fibrin clot, which makes it definitive. The last phase, the phase of stopping the growth of a clot, is still the least studied. It is now clear that in the phase of stopping the growth of a blood clot, hemodynamic features in this vessel and the size of the damage area actively intervene. In conjunction with the dynamics of the spread of thrombin, this leads to complete or incomplete occlusion of the vessel, when there is a gap in it. In this process, the formation of a new subpopulation of platelets, opened by the group of M. Panteleev, also plays a huge role. These platelets collect all of their receptors in one cluster, thereby preventing sticking of new inactive platelets. New ideas about the mechanisms of coagulation clearly emphasize that most of the existing methods for assessing haemostasis in patients have low informative value and should be replaced with new ones. It also explains why a standard coagulogram is so uninformative that doctors practically do not use it. This in turn leads to a strong underestimation of the risks associated with impaired haemostasis in many pathologies.

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SYNTHESIS OF COBALT(II) TETRAFLUOROBORATE AND ITS ELECTROCHEMICAL PROPERTIES

Cobalt in a nanoscale state has strong magnetic properties, which are the basis of all directions of its applied use [1]. Although the nature of magnetism is not sufficiently studied, cobalt is actively used in the creation of electrical and computing devices [2].

The development of a new electrolyte for conducting cobalt electrodeposition also presents interest. As is known, the electroreduction of Co(II) cations from aqueous solutions occurs through a series of stages with the participation of complex ions of different composition. The structure of these ions significantly affects the kinetics and mechanism of the electroreduction process of Co.

To simulate Co^{2+} complexes with a different composition of the internal coordination sphere, such a solution should be used as the initial one, which would contain only Cobalt Aqua Complexes. Such solutions can contain cobalt nitrate and tetrafluoroborate. Since there is no preparative cobalt tetrafluoroborate, it should be synthesized for further use in electrochemical studies. Cobalt tetrafluoroborate can be obtained by reacting tetrafluoroborate acid with cobalt(II) carbonate.

First, a precipitate of the basic salt of cobalt(II) carbonate was obtained by the exchange reaction [3]. The fresh precipitate was washed with distilled water. Then, the washed precipitate was dissolved in a minimum amount of tetrafluoroborate acid until the evolution of gas bubbles ceased. To obtain crystalline cobalt tetrafluoroborate, its resulting solution was evaporated on a hot plate until a crystalline film formed on the surface of the solution. The resulting mixture was cooled and placed in a desiccator filled with concentrated sulfuric acid. After long drying, cobalt tetrafluoroborate crystals were obtained, red in color. The absorption spectrum of the resulting solution was measured. The spectrum has the same appearance as for cobalt(II) sulfate, with the maximum absorption at 510 nm. Thus, direct spectrophotometric determination of salt concentration is possible. The electrochemical activity of the synthesized compound was examined. For this, an electrolyte containing 0,1 mol/l $Co(BF_4)_2$ and 1 mol/l $NaBF_4$ was prepared. In this solution, cyclic voltamperograms (CVA) were measured on platinum, gold, and copper electrodes.

It was found that the cathode branch of the voltamperogram has two sections: 1) at a potential of -0,2V, which corresponds to the reaction of hydrogen evolution; 2) at potentials of -0,5 ÷ (-1,0) V, which corresponds to the reduction of cobalt (II) cations.

When comparing the obtained voltamperogram with a similar dependence measured in the chlorate-acid electrolyte, a number of differences were revealed. Three characteristic waves were observed in the chlorate solution. The first wave in the potential region is -0,5V, the second is about -0,8V and the third is at a potential of -1,3V. The presence of the 2nd and 3rd waves on the cathode voltamperogram indicates that the electroreduction of cobalt(II) cations in the perchlorate electrolyte occurs in stages. It was found that in the tetrafluoroborate solution the peak of hydrogen evolution appears earlier than in the perchlorate electrolyte. Thus, the manufactured solution based on $Co(BF_4)_2$ can be further used to study the kinetics of the electroreduction of the Co^{2+} hexaaqua complexes.

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THE EFFECT OF SOIL ON SPATIAL VARIATION OF THE HERBACEOUS LAYER MODULATED BY OVERSTOREY IN THE EASTERN EUROPEAN POPLAR-WILLOW FOREST

The composition of tree species can influence the dynamics of herbaceous species and enhance the spatial heterogeneity of soil. But there is very little evidence on how both overstorey structure and soil properties affect spatial variation of the herb layer. The aim of this study is to evaluate the factors of the soil and overstorey structure which explain the fine-scale variation of herbaceous layer communities in the Eastern European poplar-willow forest [1]. The research was conducted in the "Dnipro-Orils'kiy" Natural Reserve (Ukraine). The research polygon (48º30'51"N, 34º49"02"E) was laid in an Eastern European poplar-willow forest in the floodplain of the river Protich, which is a left inflow of the river Dnipro. The site consists of 7 transects. Each transect was made up of 15 test points. The distance between the rows in the site was 3 m. At the site we established a plot of 45×21 m with 105 subplots of 3×3 m, organized in a regular grid. The adjacent subplots were in close proximity. Vascular plant species lists were recorded at each 3×3 m subplot, along with visual estimates of species cover, using the nine-degree Braun-Blanquet scale. Within the plot, all woody stems ≥1 cm in diameter at breast height were measured and mapped [2].

Dixon's segregation index was calculated for tree species to quantify their relative spatial mixing. Based on geobotanical descriptions, a phytoindicative assessment of environmental factors according to the Didukh scale was made. The redundancy analysis was used for the study of variance in the composition of herbaceous layer species. The geographic coordinates of sampling locations were used to generate a set of orthogonal eigenvector-based spatial variables [3]. Two measurements of the overstorey spatial structure were applied: the distances from the nearest tree of each species and the distance based on the evaluation of spatial density of point objects, which are separate trees. In both cases the distance matrix of sampling locations was calculated,

which provided the opportunity to generate eigenvector-based spatial variables [4]. A kernel smoothed intensity function was used to compute the density of spatial distribution of the trees from the data of point patterns. Gaussian kernel functions with various bandwidths were used. The coordinates of sampling locations in the space obtained after conversion of the spatial distribution densities of trees were used to generate a set of orthogonal eigenvector-based spatial variables, each of them representing a pattern of particular scale within the extent of the bandwidth area, structured according to the distance and reciprocal placement of the trees. An overall test of random labelling reveals the total nonrandom distribution of the tree stems within the site [5]. The unexplained variation consists of 43.8 %. The variation explained solely by soil variables is equal to 15.5 %, while the variation explained both by spatial and soil variables is 18.0 %. The measurement of the overstorey spatial structure, which is based on the evaluation of its density, allows us to obtain different estimations, depending on the bandwidth [6].

The bandwidth affects the explanatory capacity of the tree stand. A considerable part of the plant community variation explained by soil factors was spatially structured. The orthogonal eigenvector-based spatial variables (dbMEMs) approach can be extended to estimate the effect of forest structures on the herbaceous layer community [7]. The measurement of the overstorey spatial structure, which is based on the evaluation of its density, was very useful in explaining the variation of herbaceous layer community.

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DIE PROBLEMATISCHE EPOCHE DER „*ANNÉES NOIRE*“ IM WERK VON PATRICK MODIANO

Die Ära der Besatzungszeit wird zum zeitlichen Hintergrund der Werke des modernen Klassikers der französischen Literatur *Patrick Modiano*. Er schätzt sie als die Quelle der ganzen Generation. Der Autor versucht jedoch nicht, seine eigene Beurteilung der Generation, Zeit und den moralischen Werten zu geben. Für ihn, wie er tatsächlich in einem seiner Interviews erwähnte, ist die Atmosphäre der Epoche ein wichtiger Hintergrund.

Diese Nichteinmischung gibt dem Leser die Möglichkeit, seine eigenen Schlussfolgerungen zu ziehen und diese „dunklen“ Jahre der Geschichte Frankreichs unabhängig zu reflektieren. Die Kooperation mit Nazis prägt das soziale Bewusstsein ein und tritt daher auf keinen Fall als Forschungsobjekt des französischen Autors auf. Außerdem wird sie von anderen Zeitmerkmalen überdeckt.

Der Roman *„Die Straße der dunklen Läden“* ist eine typische Umsetzung von *„recherche du temps perdu“* [1]. Hier gibt es einen Kontrast zwischen den beiden Epochen: 1965 und der Besatzungszeit Frankreichs (1940-1944). Die *„wirkliche“* Zeit, in der unser Held lebt, soll im Jahre 1965 sein, da die gesamte Korrespondenz der Ermittlungen aus diesem Jahr stammt: *„Madame E. Kahan – Nice, le 22 novembre 1965, rue de Picardie Nice“* [2]. Die Zeit vor der Besatzung ist in die Kategorie des Realen verwoben.

In den gleichen Memoiren von *Madame Kagan* werden das Jahr 1937 (Bekanntschaft mit *Oleg de Vredet*) sowie die 1950er Jahre (das Todesjahr von *Gay Orlova*) erwähnt. Über *„echte“* Zeit (1965) erfahren wir fast zufällig – aus einem Brief. *Gi Rolan* scheint Jahre absichtlich gemieden zu haben, indem er uns nur unvollständige Daten gegeben hat. Dazu neigen auch seine Bekannten und Zeugen, die die wahre Identität des Helden bestimmen. Sogar Zeitungsnotizen sehen so aus, als ob sie diese Anziehungskraft für Unsicherheit unterstützen würden: *„On nous prie d’annoncer le décès de Marie de Resen, survenu le 25 octobre l’inhumation au cimetière de Sainte Geneviève des Bois, aura lieu le 4 novembre à 16 heures“* [3].

Im Roman *"Das verschwundene Viertel"* können wir dieselbe Konstruktion des Zeitraums (zu der ist auch die dritte Epoche hinzugefügt) bemerken: die

Vorbesatzungszeit und die tatsächliche Besatzung (1938, 1941); das Zeitalter des zwanzigjährigen Jean Dekker (1965), bevor er aus Paris geflohen war und die heutigen beschriebenen Ereignisse (die Rückkehr des Helden nach Paris zwanzig Jahre später vor seinem siebenunddreißigjährigen Geburtstag): *„J'aurai trente-neuf ans à la fin du mois de juillet"* [2].

Die Besatzungszeit ist mit dem Nebel gehüllt. Die Kameraden, die der Held vom Roman *„Die Straße der dunklen Läden"* trifft, leiden ebenfalls an Amnesie. Die Krankheit ist aber bei ihnen anders als im Werk von Pedro Stern – nicht total, sondern nur partiell. Sie erinnern sich nicht nur an Jahre, sondern auch an Ereignisse, Monate, Zahlen, die alle in ihrem Gedächtnis gespeichert sind: *„Ça remonte à quand? ... De toute façon, cela remonte au déluge ..."* [3]. Das Verständnis der Zeit, die die Helden als Flut oder Abgrund in ihrer eigenen Geschichte erfahren haben, kann als eine Art Schutzreaktion erklärt werden, denn das Vergessen hilft ihnen, aus ihrer traumatischen Vergangenheit herauszukommen und den Schrecken des Krieges leichter zu überleben.

Ein anderer, ein zusätzliches Merkmal der Epoche, genauer eine Anspielung auf diese Zeit entsteht aus den Worten verschiedener Menschen: für Sonachidse ist das *„C'était une époque beaucoup plus belle que la nôtre, et surtout les gens étaient de meilleure qualité qu'aujourd'hui ..."* [3]; für Helen Pillgram: *«C'était vraiment une drôle d'époque ... »* [3]. Der Leser muss durch diese Stellen drängen, um die Zeit aus den einzelnen Stückchen zu porträtieren. Sogar das Wort *„Besatzung"* wird, wie wir bemerkt haben, nur einmal im Werk verwendet: *„La dernière fois que je l'ai vu, c'était pendant l'Occupation"* [3]. An dieser Stelle ist jede Genauigkeit, jede Gewissheit der Zeit vermieden, obwohl sich ein direkter Beweis unserer Hypothese immer noch in einem Brief von E. Kagan finden lässt: *„Pendant la guerre – je pense que c'était en 41-42"* [3].

Manchmal nehmen Erinnerungen ihren Platz ein, aber wir erleben die Entwicklung paralleler zeitlicher Reihen. Obwohl die Zeit ständig abrutscht, hilft uns diese *„Flucht"*, eine Zone zu betreten, in der die Vergangenheit mystisch wird. Dies führt zu einer zweimaligen Begegnung, die unbeweglich und zeitlos wird [4].

Zeiträume erinnern an ein Puzzle und lösen sich dann im Gedächtnis auf und schaffen eine Atmosphäre, ein Gefühl der Unbegreiflichkeit und die *„Flucht"* der Besatzungszeit. Die Periode ist frei von neuem Verständnis, spielt die Rolle des schmerzhaften Fließens, die Umsetzung der verlorenen Zeit.

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CHINESISCHE INVESTITIONEN IN LATEINAMERIKA

China hat unter Präsident Xi Jinping eine eigenständige und globale Konnektivitäts-politik etabliert. Dazu gehören Infrastrukturinvestitionen und internationale Kredit-vergabe, die Ausweitung der Kooperation mit und die Einflussnahme auf Institutionen in Forschung, Finanzen und Politik.

Chinas ausländische Direktinvestitionen (FDI) sind seit dem Ende der neunziger Jahre sehr schnell gewachsen. Dies hängt zum einen natürlich mit dem Wachstumstempo der chinesischen Wirtschaft zusammen, zum anderen ist dies eine Folge der von den chinesischen Behörden gewählten «ausgehenden» Strategie [3]. Seit 2014 ist China nach den Vereinigten Staaten die zweitgrößte Quelle für ausländische Direktinvestitionen [1, S. 9].

In den letzten zehn Jahren hat sich Lateinamerika zu einem wichtigen Empfänger ausländischer Direktinvestitionen (FDI) und Darlehen aus China entwickelt. Darüber hinaus ist Lateinamerika der zweite Empfänger chinesischer Direktinvestitionen und erhält mehr Direktinvestitionen als die USA und Europa [3]. Lateinamerika und der Rest der Welt hängen von der Wirksamkeit der chinesischen Wirtschaft ab. Aufgrund dieser Tatsache prognostizierte die Weltbankgruppe 2015, dass ein Rückgang des chinesischen BIP um 1% zu einem Wirtschaftswachstum von 0,6% in Lateinamerika führen würde [2].

Laut den von Zhou L., Leung D., vorgelegten Indikatoren für den Zufluss ausländischer Direktinvestitionen aus China in verschiedene Regionen der Welt sind 68% dieser Investitionen aus wirtschaftlichen und handelsrechtlichen Gründen an asiatische Volkswirtschaften gerichtet, die enge Verbindungen mit chinesischen Produktionsunternehmen und regionalen Ketten von Zwischen- und Endproduktpreisen haben. 13% der Investitionen gehen jedoch nach Lateinamerika und übertriffen das Volumen der ausländischen Direktinvestitionen in Europa und Nordamerika [3].

China investierte im Zeitraum 2008-2013 durchschnittlich fast 10,7 Milliarden US-Dollar pro Jahr. Es wird erwartet, dass die ausländischen Direktinvestitionsströme in der Region aufgrund des Engagements Chinas für CELAC (Gemeinschaft der Länder Lateinamerikas und der Karibik) deutlich ansteigen werden [1, S. 9-10].

Daher verfolgt China in Zusammenarbeit mit der lateinamerikanischen Region einen durchdachten und integrierten Ansatz: Durch direkte Investitionen in die Entwicklung von

Rohstoffen und die Sicherung seiner langfristigen Präsenz in der Region löst Peking die eigenen Herausforderungen in Bezug auf Energie und Rohstoffsicherheit.

Signifikante Investitionen in die Modernisierung der Verkehrsinfrastruktur, die Entwicklung von Häfen und die Schifffahrt sowie die Kontrolle der panamaischen Häfen zeigen Chinas Wunsch, einen stabilen Fluss von Rohstoffen und Lebensmitteln aus Lateinamerika sicherzustellen.

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CAUSES AND PROBLEMS OF GLOBAL WARMING

Global warming is a long-term rise in the average temperature of the Earth's climate system, an aspect of climate change shown by temperature measurements and by multiple effects of the warming. The term commonly refers to the mainly human-caused observed warming since pre-industrial times and its projected continuation, though there were also much earlier periods of global warming. In the modern context the terms global warming and climate change are commonly used interchangeably, but climate change includes both global warming and its effects, such as changes to precipitation and impacts that differ by region. Many of the observed warming changes since the 1950s are unprecedented in the instrumental temperature record, and in historical and paleoclimate proxy records of climate change over thousands to millions of years.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report concluded, "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century". The largest human influence has been the emission of greenhouse gases such as carbon dioxide, methane, and nitrous oxide. Climate model projections summarized in the report indicated that during the 21st century, the global surface temperature is likely to rise a further 0.3 to 1.7 °C to 2.6 to 4.8 °C depending on the rate of greenhouse gas emissions and on climate feedback effects. These findings have been recognized by the national science

academies of the major industrialized nations and are not disputed by any scientific body of national or international standing.

You should know the facts on global warming to understand all the problems of global warming:

- The effects of global warming on plants and animals are expected to be widespread and profound. Many organisms are migrating from the equator toward poles in order to find more comfortable conditions for their existence. However, a lot of animals go extinct as they are not able to compete in new climate regime. Global warming can cause the disappearance of up to one-third of Earth`s animals and one-half of plants by 2080.
- Air quality is affected greatly by the global warming. The air pollution caused by overabundance of carbon dioxide, vehicular emissions, and power plants influences the human respiratory system. A lot of people all over the world suffer from respiratory diseases.
- Scientists have predicted the effects for the future based on the climate changes due to the global warming problem. Snow cover is projected to contract. Sea ice is projected to shrink in both Antarctic and Arctic. Future tropical cyclones will become more intense. Heavy precipitation events, heat waves, and hot extremes will become more frequent. Arctic late-summer sea ice can disappear by the end of the 21st century. Sea level rise and anthropogenic warming will continue for centuries.
- The sea-level rise accelerates 0.12 inches per year in overage worldwide. This trend will continue if gas emissions remain unchecked. People are to blame for rapidly melting ice, warming oceans, and rising sea levels. Coral reefs are in danger as the ocean warms. Two-thirds of the Great Barrier Reef has been damaged as a result of climate change. Global warming increases the acidity of seawater because of the increase of the levels of CO2.

In order to find the solutions of the problem of global warming, we should not get back and try to reduce the effects of global warming by reducing the human causes of global warming. We should try to reduce the emissions of greenhouse gases to the atmosphere and adopt some climate changes which are already happening for years. Instead of using electrical energy we should try using clean energy or energy produced by solar system, wind and geothermal. Reducing the level of coal and oil burning, use of transportation means, use of electrical devices, etc. may reduce the global warming to a great level.

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C++ IN PROGRAMMING AREA

As our lifes are changing, the technologies are developing faster and faster, opening up new possibilities for humanity in different areas of activity. For programmers such a complicated process has not gone unnoticed. After all, in recent years, different programming languages gained a rapid fame. However, in this article we are going to talk about the one of the most popular, called C++.

It was created in 1983 as an alternative to C and immediately gained deserved popularity. Its main feature is predefined classes. Microsoft Windows and Google Chrome are the most famous examples of projects created in C ++. This programming language remains in demand to this day mostly because of its ability to be used in various areas such as finance, banking, gaming, communications, electronic payment systems, retail, etc. Here are some advantages of working with C++ :

1. C++ is a highly portable language and is often the language of selection for multi-device, multi-platform app development.

2. C++ is an object-oriented programming language and includes concepts like classes, inheritance, polymorphism, data abstraction, and encapsulation which allow code reusability and makes programs very maintainable.

3. C++ use multi-paradigm programming. The Paradigm means the style of programming, paradigm concerned about logics, structure, and procedure of the program.

4. The wide range of applications: From GUI applications to 3D graphics for games to real-time mathematical simulations, C++ is everywhere.

5. C++ has a very big job market as it is used in various industries like finance, app development, game development, Virtual reality, etc.

6. C++ has many compilers to work with.

However, this programming language has some drawbacks as one for professional programmer:

1. One major problem in C++, is when the data points to the same thing from two different starting points, this causes a major problem, the C++ program will continue to have mixed up problems within the coding.

2. C++ program is complex in very large high level program, C++ is used for platform specific application commonly, For the particular operating system or platform, the library set is usually chosen that locks, when C++ program used for web applications complex and difficult to debug.

3. C++ program can't support garbage collection, It does not support Dynamic Memory Allocation, It is not secure because it has pointer, friend function and global variable and it has no support for threads built in.

4. C++ program can be heavy if it is not careful, C++ program allows classes and thus the functions with the same name (and overloaded functions) thus the symbol mangling system must be used, It can easily be wrapped in C functions though .

5. C++ program has no notion of being fast and it is not used for platform-dependent apps any more than C or anything else is, actually, given the nature of the toolchain, it is probably less dependent than others.

6. The main problem of using C++ is studying it. As it is supposed by many programmers, this is one of the most difficult languages to learn. Experts who are directly involved in software development are rarely involved, for most practical disciplines. For example, a person who has not applied STL in real projects is unlikely to be able to explain how to do this, and most importantly, why.

To sum up, C++ is a very functional programming language, the possibilities of which can be determined to a greater extent by the imagination of the programmer working with him. The language has many useful features and conveniences to use. However, as many other languages, C ++ has some drawbacks that appear during the process of learning and using it.

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MONOPOLE IN DER DIGITALISIERUNG AM BEISPIEL VON GOOGLE UND FACEBOOK

Heutzutage leben wir in der Ära der Digitalisierung. Immer mehr Prozessen finden im Internet statt. Zum Beispiel hilft das Internet den Unternehmen, Marketing-Programme durchzuführen und konkurrenzfähig auf dem Markt zu sein. Viele Betriebe nutzen Werbung im Internet, weil sie sehr effektiv ist. Aber das Internet selbst ist ein anderer Wirtschaftsmarkt mit spezifischen Regeln geworden. In diesem Markt gibt es nicht nur eine eigene Wettbewerbspolitik, sondern auch vielfältige Maßnahmen, die ein Unternehmen konkurrenzfähig machen können.

Wie funktioniert die Sphäre der Digitalisierung? Welche Rolle spielen hier Google und Facebook beziehungsweise wie können sie Monopolisten werden? Das sind die Hauptfragen dieser Thesen.

Um diese Frage zu beantworten, beginnen wir mit einer ausgiebigen Betrachtung der Definition des Monopols. Dieser Begriff wurde schon lange von Aristoteles erschaffen und wird jetzt in den Wirtschaftswissenschaften benutzt. Joseph A. Schumpeter hat in seinem Buch „Geschichte der ökonomischen Analyse“ geschrieben: „Als Monopol wird in den Wirtschaftswissenschaften eine Marktsituation (Marktform) bezeichnet, in der für ein ökonomisches Gut nur ein Anbieter vorhanden ist“ [2]. Das heißt, dass der Markt nur einen Verkäufer hat, der bestimmte Produkte zur Verfügung stellt. Und dieser Verkäufer erzielt die größten Einkommensraten im Vergleich zu anderen Marktmitgliedern.

Google und Facebook sind, natürlich, nicht der einzige Anbieter in der digitalen Sphäre, trotzdem haben sie dort einen großen Marktanteil. Jonathan Taplin hat in seinem Buch „Move Fast and Break Things: How Facebook, Google, and Amazon Have Cornered Culture and What It Means For All Of Us“ geschrieben, dass Google 88 Prozent des Marktanteils in der online-Suche und Suchwerbung und Facebook 77 Prozent des Marktanteils in den mobilen sozialen Netzwerken hat [3]. Das ist schon mehr als die Hälfte des Marktes in der bestimmten digitalen Sphäre.

Es wird somit klar, dass Google und Facebook einen sehr großen Einfluss auf den digitalen Markt ausüben. Um ihre Positionen beizubehalten, ist es für sie am wichtigsten, spezifische Beziehungen zu anderen Mitspielern dieses Marktes auszubauen. Beide Unternehmen benutzen die Strategie der Übernahmen und Erweiterung des Geschäfts. Eben darum haben sie in ihrem Portfolio viele hochwertige Produkte.

Google und Facebook können auch das Leben ihrer Nutzer erleichtern. Wenn man andere Seiten registrieren muss, braucht man nur schnell die Google E-Mail oder das Facebookkonto angeben. Auf diese Weise benötigt der Nutzer nicht fünf

Minuten, sondern nur eine Minute für diese Operation und Google und Facebook bekommen einen wichtigen Wettbewerbsvorteil.

Aber diese Unternehmen haben auch eigene Probleme. Zum Beispiel verhängt die Europäische Kommission am 18. Juli 2018 Geldbußen in Höhe von 4,34 Milliarden Euro wegen rechtswidriger Praktiken bei mobilen Android-Geräten, um die Dominanz der Suchmaschine von Google zu stärken, und wegen des Verstoßes gegen das EU-Kartellrecht gegen Google [1]. Im Gegenzug wird Facebook auf Grund des gleichen Verstoßes gegen das EU-Kartellrecht angeklagt.

Aber trotzdem haben Google und Facebook ein effektives unzerbrechliches Monopol in Bezug auf hochwertige Internetsuche und zugehörige Werbung. Und unserer Meinung nach können sie ihre Positionen im Digitalmarkt für längere Zeit beibehalten.

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ARTIFICIAL INTELLIGENCE (AI)

Since the invention of computers, their ability to perform different tasks continue to grow faster and faster. People develop the power of computers systems, increasing the speed of performing tasks and reducing the size of computers. The main developer's aim in the field of artificial intelligence is to creature the computer as clever as a person.

What is Artificial Intelligence? The author of the term "artificial intelligence" is John McCarthy, who also is the inventor of LISP language, founder of functional programming and winner of the Turing Award for a huge contribution in the field of artificial intelligence research [4].

Artificial Intelligence is a way to make a computer, a robot or software, which will think like a person. Research in the field of Artificial Intelligence carried out by studying human's mental abilities and then the results of this research are used as the basis for the development of intelligent programs and systems.

We would like to talk also about Philosophy of Artificial Intelligence. During the exploitation of powerful computer systems, everyone asked one question: “Can the machine think and behave like a human?” [2]. So the development of AI began with the intention to create intelligence in machines similar to human one.

The main aim of Artificial Intelligence is to create expert systems. Systems which will demonstrate reasonable behavior: learn, show, explain and give advice. The realization of human intelligence in machines is the creation of a machine, able to understand, think, teach and behave like a human.

What can contribute to the development of Artificial Intelligence? Artificial intelligence is science and technology based on such disciplines as computer science, biology, psychology, linguistics, mathematics, and mechanical engineering. One of the main areas of artificial intelligence is the development of computer functions related to human intelligence, such as reasoning, training, and problem-solving [3].

Applications with Artificial Intelligence. Artificial Intelligence has become dominant in various areas, such as:

1) Games. AI plays a crucial role in strategy-related games such as chess, poker, tic-tac-toe, etc., where the computer is able to calculate a large number of various solutions based on heuristic knowledge.

2) Processing of the natural language is the ability to communicate with a computer that understands the natural language spoken by people.

3) Speech recognition. Some intelligent systems are able to hear and understand the language in which humans communicate with them. They can handle various accents, slangs, etc. [1].

Progress does not stand at one place. Trends in the development of computer technology are that the development of AI is simply a necessity, since without it neither in the future nor now we can’t do.

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PROGRESSIVE WEB APPLICATIONS TECHNOLOGY

Imagine that your website is a full-fledged application that user can install on his smartphone or any other gadget and use it even without connection to the internet. This technology was announced by Google in 2015 [1], which attracted a lot of attention due to the simplicity of development, the rapid exchange of data on the network, and the smoothness and responsiveness of user interface. In 2016 at the developer conference "Google I / O" Washington Post demonstrated its site-application [1].

Progressive Web Application (PWA) is any computer program that performs a specific function using a web browser as client [2]. The application can be as simple as a news feed, or a complex mobile gaming application for several players, it all depends on the needs and possibilities because it is still problematic to work with the file system and powerful graphics. PWA is a web application created using certain technologies to achieve specified targets [3]. Targets are interpreted as follows:

Reliability – the application is downloaded and displayed immediately, regardless of the status and quality of the network connection [3].

Speed (Fast) – the interchange of data across the network is fast, the UI is smooth and responsive [3].

Attraction (Engaging) – makes the user experience with the application comfortable and enjoyable, encouraging him to want to use it again, and again [4].

Differences between Web applications are significant, although they are similar both externally and internally, since only changing information is transmitted over the network between the client and the server. And the principle of action is similar, like Android for applications, is a virtual machine, as well as a browser for a web application. As the native application accesses the file system directly, so the web application accesses its own via HTTP, but saves them locally.

The beauty of web applications is that they are much more convenient and faster than native ones and there are many reasons for this:

1. Fast installation and operation due to the optimal use of a web browser and saving information in the cache of the site.

2. Follow the link to the application.

3. User involvement (the ability to go to full-screen mode, background notifications, the ability to add an icon to the desktop) [3].

4. Cross-platform, on any device at which the browser is installed, you can use PWA except of Internet Explorer, Opera Mini, Blackberry browser [4].

Although cross-platform is not the uniqueness of web applications, its feature is that creation is faster and cheaper than native ones.

On the downside, there is a lack of experience with PWA (although this is a matter of time), because Microsoft has taken on support obligations, and Apple has added support for iOS v.11.3. As well as the mandatory requirement for the site to use the HTTPS protocol.

From the above, it can be seen that PWA is a promising technology that may soon begin to crowd out others who do not have such advantages.

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NEW TECHNOLOGIES FOR FUTURE HUMANITY

Nowadays many problems have been unsolved, but humanity didn't stand at one place and created a new invention which makes our life easier .Let's start with glasses which allow blind people to see.

In our world we have a lot of people who can't see well and they have problems with movement. Canes and guide dogs assist them, however, they can't imitate real vision, but eSight 3 can. This device is the most powerful glasses in the whole world. When man put on it, eSight 3 records a video in a high resolution and then via zoom, contrast and different algorithms converts in something such like that the blind can see. Thus he can engage in different activities even including sports while it's unavailable for others. The eSight 3 is cheaper, faster, lighter weight and have more complicated opportunities to focus distance than previous versions. According to company valuation, today more thousands patients use eSight 3 [1].

The next interesting device is the exoskeleton Comau Mate. In many enterprises workers have to do heavy physical works by their hands what leads to premature fatigue and even injuries. Italian company Comau together with Icelandic orthopedic company Ossur and Italian IUVO have developed auxiliary exoskeleton Mate which is designed in order to take this unnecessary load off. Mate weights 3 kg, it's made in two sizes and put on upper body. Thanks to coil springs connected with "torque generators", exoskeleton takes the load off the shoulder muscles when you work with heavy things. Also Mate don't allow user to commit extreme movements for his

joints. The exoskeleton can be installed in one of five positions depending on executable work. In addition, you can choose one of seven levels of aid [3].

There is also «My Special Aflack Duck». The duck-robot is created for children who suffer from cancer. It is very painful and unbearable for everybody. Course of therapy passes with morbid puncture which cause nausea ,weakness and loss of appetite and all of this make patient's and his relatives' life more difficult. It's not easy to go through something like that even for an adult and what about children? Unordinary work has been demonstrated to the general public on annual event CES (Consumer Electronical Show) at the beginning of January 2018 in Las Vegas. The robot looks like funny plush duck which must help little patients on their way to recovery.This isn't the first development of this kind. In 2015 there were teddy bears which teach children who suffer from diabetes to measure ta level of sugar in blood and do insulin shots. Aaron's creation functional is thought over very carefully. You can activate sounds of quite heartbeats which makes your child sleep better. Companion can make soothing sounds of forest, ocean and reproduce breathing exercises which teach the owner some different relaxing technicians therefore it helps to overcome pain and excitement [2].

Children are afraid of injections, so medical staff makes an injection to the duck via special prick which activate some movement and sounds. Watching for the duck's funny discontent and perseverance, the child calms down and agrees on procedures. The plush duck endures injections worthily. The toy is programmed to express a series of behavioral images. Sensors are located under the upholstery and react on touches; when you stroke it, the toy comes to life and turns head. Set of special smiles are attached to the robot that makes different emotions. If you press a certain activator to the breast sensor, you will hear necessary sounds. A happy smile will cause fun "quack-quack", but sorrowful smile –sad.

Inessential, at first glance, the function plays an important role. The fact is that it can be extremely difficult for patients to contact others. If the kids find it difficult to talk, they can communicate with the help of a duck. Demonstrating behavioral patterns develops communication skills. Robot duck has already been successfully tested, in practice proving all its advantages. The doll was given to children undergoing therapy in US hospitals, observing their reactions to contact with a sociable robot. Little patients of oncological clinics are happy for a new friend. The toy will not bring personal financial gain to the developer and manufacturers, because not intended for sales. It will be distributed free of charge in oncological institutions of the USA. It remains only to thank people like Horowitz, seeking to apply their knowledge to selflessly do well.

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AUGMENTED REALITY

Nowadays more and more people are talking about AR/VR/MR and you also might hear something about this. But for most people, it is still a quite abstract and exotic technology, often perceived as the science-fiction out of Hollywood movies. In fact, all these things do already exist.

Augmented reality is the technology that expands our physical world, adding layers of digital information onto it. Unlike Virtual Reality (VR), AR does not create the whole artificial environments to replace real with a virtual one. AR appears in direct view of an existing environment and adds sounds, videos and graphics to it.

There are 4 types of augmented reality today:

- markerless AR
- marker-based AR
- projection-based AR
- superimposition-based AR

Markerless AR. Location-based or position-based augmented reality, that uses a GPS, a compass, a gyroscope, and an accelerometer to provide data based on user's location. This data then determines what AR content you find or get in a certain area. With the availability of smartphones this type of AR typically produces maps and directions, nearby businesses info.

Marker-based AR. Some also call it to image recognition, as it requires a special visual object and a camera to scan it. It may be anything, from a printed QR code to special signs. The AR device also calculates the position and orientation of a marker to position the content, in some cases. Thus, a marker initiates digital animations for users to view, and so images may turn into 3D models.

Projection-based AR. Projecting synthetic light to physical surfaces, and in some cases allows to interact with it. These are the holograms we have all seen in movies like Star Wars. It detects user interaction with a projection by its alterations.

Superimposition-based AR. Replaces the original view with an augmented, fully or partially. Object recognition plays a key role, without it the whole concept is simply impossible. For instance, superimposed augmented reality in IKEA Catalog app, that allows users to place virtual items of their furniture catalog in their rooms.

To summarize all the said above, I would like to assume that this technology is more advanced in the modern world than Virtual Reality. And with the help of AR people can do really helpful things in the real world but not virtual.

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A REVIEW OF DATA MINING TECHNIQUES

Data mining is the process of discovering patterns in the large data sets. The purpose of the data mining is to find information from the large data sets and convert it into usable structures so that this information can used for further processing without any difficulty. It is handled by databases and managed by database management aspects. The mined results should be valid, novel, useful, and understandable.

The process of data mining is sequential which require many steps to be followed [3]: 1) Extract, transform, and load transaction data onto the data warehouse system. 2) Store and manage the data in a multidimensional database system. 3) Provide data access to business analysts and information technology professionals. 4) Analyze the data by application software. 5)Present the data in a useful format, such as a graph or table.

Data mining is complex process and it requires not only fast processing devices but good and efficient techniques of data processing. The important techniques of data mining are as listed below:

- Artificial neural networks: other techniques in AI such as knowledge delivering, knowledge representation, and search, are relevant to the various process steps in data mining [4].
- Genetic algorithms: Optimization techniques that use process such as genetic combination, mutation, and natural selection in a design based on the concepts of natural evolution. It is a relatively new software paradigm inspired by Darwin's theory of evolution [4].
- Decision trees: Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset [4].
- Rule induction: This technique is used for the extraction of useful if-then rules from data based on statistical significance.
- Data visualization: It is concerned with visual interpretation of complex relationships in multidimensional data. Graphics tools are used to illustrate data relationships.

The Knowledge Discovery in Databases (KDD) process comprises of a few steps leading from raw data collections to some form of new knowledge.

The iterative process consists of the following steps [5]: data cleaning, data integration, data selection, data transformation, data mining, pattern evaluation, knowledge representation.

Data mining algorithms realize techniques that have sometimes existed for many years, but have only lately been applied as reliable and scalable tools that time and again outperform older classical statistical methods. While data mining is still in its infancy, it is becoming a trend and ubiquitous [2].

Data mining is concerned with extracting useful rules or interesting patterns from the huge amount of data collected through various sources. There are many data mining techniques which can be used to perform the job efficiently. It is to be noted that a single technique cannot be used for all types of data because depending on the type of data, appropriate technique is available for extraction of information. Sometimes hybrid techniques are more useful instead of a single technique.

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3D MODELING IN CONSTRUCTING

Nowadays, everything is constantly evolving. Modern achievements in the sphere of high technologies have already reached the level when 3D design and visualization are no more just a simply abstract picture.

Previously, projects were considered only on a piece of paper or with the help of ordinary computer two-dimensional graphics. That is why it was difficult to visualize the final result in your mind. Appearance of 3D modeling allowed to see in advance objects which have not been done or built.

At present, 3D printing is increasingly being used in prosthetics and stomatology, making of the elements of clothes and footwear, creation of the prototypes of jewelry, etc. Availability of 3D design has also spread in house planning, architectural construction, landscape and interior designs. It provides an opportunity to examine the end product at the beginning of constructing.

Due to the special programs, it is possible to set up the model of construction in realtime with the minimum waste of time and resources. One of such programs are applied for calculations, whereas the others are applied for photo-realistic visualization.

The photo-realistic method of reflection enables to add to the 3D stage the elements which can make your interior unique and attractive. Nothing compares to the chance to see your dream even before the beginning of its embodiment [1].

3D design has a range of the additional instruments you can use to reproduce physics in real time and test your construction. In addition, you are able to edit, add or delete intrusive elements to the sketch at any moment, saving time to the architects and premonishing builders of the unnecessary costs in this way. Such functions are very useful for testing the integrity and reliability during the construction and after its completion [2].

There are resources and companies that render services related to creation of three-dimensional models of separate apartments. The special services are offered to examine large architectural projects and notice some details that can be seen only after building. For example, you can generate illumination and understand in what places the elements of lighting are absent. It is possible due to the special utilities in the programs. Moreover, using computer visualization is suitable both for large projects and planning of small dwelling houses or shops.

Development of three-dimensional models does not need much time in comparison with the creation of a draft. It is possible to choose a color gamma, measure placing for an interior and choose proper materials for apartments.

Using of 3D design is spreading fast. Scientists believe in the future prospects of this method. So in 2015 NASA set up a competition of planning a temporal or even a permanent accommodation for astronauts on Mars. The competition was named “3D Printed Habitat Challenge” and supported by Bradley University. A prize fund was 100 thousand dollars.

The competition jury estimated the works of eighteen teams, constructed in the special program, chose five virtual models and noticed that the next stage of competition would be the realization of three-dimensional model using 3D print in the scale 1:3 to the calculation sizes [3].

Thus, we can infer that 3D modeling has a lot of advantages, such as providing realistic display, the opportunity to view the object from all sides, preliminary assessment and savings. Project drawing in 3D is really cheaper than making a sample for demonstration. In general, 3D modeling is more profitable and practical at the production stage [4].

To draw the conclusion, we would say that it is impossible to overestimate the role of 3D design in the modern planning and realization of projects which have a special value.

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OBJECT-ORIENTED PROGRAMMING VS FUNCTIONAL PROGRAMMING

In fact, “argues” between OOP and FP teams never stop. OO friends claim that OOP is a better approach to creating programs, while those, who stan FP, argue that FP is better one. First of all, let’s get a light brief overview on what OO and FP actually are.

OOP “is a programming paradigm based on the concept of “objects”, which may contain data, in the form of fields, often known as attributes; and code, in the form of procedures, often known as methods. A feature of objects is that an object’s procedures can access and often modify the data fields of the object with which they are associated (objects have a notion of “*this*” or “*self*”)” [1], which essentially means, altering the ‘state’ of the object. Furthermore, in most OOP languages, objects are instances of a class, and are seen as individual entities which interact with each other. The main thing is that these objects mimic the real world.

Functional programming is a language that focuses on the computation of pure functions. The keyword there is ‘*pure’*. What exactly does it mean? Let’s see:

- there is a complete separation between the data of a program, and the behaviors of a program;

- all things created in functional programming are immutable (once something is created, it can’t be changed);

- adherence to pure functions.

It is believed that the separation of data and methods, as well as the high level of abstraction leave less room for errors. But if we consider the project as a set of "boxes", then it is convenient to use OOP. If as data conversion streams, then it is more convenient than FP. If nothing fits, then we make a hybrid or invent something else. At times, attempts to program “boxes” on a functional approach look quite funny.

It is recognizable that good programs are written using both styles, because good programs must perform several different tasks.

And what is the main conclusion from this? The more paradigms and frameworks you can do, the more adequately you can compare and select them. You do not have to choose between two paradigms. FP and OOP are orthogonal in their nature. Like the proverb says: “In a duel between a bear and a crocodile, the terrain is the decisive factor”.

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THE PROBLEM OF PIRACY IN THE IT FIELD

In the age of information technology, the problem of piracy is very common. Instead of going to the cinema, or buying a licensed disc with a movie, we simply open a website where you can watch this movie online, or even download it. This problem is connected not only with the piracy of films, but also with the piracy of applications, music or even personal information.

“Information piracy” is a method of obtaining this or that content on the Internet without permission from the copyright holders. Today, this is perhaps the most global problem on the Internet, which is closely related to the accompanying problem – copyright infringement.

A real breakthrough in the field of online piracy was the coming of the uTorrent program, which provided the pirates with a huge selection of multimedia products. It should be noted that for such a seemingly innocuous act, how to download any program from the Internet, there is administrative liability, and in some cases, criminal liability.

One of the most famous pirate sites in Ukraine was ex.ua. On this site, one could get access to both free audio and media files, as well as free applications and games. Western copyright holders repeatedly placed ex.ua in their lists of pirated sites, and the application of this resource for Android either appeared or disappeared from the official Google Play store. According to the experts [1], the site teetered on the verge of fulfilling the claims of the right holders, then again violating copyrights. But the patience of the right holders, like everything else in this world, is not unlimited and the site is eventually closed.

Piracy is detrimental not only to copyright holders, but also to site owners who distribute licensed content. According to estimates [1] of Ivan Shestakov, marketing director of MEGOGO, about 80-85% of the advertising money goes to the pirate zone. No legal site and, moreover, no cinema network will provide the variety of content on pirated sites.

One of the reasons why an ordinary person begins to engage in piracy is the high cost of legal content, not every one of us can donate some of our income for the purchase of licensed products.

According to the calculations of the site "Novoye Vremya" [2], Ukrainians should pay almost 2 thousand UAH monthly for basic subscriptions to legal online content.

According to the Ministry of Finance, the average monthly salary in Ukraine for September 2018 amounted to 9042 UAH, that is, Ukrainians should give a fifth of their hard-earned money on licensed content. It will be expensive even for people with average incomes.

According to the survey [3], among 61 students (64% male and 36% female) 84% of respondents were engaged in and continue to engage in "Internet piracy", 11% were engaged, but stopped, and only 5% never encountered this. At the same time, 63% know about responsibility for this act, 25% do not know, and 12% have never even thought about it. According to 68% of respondents, there is no need to combat "piracy" on the Internet, and the main reason for this is that most of the respondents (87%) see that the content provided by the "pirates" is free, unlike the official one.

"Information piracy" in the modern world for many is not a means of generating income, but only a means of saving. Modern pirates do not take away, as it was before, they only copy and use, considering themselves innocent. Therefore, it took such a huge scale.

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ORGANIC THIN-FILM TRANSISTORS IN FLEXIBLE DISPLAYS

The element base determines the characteristics and capabilities of various digital devices. Modeling and application of organic thin-film transistor (OTFT) based circuits is a rapidly developing area of research. A thin-film transistor is a kind of field-effect transistor, in which both metal contacts and the semiconductor conduction channel are made in the form of thin films (from 1/10 to 1/100 micron).

The advantage of organic thin-film transistors is that they can be formed at low temperature by vacuum deposition or applied in liquid form by centrifuging, unlike thin film transistors (TFT) from amorphous silicon (a-Si), which require heating substrate to a temperature of 300 ° C. It is obvious that at this temperature the plastic substrate will simply melt.

Currently, research in the field of thin-film transistors made from organic materials (Organic Thin-Film Transistor, OTFT) is actively carried out by scientists from Bell Labs (now Lucent) [2], employees of Polymer Vision (one of the Philips subsidiaries) [2], and also a government-backed and Taiwan-based organization, the Electronics Research Services Organization (ERSO) [2].

The technology of vacuum deposition allows producing more efficient thin-film transistors, while the main advantage of centrifugation is lower production costs. In fact, thin-film transistors made of soluble organic materials can simply be printed directly on the substrate, using time-tested technologies such as silk-screen printing, embossing, etc.

The research group MANA [3] has developed a printing technology with which it is possible to form electronic circuits and elements of thin-film transistors, which makes it possible to create an electronic circuit containing completely organic thin-film transistors with a channel length of 1 μm.

Electronics printing is one of the most promising types of production of electronic devices using materials dissolved in inks. This method allows the production of flexible electronic devices on a roll scale at a fairly low cost and provides at least ten times higher resolution, which makes it possible to produce subminiature electronics. The technology is based on a method that allows forming hydrophilic and hydrophobic areas on the base surface by vacuuming and illuminating with ultraviolet light with a wavelength of no more than 200 nm using DryCure-Au inks filled with metallic nanoparticles. Such precision manufacturing, which is unattainable for other methods of printing electronics, allows you to make thin-film organic transistors, the parameters of which are in the same range. The mobility of electrons in such transistors with a channel length of 1 μm is about 0.3 cm ^ 2 / (V * s), which is the best such indicator among all such transistors.

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THE MODERN NEUROSWITCHES

A neuroswitch is one of the implementation of neurocomputer interface technologies. With the help of neuroswitches, a person gets an opportunity to control digital devices directly. A signal comes from the brain to any electronics that has some ports for receiving the digital codes.

Brain Computer Interface (BCI) – is a human brain communication system with electronics [1]. The Brain Computer Interface Technology is based on the registration of the electrical activity of the brain and the detection of specific patterns in it, which are responsible for specific human actions. Therefore, the electroencephalography (EEG) is used for registration of the human brain electrical activity. This method allows to obtain a non-invasive reception of the human brain electrical activity [1].

One of the already standard circuit design solutions is the implementation of the EEG registration facility from the OpenEEG Open Project, which was developed early in the 2000s [2]. The ADC uses the ATmega8 microcontroller to convert an analog signal to a digital one. However, the main disadvantages of this solution are:

- a large number of elements;
- an old element base;
- the size of the final device;
- a low bit ADC.

Taking into account all disadvantages of the standard solution, ADS1298 and ADS1299 are used to develop some modern ADCs (Texas Instruments) that were specifically designed for medical measurements and checks [3]. The ADC includes 8 differential input channels with an internal, programmable amplifier, an EMI filter and a 24-bit capacity. One of the up-to-date developments examples in the BCI sphere is an open source OpenBCI project (Fig.1), which can be found in shared access [4].

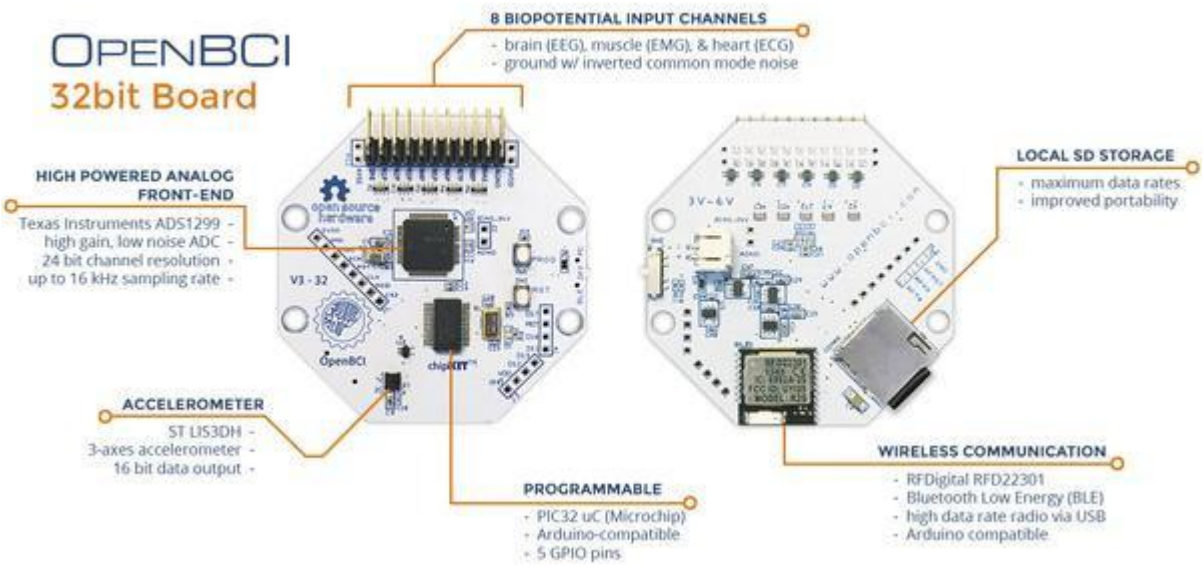

Fig. 1. Printed circuit board for OpenBCI

After conducting the research work on finding an actual circuit design solution, it was considered to perform the future development of a neuroswitch that is based on a given chip ADS12 (98/99) by Texas Instruments.

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AMP: THE FUTURE OF E-MAILS

The biggest blessing course of email is that you can exchange your messages. If you need something more, you can use chat apps, video call or file hosting. These useful tools are connected with email, sometimes it is integrated in, but not a part of it.

Project AMP was designed to improve user's experience in web as well as work with email. It seems that JavaScript can be a great solution, but due to AMP framework users can work with messages in real time, avoiding risks of safety of your data.

It is a technology of accelerated mobile web pages with open source code. It was created by Google in 2015. The usage of AMP in emails let user to read articles, take notes, organize events and complete your everyday tasks in email's body.

Due to AMP framework, users get a new way of working with messages: now, you can reply for invitations, fill in the surveys, scroll catalogs or comment in a body of the letter. In addition, you can update your data like new comments in a theme or recommendations.

AMPHTML Email will give the opportunity to authors to make up in pages, as you can do it in a browser[1].

AMP messages are compatible with current email ecosystem due to a new MIME standard. So that, if a user's device does not still support AMP, a message will be shown in HTML format.

AMP-pages are created for static content and it is better because of faster speed pf loading. In addition, AMP consists of 3parts [2]:

1. AMP HTML is markup with limits for increasing the work safety.

2. Expansions for creating content that is out of boundaries of basic HTML markup.

3. AMP JS library provides fast AMP-pages visualization.

Google AMO Cache is used for displaying AMP-pages.

AMP changes user interaction with a publisher due to two things: the user does not open a page because of the opportunity to see the content in Google search results and page navigation looks like a carousel – you can flip through the page [3]. A page is loaded very fast. An article card takes large page space and is provided with a special mark.

AMP framework is introduced in emails of the biggest email services. On March, 26, 2019 Google started to integrate "dynamic" messages in Gmail [4]. For example, having received a notification, a user can comment in Google Docs. Instead of separate mails about each comment, a Gmail user will see only topical messages. Some companies have already started to test a new way of messaging – Booking.com, Nexxt, Pinterest and others.

«We aim to provide the highest quality email experiences for our consumers and we are excited to be one of the first providers to participate in the AMP for emails. This allows us to enable fast, responsive, and high-performing experiences right within email», – Marcel Becker, Director Product Management for Yahoo Mail [5].

Open source program code, support from developers, the strategy of gradual migration and open group work, where you can stick to any opinion, will help us to create a new era of email service, which will be open to anybody.

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THE CLASSIFICATION ALGORITHM ON THE BASIS OF THE FUZZY LOGIC WITH DYNAMIC KNOWLEDGE-BASED SYSTEM

Nowadays the algorithms of artificial intelligence and fuzzy logic are widely used for the solution of a large number of practical problems [1]. With the help of systems built on their basis, it is possible to eliminate the difficulties of formalizing knowledge about technological processes and to recognize non-standard and emergency situations. It allows to manage tasks without the use of accurate mathematical models based on the apparatus of mathematical equations and the classical decision theory.

The main component of intelligent systems is a knowledge base, which includes a set of rules for logical output, expressed in the form of crisp or fuzzy productions. The rules of the knowledge base describe the interrelations in the subject area, which can be found on the basis of experimental data obtained as a result of observation. There are two approaches in the development of the expert systems knowledge bases:

– expert (expert group) knowledge analysis on the basis of experience;

– automatic formation of knowledge base using intelligent analysis methods of data and algorithms of machine learning.

The development of the second approach is defined to be of greater value. It is necessary to implement the object with the given characteristics in a set of other objects, the rules for the classification of which already exist in the knowledge base. For objects whose characteristics don't match with the characteristics of the objects available in the knowledge base, it is necessary to create new rules. In this case, the rules structure of the system is unchangeable, which helps to avoid additional checks of logical rules for the existence of contradictions.

For the objects classification, the main features were identified, according to which the affiliation of an object to one or another class can be determined. The mechanism of fuzzy logic output will use fuzzy logic rules which are created for combinations of the entered characteristics.

In contrast to the classical procedure of fuzzy logic output a comparison mechanism is added to the developed system, which makes it possible to compare a new object with features of already existing objects in the system [2]. The proximity of the system objects is determined by using the introduced metric – the Euclidean distance. In case if there is no object in the existing knowledge base with which the investigated object is possible to be identified, then a new logical rule is formulated for this and a new class of objects is created.

An example of the work on this algorithm can be seen on the website of the program [3]. With the help of the developed algorithm, a high speed of the problem solving is achieved, since only the expansion of the existing rules system in the knowledge base is foreseen.

The proposed approach allows to generate the production rules of the knowledge base system automatically and it is based on a comparison of new objects with the existing ones in the system, with the metrics usage and a comparison block for a new object.

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THE MAIN PROBLEMS OF IT-DOMAIN

Information technologies are an integral part of modern life. We come across them everywhere: at work, at school or university and in daily life. Each day information technologies keep step in due course, developing and improving. It is evident that on the way of any development some problems arise, but before speaking about IT-problems, we will consider their main functions and tasks.

So, the basic tasks of IT are the following:

- development and use of industrial and technological processes;
- approaching optimization tasks;
- search for necessary information, its analysis and storage;
- development of optimum methods and means of information transformation;
- creation of new urgent information;
- supplying the maintainability of information production.

Knowing that today information technologies play a very important role in the development of various socio-economic processes, it is important to understand that they should develop and be improved. Nowadays there are a lot of problems in modern information technologies, which influences the level of economic development of our country. One of the main problems in this area is the process and quality of training specialists engaged in the IT-branch. That is, as IT-domain develops

momentarily, staff training should be done regularly, training process should be properly organized, centralized, and should take place with use of modern technologies.

Also, the prevalence of foreign information technologies and low percentage of our own ones contributes to urgent problems of modern information technologies. Another problem is migration of qualified specialists, the so-called “brain drain”, which means mass migration of intellectual part of population to countries of Europe and North America, which took place at the beginning of two-thousand. Of course, without qualified specialists the economic growth of one or another branch, in particular, IT-branch is impossible.

The final problem is deficiency of specialized equipment. There is no denying that any general educational organization will find this question urgent. In fact, kindergartens, schools, higher educational establishments – all of them are need desperately to have up-to-date computer equipment. But the main problem is not that the equipment becomes outdated, but rather its absence. Some rural schools still do not have a single computer. However, such discipline as Computer Science exists and requires increased attention. But how should the modern generation master the basics of programming, if it has no idea what a printer looks like.

For information technologies to develop and bring a good economic effect, they require investments, such as:

• financing, first of all from the state, and investments;

• development of government and commercial programs for the effective development of IT-technologies;

• highly qualified IT specialists;

• loyalty system in relation to taxation of software manufacturers;

• development of own electronic industry with active use of the latest scientific achievements in this field;

• tightening legislation in the field of intellectual property protection.

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BOSTON DYNAMICS

Robotics is an interesting branch of engineering and science that develops constantly nowadays. This article deals with one popular robotics company called Boston Dynamics.

Boston Dynamics is an American engineering and robotics design company founded in 1992 as a spin-off from the Massachusetts Institute of Technology. Headquarters of Boston Dynamics is situated in Waltham, Massachusetts.

Boston Dynamics is known for the development of BigDog, a quadruped robot designed for the U.S. military with funding from Defense Advanced Research Projects Agency (DARPA) and DI-Guy, software for realistic human simulation. Early in the company's history, it worked with the American Systems Corporation under a contract from the Naval Air Warfare Center Training Systems Division (NAWCTSD) to replace naval training videos for aircraft launch operations with interactive 3D computer simulations featuring DI-Guy characters. The company is a pioneer in the field of robotics and it is one of the most advanced in its domain. Marc Raibert is the company's president and project manager.[1]

Nowadays, Boston Dynamics teams are working on three projects:

- Handle,
- SpotMini,
- Atlas.

Firstly, let us consider Handle. This is a robot that combines the rough-terrain capability of legs with the efficiency of wheels. It uses many of the same principles for dynamics, balance, and mobile manipulation found in the quadruped and biped robots they build. Wheels are fast and efficient on flat surfaces while legs can go almost anywhere: by combining wheels and legs, Handle has the best of both worlds.

Handle can pick up heavy loads while occupying a small footprint, allowing it to maneuver in tight spaces. All of Handle's joints are coordinated to deliver high-performance mobile manipulation.

Secondly, we have SpotMini. That is a small four-legged robot that comfortably fits in an office or home. It weighs 25 kg (30 kg if you include the arm). SpotMini is all-electric and can go for about 90 minutes on a charge, depending on what it is doing. SpotMini is the quietest robot company have ever built.

SpotMini inherits all of the mobility of its bigger brother, Spot, while adding the ability to pick up and handle objects using its 5 degree-of-freedom arm and

beefed up perception sensors. The sensor suite includes stereo cameras, depth cameras, an IMU, and position/force sensors in the limbs. These sensors help with navigation and mobile manipulation.

The last one on the list is Atlas. Atlas is the latest in a line of advanced humanoid robots Boston Dynamics is developing. Atlas' control system coordinates motions of the arms, torso and legs to achieve whole-body mobile manipulation, greatly expanding its reach and workspace. Atlas' ability to balance while performing tasks allows it to work in a large volume while occupying only a small footprint.

The Atlas hardware takes advantage of 3D printing to save weight and space, resulting in a compact robot with high strength-to-weight ratio and a dramatically large workspace. Stereo vision, range sensing and other sensors give Atlas the ability to manipulate objects in its environment and to travel on rough terrain. Atlas keeps its balance when jostled or pushed and can get up if it tips over.[2]

There are a lot of possibilities for different specialists in robotics sphere. Check out more at www.bostondynamics.com.

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MATHEMATICAL MODELS IN REAL LIFE

Mathematics has been used in life ever since the very beginning of human existence. Different civilizations with the course of time have left a cumulus of mathematical knowledge of various types and in different contexts. Each of these parts of knowledge corresponded to the needs that prevailed at different points in history and had the objective of providing answers to all phenomena, whether from the fields of physics, chemistry, astronomy, music, astrology, art or religion. Today we will talk about modeling tasks and situations in real life.

Various descriptions of the process of mathematical modeling can be found in the literature. Many of them illustrate the use of approximate and limiting cases to obtain an "idea" about the problem and the behavior of the solution. We can point out that one must remain flexible in mathematical modeling and not be tied to a particular approach.

However, there is a detailed plan where the main ways of solving problems are described.

PROBLEM SOLVING

Process

Although various processes or strategies have been illustrated in the literature, they all contain the four elements outlined by Hungarian mathematician George Polya. They are as follows:

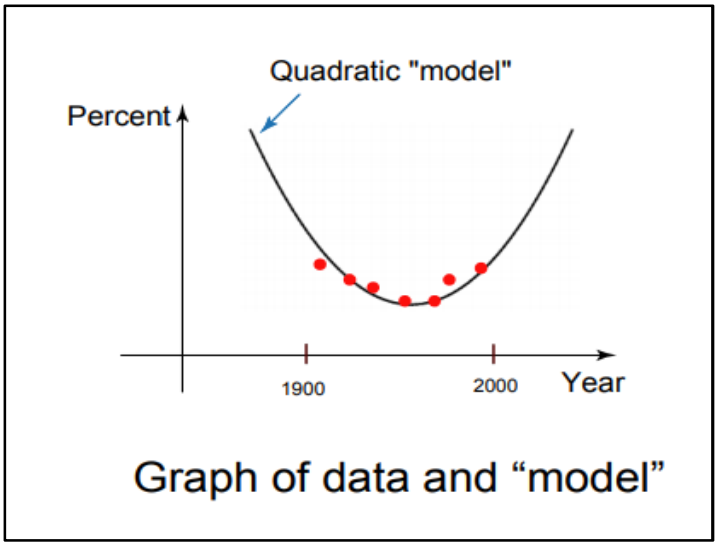
1. Identify the problem.
2. Develop various solution schemes.
3. Implement a solution.
4. Check our result.

Constructing a model

1. Start with a set of real-world data
2. Look for a pattern in the data.
3. Describe a principle that produces the data.
4. Try to express what we've discovered in relation to the data algebraically, as a function.
5. The model allows us to make conclusions about the simulated thing. The independent variable of the function "predicts" the dependent variable [1].

Example

We are given a data on the percentage of the US population born abroad since the 1900s and we are asked to find a quadratic function that "models" the data. Due to the information we got, we build dots in a rectangular coordinate system illustrating the data. The line connecting dots is a desired graph.



Graph of data and "model"

HEURISTICS

Heuristics are guides or hints which serve as aids when someone "gets stuck" at a certain point in solving a problem. They are not infallible, but can prove helpful in applying a different view of the problem. Table 2 lists some heuristics with a brief description of each one.

Table 2. Some heuristics or guides

1. Solve a simpler problem. Many times a person can get into a complicated problem and "get stuck." Simplifying the problem to a stage where the person recognized the solution approach can aid in developing the actual solution procedure.

2. Overcome excess anxiety. When a person becomes "stuck," he can develop a large amount of anxiety which prevents effectively developing a solution. Awareness is the first step to combatting this. Relaxation can minimize this excessive anxiety.

3. Inform another person about your issue. It is sometimes very beneficial to try to explain your situation to another person who is familiar with the subject. Describe what you have done and what you are trying to do. Often this helps to point out additional information or errors in reasoning.

4. Brainstorming. When "stuck" on a problem, generate a list of words or phrases which immediately come to mind. Write everything down and defer judgment until you have exhausted the flow of information.

5. Personal analogy. Pretend that you have entered the system under study. Try to imagine what you see, feel, etc. This helps to "visualize" the situation.

6. Look at extreme cases. Ask yourself a lot a "what if" questions to get an "idea" about how you think the system will respond. Have will to doubt. Focus attention on different aspects of problem.

7. Incubation. Sometimes it is useful to stop actively working on the problem when "stuck." Let the problem "be in force" for some time. Some information may “emerge” in your mind or, upon your return to the problem you can see errors in reasoning or other obstacles to the solution that were not previously obvious [2].

Polya describes a large number of heuristics related to solving mathematical problems. The reason for using heuristics is that development of an acceptable mathematical model is usually carried out in one step, described in the process of solving a problem. Often the problem is not well-defined initially and/or erroneous assumptions are used. As the initial approach to the solution becomes "blurred," one needs a mechanism for reevaluating the problem. Heuristics can serve this purpose. To be useful, different heuristics must be tried so that a person can find the ones that work best for that individual. A person can also develop his/her own heuristics through experience in problem solving. The more heuristics that a person can use, the greater the likelihood that he/she is to get "unstuck" in a problem and get a lasting result [2].

CONCLUSION

Mathematical modeling and problem solving have been shown to have many common elements. Modeling is a subset of the problem solving process. Most of the previous descriptions of mathematical modeling show the strategy but neglect

the psychological aspects. These aspects include creativity, anxiety reduction, and heuristics. By including these elements, you get a general approach to problem solving and mathematical modeling.

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ACTUAL PROBLEMS OF THE LATEST INFORMATION TECHNOLOGIES

Information technologies are now used in all spheres of human activity, they move forward, develop and improve, but today there are many problems in the development of modern information technology.

1.*Problem of data insecurity*. Now information is considered as a product, and this product is very easy to steal, modify or destroy. This problem is becoming more actual in view of the proliferation of Internet of Things (IoT) devices. Only intelligent security investments and redesigned devices are the solution to this problem [1].

2.*Problem of the influence of artificial intelligence (AI).* The next important issue is the influence of artificial intelligence(AI). According to Gartner, artificial intelligence is a digital business and by 2022 it will reach almost $ 3.9 trillion [7]. AI can encompass anything from Google's search algorithms to IBM's Watson to autonomous weapons [8]. But experts such as Stephen Hawking, Elon Mask, Steve Wozniak, Bill Gates, and many others are worried that as AI has the potential to become more intelligent than any person, we have no reliable way of predicting how it behaves.

3. *Serverless computing* is an innovative software architecture that is gaining popularity now. In fact, it can generally eliminate the need for infrastructure provision [10]. However, businesses need to learn how to use such technologies.

4. *Network flexibility*. The network is a platform for peripheral computing. The problem is how to provide access to the network. In 2019, IT leaders should focus on helping their team increase network flexibility to meet business needs, which will be caused by the emergence of 5G networks and affordable IoT devices that are growing rapidly [10].

5. *Denial of data centers*. According to Gartner, by 2025, 80% of enterprises will completely have abandoned the use of local data centers [10]. From colocation to

public clouds, there are many alternative local central data centers. IT leaders must determine that the existing amount of investments is usually amortized for a very long time.

6. *Problem of transition to Software as a service (Software as a Service – SaaS)* [10]. Increasingly, cloud storages are used not only to store information, but also as full-fledged platforms providing services. It is expected that the cost of "clouds" in 2019 will grow by 22%. For comparison, the cost of the rest of the software will increase by only 6% [6].

7. *Talent management becomes critical*. In fact, qualified specialists are the most important ingredient of a modern high-performance technology corporation, which is why great talent is in demand. People who demonstrate versatility and adjustment quickly become “mandatory, especially in hybrid environments” [10].

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WHY IS IT SO IMPORTANT FOR ENGINEERS TO LEARN BIOLOGY?

What is the most important rule of a successful inventor? Saw a good idea-steal it! And if you're going to steal, you need to steal from the most talented author. We all know the name of the author, who first invented the needles in syringes, the wings of the aircraft, underground drilling, echo location – this name is NATURE. After all only nature has maximum efficiency, the most useful solutions, billions of years of experimentation, and it is silly not to use it. Copying from nature is not called theft, but biomimicry, and this is a whole science. Today we will look at 4 levels of biomimicry, and you will understand why engineers simply need to learn biology.

So, the first level called "Copying forms." At this level, an engineer should look closely enough at an animal to see its potential. For hundreds of years people tried to copy the model of the flight of birds, but the mistake was that they tried to repeat the flapping of the wings, but all they had to do was copy the shape of the wing. The fact is that the wing is very cleverly arranged, with aerodynamics, the air above the wing moves faster than under it, and where there is more speed, the pressure is lower and air raises the bird, allowing it to float in the air. But the example with a bird and a plane is rather banal, so let's consider a whale. More precisely, not just the whale, but its fin, if you look closely, we will see on the fin protrusions that resemble a saw. These protrusions help the whale to cut the water into several streams, which facilitates its movement. Without thinking twice, attentive inventors immediately applied this form to the blades of wind turbines, this solution significantly reduced air resistance and noise levels.

We are already approaching the second level, which is called "Hidden Properties". This is no longer a simple copying of forms, but the creation of analogues of natural mechanisms. Have you ever thought about whether woodpeckers have a headache? They knock on wood 22 times a second, 12,000 beats per day a day. One blow creates a load of 1200G, for comparison, when 5G a person loses consciousness, and the maximum overload that a person has ever experienced is 214G. Four devices help the woodpecker to cope with such a load: an elastic beak, a porous skull, a shock-absorbing fluid and a springy bone. Now this technology is used to protect fragile electronics: hard steel case, soft aluminum, rubber layer and a large number of glass balls. This design stands 60000G.

The third level is called "Copying processes". Do you know something about Kilo Bots? For those who have not heard, these are small robots, one by one they are useless, they can only react to light, measure the distance and notice other Kilo Bots. But as soon as 1000 bots come together, then they act as a single whole, they can

imitate the behavior of fireflies, build complex shapes, like the cells of our body do, gathering into tissues and organs. In the future, they will look for people among the rubble, and explore hard-to-reach places. Rolls Royce is already preparing its group of robots to search for defects in the engine.

The final and the most difficult level of biomimicry is “Ecosystem”. To better understand the last level, you will need to strain your brain well.

What if I invite you to turn the deadliest place on the planet, the Sahara desert, into an oasis? It seems nothing complicated, you need to solve only one small problem, the problem of lack of fresh water. But wait, the camel somehow survives. No, it's not his humps, you need to look closely at his nose, the camel has learned to extract water where it would not appear. He inhales the hot air, the water droplets condense on the micro hairs in the nose of the camel. The authors of the Sahara Forest Project are now engaged in the creation of an oasis in the desert; they have created huge farms that process salt water into fresh water by evaporation.

Today I gave you not the most interesting examples of biomimicry, I gave the simplest, for the easiest understanding, but there are thousands of such examples that are used everywhere: medicine, computers, architecture, transport, etc. Everything is in your hands, look at the world more attentively.

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ELECTRONICS CAN BE HACKED THROUGH MUSIC

Apparently, all electronic devices including smartphones, tablets, personal computers or even cars which electrical circuits contain programs, can be hacked through music or more precisely through certain sound signals. That has recently been confirmed by researchers from the University of Michigan.

The majority of modern electronic devices, which have programmable or software defined chains, also have a large range of different sensors. One of the most common audio sensors is a microphone. It converts vibrations of air created by sounds, speech or music into electrical impulses.

Research has proven that these devices can be influencedthrough music which contains signals with different tones. In doing so, the sound is not only interfered

with the workof the device by disruption of the functioning of its sensors. These signals allow to control electronics by changing software settings. The changes will not come out during normal usage, so user is unlikely to detect defects.

There are two approaches whereby acoustically spoofed sensor data could be detected: detection of data irregularities or detection of the acoustic interference. Depending on the application to which the vulnerable sensor is deployed to the service, it may be possible to detect irregularities in the measurements reported by the sensor.

What if as a result of such effects your smartphone will delete all your personal information or account settings? And what if this affects your new "smart" car or even worse – implanted medical device?

Researchers have already demonstrated examples of such outside intervention. They used a fairly cheap dynamic with limited frequency range. They managed to take over a smartphone and a car.

Note that they laced a music video with the tones, demonstrating that the interference remains effective even when combined with videos and music that could be automatically played from websites, email attachments, Twitter links tapped on a smartphone, etc.

This leads to the conclusion that it is long past time for developers and electronics manufacturers to improve their products` security. In doing so, protection should be pursued in advance, before effects would occur.

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ALGORITHM FOR GENERATING RANDOM VALUES

Generators of random numbers are the main part of the whole computer security system. The definition of term "random value" is "a value that that takes some parameters and returns a new value that cannot be predicted".[1] So, the set of random values cannot be predicted by known parameters. Random values are used in cryptography, computer security and in some games for emulating the in-game events.

The two main categories of generators are the pseudorandom number generator which uses only one parameter and the random number generator which can use not

only one parameter. But the main vulnerabilities are that pseudorandom values can be predicted by the parameter or values will repeat soon (the algorithm will go in a loop) [1]. As John von Neumann said, *"Anyone who considers arithmetical methods of producing random digits is, of course, in a state of sin."*[3]. So, the best algorithm must include one or more parameters that are taken from the entropy set.

The ideal generator must return one value with the same frequency as another one $(A = \{a_1, a_2, \dots, a_n\} |A| = n \; \forall n \in \mathbb{N}, \forall a \in A, \forall k \in [1; n] \; v(a_k) = \frac{1}{n}$ where $v(a_k)$ is a frequency of $a_k$which is a random value). After the interpolatingof non-ideal generated values their frequency will be the same because of $\forall a_n \in \mathbb{R}, n \in \mathbb{N} \lim_{n \to +\infty} \sum_{i=0}^{n} a_i = 0$, so non-ideal generators can become ideal after a big amount of iterations.

There are lots examples of pseudorandom and random generators in the Internet. Usually, pseudorandom generators take one of constant inner parameters, and random generators use chaotic values. For example, the most known generators are "/dev/random" in UNIX OS, CryptoAPI from Microsoft and RdRand from Intel. The first one uses the CPU values as chaotic value, the second one – time, amount of memory and hardware values, the third one – sounds of current[3].

The set of random numbers is usually displayed in borders of 0 and 1. So, the basic algorithm will be similar to $((x + D) * \sum_k c_k * x_1^{i_1} * x_2^{i_2} * \dots * x_n^{i_n} + C, k = (i_1, i_2, \dots, i_n), x - chaotic\ value, D, C \in \mathbb{R})$. Good idea will be a random amount of operations before displaying a result. For example, use one algorithm for the first random value *v1* and use different algorithm depending on *v1* $\not{f}(v1)$ times.

The most common method to get chaotic value is to use value from Analog-to-digital converter, for example, the sound from microphone. You just need to record some sounds and then open them in digital format to get some n symbols from this file opened in numeric system format (the most common is binary).

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THE USE OF ULTRASTRONG MATERIALS OF A WIDE SPECTRUM OF ACTION

In modern conditions, new ultrastrong materials have been created which can be used in chemical industry, mechanical engineering, rocket and space technology to create products for a responsible purpose.

Scientists were independently analyzing gecko adhesion with different aims. For a long period of time, biologist Duncan Irschick had been studying gecko climbing and clinging adhesion. While Alfred Crosby had been working on polymer adhesion for almost as long and was interested in creating a novel adhesive material that would embody gecko attributes.

Geckos possess a complex set of specializations for adhering to smooth surfaces, but the principles underlying gecko adhesion remained elusive until now.

In 2009, Crosby's research team worked on synthetic adhesives built on the simple principle: they believed that if adhesives were made from stiff fabrics, adhesive force could increase dramatically. Most commercial adhesives are soft and gooey, yet the Crosby group believed that this compliant nature was a limitation. They discovered, as hypothesized, that geckos possessed stiff tendons attached to their toepads, which acted just like the rigid fabric adhesives that the Crosby lab had been developing. «Geckskin» was formally revealed to the world in February of 2012 [1].

The resulting material, called Geckskin, replies on a concept known as draping adhesion, unlike traditional pressure-sensitive adhesives, which rely on viscoelasticity. The adhesion is created with materials that can drape, to create contact with a surface while maintaining elastic stiffness in directions where forces will be applied. This design enables adhesive loads to be more evenly distributed across the pad surface, while also allowing for a rapid and low-energy transition between attachment and detachment. Geckskin is composed of stiff fabrics like carbon fibre or Kevlar, combined with soft elastomers such as polyurethane or polydimethylsiloxane (PDMS). The researchers also introduced a ‘green’ version, made from renewable materials. For this, they used natural rubbed impregnated into stiff natural fibre fabrics such as cotton and hemp [2].

By integrating the soft elastomer (the pad) with a stiff fabric (the skin), the pad can be draped over a surface to maximise contact. Like an actual gecko foot, the skin is woven into a synthetic tendon, creating a design that plays a key role in maintaining stiffness and rotational freedom. The result is an adhesive device that is so powerful that an index-card sized piece can hold about 318 kilogram on a smooth surface, such as glass. The material can easily be removed, reused, and leaves no residue [2].

Due to the unique properties of this material, it can be used in all industries without restriction.

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METHODS FOR IMPROVEMENT OF SPATIAL RESOLUTION OF RADIOIMAGES IN NEAR AND INTEREMEDIATE ZONES

Radar imaging in the far zone can be a costly and technically difficult procedure due to the need to conduct measurements at large anechoic radar ranges. Near to intermediate zone imaging can be carried out in a laboratory, but it is more demanding during the processing phase due to the peculiarities of wave propagation and lack of the adequate models. One of the key problems of radar imaging is the improvement of spatial resolution. The traditional approach to transversal image compression is the application of the synthesized aperture technique. This technique is usually applied for a range of frequencies, which enables one to acquire the depth portrait of the scanned structure. Any real radar system is subjected to different sources of noise and distortions. Different algorithms are used in order to eliminate the noise and distortions from the signal. The aim of the current research is to test the applicability of inverse filtration with evolution control, as well as the Prony's method for the recovery of radioimages under the influence of external noise and distortions caused by the air and near to intermediate scanning technique.

Horn antenna, which was moving in a transversal direction with a set step, was used for imaging during the experiment. The scanned structure consisted of one or two similar copper plates, which shared a common plane parallel to the aperture of the horn antenna and were 10 mm in length. Experiments were carried out for a variety of distances between the plates and between the common plane and the aperture of the antenna. For both methods the variable values were estimated with the help of the trial and error method.

The inverse filtering with evolution control is considered to be one of the best methods because it provides a sufficient amount of means for noise dampening [1]. The result of filtering can be seen in Fig. 1.

The Prony's method is known for its ability to provide adequate approximation results under the influence of noise [2].

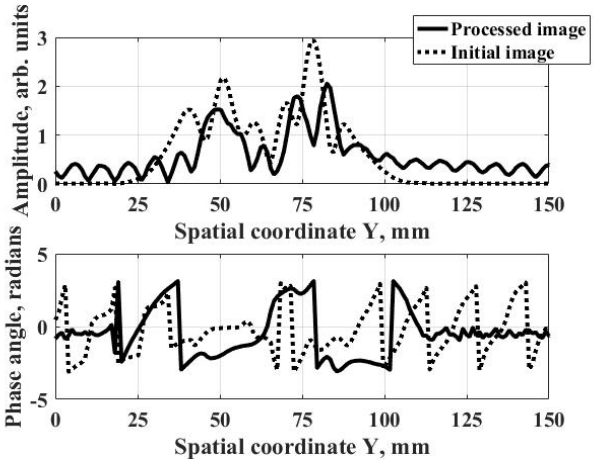

Fig. 1

The main idea of the method implementation is to represent the Fourier image of the initial picture as a sum of exponential components with complex frequencies and amplitudes. Several first frequencies can then be interpreted as the spatial coordinates of the edges and centers of the plates. The result of processing with the help of the Prony's method can be seen in Fig. 2.

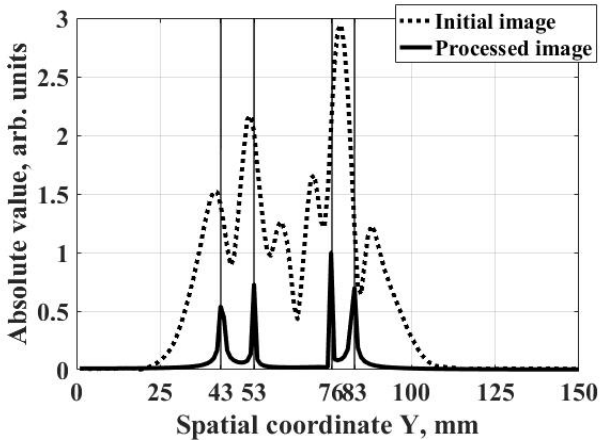

Fig. 2

The inverse filtering with evolution control was proved to provide better results if the scanned structure was positioned further from the aperture. Both methods were proved to be able to distinguish closely placed metal plates with the distances between the edges as small as 15 mm.

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MOTIVATION TO LEARN A PROGRAMMING LANGUAGE

If you want to learn how to program well, but you do not know where to start then start with yourself. You need to decide you want to study programming as a hobby or you want it to become your occupation. And after you have determined what you need programming for, you can go for studying. But before that, you need to realize from the very beginning that extremely rarely something happens as quickly as you would hope and our dreams and desires are not fulfilled instantly. Moreover, success in programming is a result of the titanic work, both from the study of the latest technologies, and the work on oneself. Here is a good question for you "how to study and where to start?". In my opinion, there are 3 main things interconnected with studying [1]:

1. Books. It can be both regular books and audio versions. After all, we spend a lot of the time on the road, no matter where: at home, at work or at school. The main thing is that you can get some knowledge during these trips.

2. English. At least basic knowledge of this language will help you to understand the terms in different programming environments.

3. Practice. Every day you need to type a few lines of code. After all, without practice, your theory is almost worthless.

You just have to start. Select one programming language and start with basics (variables, cycles, data structures, etc.). Also, very important thing is to understand the basic concepts of programming and to create the foundation of theoretical knowledge. And in order to determine what to choose, you can find out which languages have been popular for several years, or if you have some friends in programming consult with them. But you must remember that it should not be too difficult to study.

And then after you master one language you need to learn the others, the more you know the more you will be able to use. And because of this, each programmer should constantly monitor technological trends in the IT world. New technologies appear very quickly, so you will have to study throughout your life. One of the biggest struggles while learning to code is finding ways to stay motivated. Codementor and other [2, 3] give such recommendations:

1. Make sure this is actually something that you want to do. If coding is not something you want to do, then leave it to those who do.

2. Start small, celebrate the little things, and build, build, build! Learning to code can certainly be a daunting task to many but one of the most helpful ways to learn and stay engaged is to start small.

3. Get a mentor. Most programmers can probably tell you how much they have gained and learned from a mentor.

4. Maintain a Portfolio. Keep a collection of your work. Whenever you are feeling a lack of motivation, you can always refer to it and see how far you have come.

5. Just do it or do nothing. Keep in mind that it is easy to burnout after a few hours of binge-watching tutorials or non-stop programming. It is important that you allocate some time to get some rest in order to recover and recharge.

6. Balance. Make sure that you are consistently taking breaks away from your computer.

7. Be a part of a supportive community.

If you will work hard on these aspects, your career will be quite successful. And here the motivation is useful as nowhere else. We can always be better and more professional and we should do it, because programming is goal-oriented and motivates developers who create truly complex and important things.

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SOLAR POWER

Today, solar power is widely used in cases where other sources of energy are inaccessible. In places with a sufficient amount of solar radiation, its use is economically and environmentally friendly.

Stations working on solar energy are generally noiseless. In order for the plant to produce a 1 MW power solar power plant (SES), it needs to draw at least 1.5 hectares of ground. About 4% of the world's electricity is produced by the SES. The conversion of solar energy into electricity occurs through the use of photovoltaic cells [1].

Solar energy can be partially provided with electricity by private sector residents. To do this, we need to use the solar panels that are located on the roof of the house.

Any small private solar power plant must include next components in order to meet the needs of a private medium-sized house [2]:

• Solar (photoelectric) elements that we usually see in the form of panels. Elements that generate electricity by converting light into electric current.

• Inverter: a device that converts a constant electric current into a variable so it can be used in a home with a voltage of 220 V.

• Controller: a peculiar heart of a solar power plant, a device that provides uninterrupted interaction between the components of the station and the smoothness of energy supply.

• Rechargeable battery: an optional station element, but it is desirable to set on, since it allows you to accumulate an electric charge and use it when there is no sun, for example at night, and to ensure the autonomy of supplying electricity to the house in case of an emergency

Advantages. Solar power plant does not require maintenance at home use. Several times in a year the modules require cleaning. The average station is 20 years old. Saving: Many countries have different rates that allow them to sell electricity generated by station power. Ecology: Pollutants that arise in the production and transportation of solar systems are negligible compared with the damage to the ecology of the planet caused by the extraction of traditional minerals [3].

Disadvantages: High cost: the devices required for the station are not cheap. Variability: the amount of energy received depends directly on the intensity of the sun's radiation. Stationary stations occupy a large area. There are stations located on the roofs and walls of buildings, but space is still needed.

According to the forecasts in XXI-th century there will be a rapid increase in the use of solar energy so solar power can become one of the main sources of renewable energy. The average annual amount of total solar energy that enters the territory of Ukraine annually is in the range from 1,070 kWh / m. square in the northern part of Ukraine up to 1 400 kWh / m. square and higher in the southern regions. Therefore, photovoltaic equipment can be used efficiently throughout the year, effectively for 7 months in a year (from April to October) [4]. Is it possible to compare the disadvantages of solar power plants with advantages? This is a future issue. But we are sure that these funds are scanty for the preservation of the environment, and yet we are becoming more and more energy independent.

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GAMING INDUSTRY

The game industry is growing in revenue every year, in 2017 revenues were expected to reach 108.9bn around the world. Naturally, new studios are emerging at a fast pace on the promise of remaining lucrative for the following years. As a consequence, the search for highly skilled workers in the game industry is increasing.

Opportunities are plenty not only for developers but also for artists, marketers, HR experts and project managers. However, studios usually opt to hire an experienced workforce, as it takes a lot of effort of the team to train people internally, especially in the middle of a production phase.

With digital distribution on the rise, many indie companies are surfing the wave and uploading their games on platforms suchlike Steam. Thus, companies can monetize with ads and in-game purchases and users can benefit from a vast portfolio of games for affordable prices. In the past, games were all boxed and sold separately with consoles, although the hype for consoles is still a big thing, they are no longer the only way out to play.

Nowadays, it is possible to be a gamer no matter the size of your pocket. Furthermore, game studios are expanding their activities towards mobile and social games allowing people to play from mobile and tablet devices.

The game industry was never so lucrative, and experts say the boom for games will persist longer. So, let's dig into game studios and find out what it looks like to work for one.

Whenever I listen to people talking about game companies, I always have the impression people are forgetting that there is something uniting every single enterprise on earth, profit. Think of a game studio as a company developing a product to be monetized. In order to keep the cashflow running, the studio needs to create a successful game able to generate revenue high enough to pay for production costs (developers, artists, testers and many other operational expenses).

But we shouldn't romanticize, people are not hired to play games on working hours and not always they'll produce their next favorite title. I understand it is great when we help to develop a game, we'd enjoy playing yourselves, but realistically we'll work in a title that is not exactly ourfavorite, or that maybe we wouldn't play if we weren't working to develop it.

Developing games is a business like any other, and therefore the studios will develop whatever is lucrative to them.

There are mainly four different types of game studios: publishers, game dev studios, indie companies, and mobile game companies.

The publishers are the big players, the ones producing the most expensive titles, they invest massively in marketing to guarantee the return on their (very high) investment -ROI. Publishers pay generally the highest salaries and are well known for having an amazing infrastructure. However, is common that publishers decide for not producing games internally. In general, they outsource game dev companies to have their games produced partially or totally externally, this practice is called External Development.

Indie studios, in turn, produce and publish their games digitally, they are rather small companies, often independent developers working on their own. Indie studios have a limited budget if compared to publishers, and are responsible for producing, distributing and marketing their own games online. The good catch about indie studios is that they are generally more open to new ideas than publishers are.

On another category, there are mobile game companies. They produce games to be played in mobile devices that can be easily found on Play Store, App Store and mobile versions of social media websites.

Quick reminder, there are also gamble game companies, educational game companies, companies producing games to be played by patients experiencing mental disorders… and the list goes by.

The entertainment industry is accountable for the most exciting careers you can find in this life. Can you imagine yourself working for something you usually do for fun? That's how gamers imagine themselves when working in a game studio.

However, crunch time and high lay off-rates can be real. They occur because game development is composed of releases, during the production, more staff can be hired to attend urgent demands and tight deadlines. Once the production ends and the game is finally released, the company has to cut costs until the next production starts and so the laid offs occur.

If you want to work in a game company be prepared, the challenges in the game industry are high, artists have to constantly outperform in quality due to an increasingly exigent market. Developers will come across multiple technological obstacles, including the implementation of new tools. Changes take place weekly, candidates are expected to learn by doing in an unstructured way. If you are the kind who doesn't adapt well to modifications you may find it hard to survive in the game industry then.

It doesn't come off as a surprise the hiring process in the game industry is tough. Not that you wouldn't have a bad time preparing yourself for any other job interview anyway, but game studios know the challenges to be faced ahead. The right employee should be more than just a game lover, but a highly skilled professional with extra energy and above all a team player.

If the game industry is for you or not, I think only you are capable of answering to this question, but if I have a take away message from all of this, I would say

the game industry, like any other, has definitely its good, bad and ugly sides, ask people, get information, analyze and go ahead.

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GO PROGRAMMING LANGUAGE

Gorland or GO is a programming language, which was created in 2007 by Google employees Robert Grizmer, Rob Pike and Ken Tompson.

GO supports type security, dynamic input, and output opportunities have a huge standard function library and embedded data types such as an array with dynamic size and associative array.

Multithreading helps GO to make calculating and networking simpler and to split them. Modern types of data can transform your code into a more flexible and useful one. Programs compile fast, wherein you have garbage collector and reflection.

Program size in GO can consist from three to several million lines, written in one or more files with file extension .go. Modern text redactors such as vim can work with this extension.

What makes Gorland so different?

- There are no classes and everything splits into packages. GO works with structures and not with classes;
- It has no inheritance because it makes the code simpler to read. For example, you have A class which is inherited by B class. When you change something in B class, it can cause some problems in other classes which it is inherited from. Without inheritance GO is more readable too, there are no superclasses, which you must learn;
- No generics;
- No annotations;
- No constructors;
- No exceptions.

GO concept is created relying on the experience of making usual programs and does not have any goals to make a revolution in programming. Go does not have any important functions, which can let another language (C++, Java, Python) be really powerful but there are at least three reasons to learn Gorland:

• It has quite readable code. Every programmer has his own “right” style of coding, but Go force programmers to create code only in one way. As a result, there are no problems with language syntax and you have to code according to those rules.

• You can create fast programs in a little period of time. The productivity of work on Go cannot be so impressive as on C but compilation speed for the big program will be faster. For many projects, it is quite useful.

• Most errors occur in untested or complex code.

Go has handy testing instruments. Besides, type security removes some stupid mistakes. GO is not quite a standard language, but it can provide many benefits:

• High productivity, like c\c++

• Pretty effective parallelism processing as in Java or Python

• Comfortable coding

This language can be a good option for your project, so I would advise you to be familiar with it.

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THE USE OF ADDITIVE TECHNOLOGIES FOR RECEIVING THE TURBINE DISK BLANKS OF TURBOPUMP ASSEMBLIES

The turbine disk is one of the most important parts of the turbopump units (TPU), which is intended to be put into operation pumps that supply fuel components to the engine and operate in a high temperature environment of corrosive-active gases, it is also important to take into account the high requirements for their durability and reliability. However, the provision of these requirements, in particular, is ensured by the use of unique and science-intensive manufacturing technologies, such as: stamping in sealed seals and welding with the usage of a huge number of expensive equipment [1]. However, in conditions of small volumes of production, the production methods lose their attractiveness due to the high cost of one unit of the product. The main idea here is to compare the existing production technologies of the TPU dick blanks and to

reduce the technological cost of production by using some modern additive technologies (DMLS – a direct sintering technology) [2].

Modern addition technologies allow you to print a turbine disk, which is made simultaneously with blades of a bandage ring, which allows to provide the high durability of the construction with a minimum mass and with a minimum technological allowance, which is one of the most significant factors for reduction of the amount of technological equipment and the production cycle in a whole significantly. Thanks to the high precision of the printer, DMLS technology allows to produce the complex configuration elements, while reducing production waste, as well as the ability to make products in small volumes.

The urgency of this issue for the Ukraine rocket and space industry is ensured by the need of finding the ways to reduce the cost of production for the TPU elements manufacturing and to increase the competitiveness of domestic rocket and space technology.

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THE INVERSE PROBLEM OF THE DYNAMICS OF THE MATERIAL POINT

The first result concerning the inverse problem of dynamics is due to Newton, who presented the form of the gravitational potential on the basis of Kepler`s laws [1]. With further development of the dynamics new problems with combination of both types appeared. They considered the optimal movement, movement of a point with a non-constant mass and many others, closely linked to the needs of developing machinery [2].

The use of the apparatus of the inverse problems of dynamics makes it possible to determine the control actions, under the influence of which the object will move along the designated trajectory. Such statements arise when solving various problems of control theory, including when planning the trajectories of the movement of aircraft, when building systems and algorithms for operating manipulators.

The problems of the dynamics of the material point can be divided into direct and inverted. While formulating the inverted one, forces, affecting the material point,

its mass and a starting point are known. The aim of solving the problem is to find the kinematic characteristics of the point (law of motion, speed and velocity) [3]. Forces, affecting the point can be constant or given functions of time, coordinates and speed of a point. Solving of the problem becomes easier, when vector of the external forces affecting the point is constant, or depends only on time or position of a point.

The singular forces, in case more than one is present, cannot be found, because systems of forces with the same resultant produce the same motion in the case of material points [4]. Mathematical model of a direct problem describes the motion of a material point with a mass m by a system of differential equations [5]:

$$X = m\frac{d^2x}{dt^2} \quad Y = m\frac{d^2y}{dt^2} \quad Z = m\frac{d^2z}{dt^2} \tag{1}$$

Using the given equations, that present coordinates as known functions of time: x(t), y(t), z(t), we can find the unknown force F, which affects the point. To do this it is necessary to put the given mass m and the given motion equations in the equations (1). To solve the inverse problem of presenting coordinates as functions of time, it is necessary to integrate differential equations of point`s movement (1) considering X, Y, Z as unknown functions of time. To fully determine the point`s movement law under the influence of a given force F, it is necessary to set the initial conditions – the initial position of the point and its initial speed.

In this paper, the partial case is considered when the material point is moving along the Ox along the rectilinear trajectory under the influence of F. Then the system (1) will look as:

$$X = m\frac{d^2x(t)}{dt^2} \quad Y = 0 \quad Z = 0 \tag{2}$$

For example, let's solve the problem of determining the law of motion of a body with mass m, which is lowered by a smooth surface, inclined at an angle of 30 °, provided that its initial velocity is 2 m/s (Fig. 1). The starting location of the point – the beginning of the coordinates, Ox is directed along the movement, vector of the speed is located on Ox, Oy is directed perpendicularly up the Ox. The point is affected by the gravity force m*g, which is directed vertically down, and the supporting reaction`s force. N, directed perpendicularly to the plane of movement (Fig. 2).

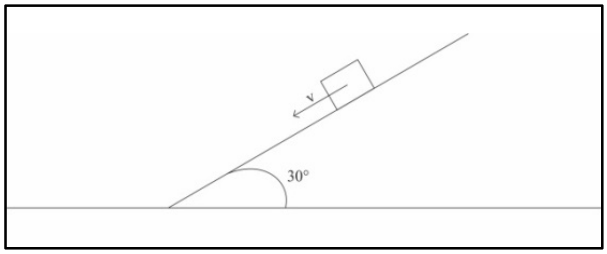

Fig. 1. Conditions of the problem

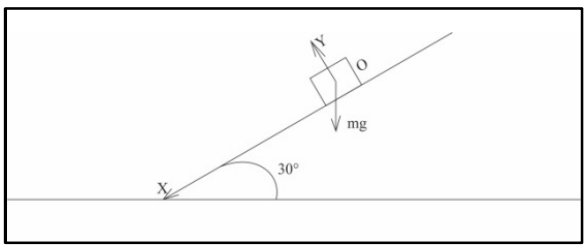

Fig. 2. Conditions of the problem with the axis

With the specified choice of the direction of Ox, the equations will look as follows:

$$X = mg\cos 60° \quad Y = N - mg\cos 30° \quad Z = 0 \qquad (3)$$

In addition, at the beginning moment of time with t=0 we have the following:

$$x(0) = y(0) = z(0) = 0; \qquad v_x|_{t=0} = 2;\ v_y|_{t=0} = 0;\ v_z|_{t=0} = 0; \qquad (4)$$

While composing the differential equations of movement`s law, we get:

$$m\frac{d^2x(t)}{dt^2} = mg\cos 60°; \quad m\frac{d^2y(t)}{dt^2} = N - mg\sin 60°; \quad m\frac{d^2z(t)}{dt^2} = 0 \qquad (5)$$

While integrating the first equation, we get: $\frac{dx(t)}{dt} = 4{,}9t + C_1$ (6)

To determine the random constant C_1we use the known value of speed vector`s projection on Ox at t=0. Wherefrom: $C_1 = 2$. After determining the second random constant C_2 we will finally get:

$$x(t) = 2{,}45t^2 + 2t;\ y(t) = 0; \quad z(t) = 0 \qquad (7)$$

Thus, when solving the inverse problem, the law of body motion is identified, the relations obtained allow us to determine the time during which the body travels a specified distance.

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MUSIC IN ELECTRICITY

We all know that music is an art. Music possesses incomparable possibilities with any other kind of art. It has the power of the greatest emotional impact on a person. However, the development of technical sciences played a huge role in the development of music. In this paper, we will consider the impact of technological development on musical instruments.

Let's go back to the beginning of the XIX century. When the Maxwell equation, which described the electromagnetic field and its connection with electric charges and currents in vacuum and continuum, was formulated. This allowed Georges Bosch

to create an electromagnetic pickup in the mid-1920s, which later became a feature of electronic musical instruments. Let's consider the work of the pickup on an electric guitar (a kind of guitar with electromagnetic pickups and metal strings) [1].

This pickup was a device that converted the energy of a metal string oscillation into an electric current, and the latter, in turn, was processed and reproduced through acoustic systems (a device for reproducing sound). It happens as follows: the metal string oscillates in the field created by the permanent magnet(s) of the sensor. Inside the coil of wire, wound around these magnets, an electric current arises, which is fed through the wires into the amplifier [2].

Fig. 1. Electromagnetic pickup

The "transformation" of sound into electric current made it possible for musicians to process the sound at will. Today, effects pedals are created through which a musical instrument is connected to a speaker system. The effects pedal is an electronic device for processing the sound of a musical instrument (in our case, an electric guitar). The electric current that is generated through the electromagnetic pickup enters the pedal. The pedal is processed and the electric current is sent straight to the speaker system. Thus, the effects pedal can both color and radically change the sound [3].

Fig. 2. Guitar effects pedal

Summing up, all this shows that technical sciences are not just formulas, theorems, hypotheses, laws. It is something more that can influence any sphere of life and radically change it.

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THE ANALYSIS OF ELECTROMAGNETIC SPACECRAFT ORIENTATION SYSTEM TESTING METHODS

All spacecrafts require an angular orientation in space. The orientation and stabilization are provided by the system of angular orientation and stabilization (SAOS). The most widespread type of SAOS is a system with the flywheel engines, which provides high orientation accuracy and short time of program turns. However, this type of SAOS has a significant drawback – a time output to the limit modes and the loss of control [1].

Additional executive systems, which unload the flywheel engines from the accumulated kinetic moment, are used to prevent this flaw. In most cases the electromagnetic system of orientation and stabilization is used, that implements the orientation on the Earth magnetic field. During the flight at its different points, the orbit projection of the magnetic field vector on the spacecraft axes changes that should be taken into account for stabilization in a given angular position. Mathematical and computer modeling is being performed for evaluation of the SAOS characteristics, but it does not always show the real process. It is necessary to carry out SAOS tests in terrestrial conditions to confirm the SAOS characteristics (the angular accuracy, the angular velocity and the time of rotation to a given angle) [3]. There are two main options.

Option 1 is the SAOS working out with the constant magnetic field vector. This kind of stand consists of a mockup of the orientation system, detectors, executive systems and an aerodynamic suspension. The stringy suspension is sometimes used instead of aerodynamic one, but in this case the mockup has only one degree of freedom and may rotate around the axis of the suspension. The main problem of such tests is the constancy of the Earth magnetic field vector in the test area [2].

Option 2 is the SAOS working out with a system of the Helmholtz rings. This system consists of three pairs of coils, arranged mutually perpendicular, which can create almost homogeneous magnetic field with certain modulus of tension and direction. In order to test the equipment with Helmholtz rings, the algorithm for current coils control must be obtained, which should form the control signals depending on the parameters of spacecraft movement – the orbit height, the tilt angle and eccentricity, taking into account the Earth magnetic field model.

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KNOCKING FUTURE'S DOOR WITH BLOCKCHAIN

The technology that is likely to have the greatest impact on the next few decades has already existed. It is not social media. It is not either robotics or artificial intelligence. It is called blockchain. It has an enormous potential and it is possible that this technology will be the next generation of the Internet [1].

Getting any information about transactions with bitcoins and their mining is only one way to use blockchain. However, this technology might be used as a storage for any information [2].

So, blockchain is a real chain of specific blocks, each unit is encrypted with hashing and bounded with a previous one. Hash is a string with the fixed length, which contains some numbers and letters. No matter what you are hashing, this hash always remains of the same size and different inners. Moreover, if you add a new record, the previous hash record will be changed. Blockchain sums up all the preceding blocks of hashes and other nonces as a random number generated by the network. In the case of the cryptocurrency, computing this nonce is a competition between miners. Anyone who finds it first will be rewarded in the digital currency [1].

Nowadays intermediaries eliminate millions of people from the world economy. They slow things down, undermine our privacy and turn all the digit era's capabilities to their benefit. Blockchain is a vast, global, distributed ledger running on millions of computers and available for everybody. It is a kind of database, where every kind of asset could be stored, managed or transacted without intermediaries. So how does it work? Data are not stored in one space, but rather distributed across a global database, using the highest level of cryptography. And when any transaction is performed, it is posted globally across millions of computers all over the world [1].

Why is it impossible to hack blockchain? Every ten minutes some kind of the heartbeat of a network happens, and a block gets created that has all the transactions from the previous ten minutes. And then that block is linked to the previous block and

the previous block creates a chain of blocks. Each of them is time-stamped, this is a kind of a digital waxed seal. Thus, if anyone wants to hack this system and, for instance, pay two different people the same money, this person would have to hack the current block plus all the preceding blocks and the entire history of commerce on a blockchain for that matter. The most important thing is that you must do it not just on one computer but across millions of computers, simultaneously, all using the highest level of encryption. That's why blockchain is a new and very powerful way to protect our privacy [1].

Blockchain will assist you to perform any activity on the Internet at the highest level. Blockchain Ethereum, for example, allows you to build smart contracts. This is just as it sounds: self-executed contract handles the management, performance, and payment – in two words, handles agreement between people [1].

Blockchain will help us to get rid of intermediaries, eradicate internet fraud, unwanted data changes and protect your privacy. This technology definitely will expel a settlement, cause the payment and the settlement is the same activities, just a change in a ledger. Blockchain will substitute realtors, attorneys, notaries – all the people responsible for any kind of fraud. This will make people trust each other and cooperate on equal terms. Using this really unique technology we can even elect the president in our country without cheating from any side [1].

To sum up, blockchain confidently knocks future's door and offers people to figure out plenty of different problems, from privacy protection and to social inequality. This technology lets everybody live with a sense of privacy and thrive in the open spaces of the worldwide network.

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TECHNICAL METHODS OF SOLAR ENERGY SYSTEMS PROTECTION FROM DESTRUCTION BY WIND FLOWS

In Ukraine, storm warnings are often announced, but serious natural disasters do not occur. The velocity of wind does not exceed 20 m/s, therefore it is qualified as a strong storm. In this decade, extreme weather events happened in 2011, 2013, 2016, 2017, mainly in the coastal regions of Ukraine as well as in the Carpathians [1]. In

the settlements, cataclysms damaged hundreds of homes, thousands of trees and disrupted the local power transmission systems. Hazardous meteorological phenomena are always damaging the economy.

The problem of using solar energy systems during the extreme weather events is that high-speed winds threaten to damage the roofs and terrestrial systems of solar energy or disable parts of the electrical system. Although the solar panels have high resistance to different types of damage from wind, in most cases malfunctions appear due to the weaknesses in the rack system.

In order to prevent the devastating influence of wind on the efficiency of solar stations and its separate parts, it is necessary to adhere to certain technical norms or to apply some basic methods. Protection technologies can be independent modifications, or mean an alternative to the panel shape of the device. First, you must use strong support elements and minimize airflow through the working devices. This can be achieved by installing longitudinal ceilings or windscreens, the size of which depends on the length of the station and the height of the panel raised above the ground [2]. Otherwise, it is necessary to provide a solid framework, for example, by deepening the structure or by fixing it on the foundation [3].

In addition, there is a spherical type of solar energy generator that monitors the sun as an alternative to the panel batteries with superiority in efficiency and durability [4]. The design uses a spherical lens to concentrate light on a small photovoltaic panel and combines it with a double-axis hinge that tracks the movement of the sun. This form allows the structure to be resistant to wind flows due to its weight and good aerodynamic properties of the spherical concentrator.

The suggested solutions and methods increase the reliability of solar energy supply systems, as well as guarantee the integrity of buildings and structures, other electrical systems in the vicinity, during the extreme wind conditions. Almost all security technologies do not require significant investment and are easy to implement, that makes them the most affordable and most effective solution when it comes to supporting the operation of solar panels during hazardous wind activities. Provision of the protective measures creates the safety of working conditions and life of a person on the whole and also excludes the devastating effect of deformed and disrupted working devices, elements of fasteners and their parts on the environment.

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FERMAT'S LAST THEOREM

Cubum autem in duos cubos, aut quadratoquadratum in duos quadratoquadratos, et generaliter nullam in infinitum ultra quadratum potestatem in duos ejusdem nominis fas est dividere: cujus rei demonstrationem mirabilem sane detexi. Hanc marginis exiguitas non caperet.

Pierre de Fermat [1]

There are cases in the world of mathematics, when the theorems proofs are stretching over sufficiently long periods of time, leaving behind a huge number of stories, closely related to it. One of the most famous theorems that fits this description is the Fermat's Last Theorem, which has been disturbing the minds of inquisitive mathematicians, who were great and not really, for three and a half centuries.

It was phrased in 1637 by Pierre de Fermat, a French lawyer, who had a large passion for studying mathematics. He spent his free time reading mathematical treatises and various researches. Besides it, he corresponded with famous mathematicians of his time. From his correspondence with Pascal begins the formation of probability theory. He also made a significant contribution to the development of analytic geometry, mathematical analysis and number theory.

Fermat had a habit of making notes on the margins of the mathematical treatises, which he was reading, and in the same place he formulated the problems and theorems, which were coming to his mind during the study of these treatises. One of these notes, phrased in the margins of Diophantus's "Arithmetic" and had an extremely simple form, is particularly interesting. It states that if n is an integer greater than 2, the equation:

$$x^n + y^n = z^n$$

has no positive integersolutions. This statement was called the "Fermat's Last Theorem". It is also interesting that the theorem was wrote with this remark: "It is impossible for a cube to be the sum of two cubes, a fourth power to be the sum of two fourth powers, or in general for any number that is a power greater than the second to be the sum of two like powers. I have discovered a truly marvellous evidence of this, but book's margin is too narrow for it."

For the reason that Fermat did not provide a complete proof of the theorem (only for n = 4) the question of the validity of this statement remained open. Brilliant mathematicians tried to prove the theorem. In 1770 Leonhard Euler gave proof for n = 3, Dirichlet and Legendre in 1825 for n = 5, Lamé for n = 7.Attempts to prove the theorem led to the discovery of many interconnections, regularities, and the development of theories, which later escalated into large mathematical sections. Thus, Ernst Kummer, who managed to bring proof for all simple n <100, with the exception of irregular simple (37, 59, 67), laid the foundations of algebraic number theory, while he was trying to prove the theorem.

In 1908, Paul Wolfskehl, professor of mathematics from Darmstadt, left a testament of 100,000 marks for the first complete proof of the Fermat's Last Theorem. This, paired with the simplicity of theorem formulation, entailed a huge stream of incorrect evidence from people who belonged to completely different social groups, many of whom did not relate to mathematics. Unfortunately, after World War I, the premium lost its currency value.

It seemed that the proof would not be found: "Mathematicians have debated whether Fermat indeed possessed the proof of the theorem. Perhaps, at one point, he mistakenly believed he had found such a proof. Despite Fermat's honestly and frankness in acknowledging imperfect conclusions, it is very difficult to understand today, how the most distinguished mathematicians could have failed to rediscover a proof, if one had existed. It is also highly improbable that Fermat would have claimed to have proved his last theorem, just because he succeeded in proving it for a few small exponents. In congrats, Gauss believed that Fermat's assertions were mostly extrapolations from particular cases" [2]. However, the fears were not justified. After seven years of work in 1993, Andrew Wiles, a professor at Princeton University, published his first version of the theorem's proof, but it contained some omission that was quickly resolved. Thus, in September 1994, the complete evidence of the Fermat's Last Theorem, which occupies about 160 pages, was published in the journal "Annals of Mathematics" [1]. In 2016, the Norwegian Academy of Sciences awarded the Abel Prizeto Wiles for proving a theorem with a postscript: "for stunning proof of the Fermat's Last Theorem using semistable elliptic curves that marked the beginning of a new era in number theory".It is interesting that concept called "elliptic curves" was mentioned for the first time in Diophantus's "Arithmetic": "The path on which our investigation took us began with Mordell's book and proceeded to Diophantus, to the "Arithmetica", to the first appearance of those wonders known as elliptic curve, to a certain family of elliptic curves, and back to Mordell." [3] However,the evidence of modularity theorem for semistable elliptic curves, which playedone of the key roles in Wiles proof, was created by him much later than Fermat left his theorem.

Fermat's Last Theorem left a truly outstanding print in the history of mathematical thought. The effort spent on finding its full evidence changed the attitude of many people towards mathematics, and some even toward life.The theorem's proof perfectly shows how the development of mathematics allows humanity to turn impossible things into reality.

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SORTING ALGORITHMS

Sorting is one of the most common procedures for modern data processing. Tasks for sorting data are found on a computer very often, because navigating in sorted data is much easier than in unsorted. The algorithm represents process of a given sequence of objects rearranging in a certain order (for example, placing numbers in ascending order, or letters in alphabetical order).

The main problem is that the absence of the method is always the best. There are many different data sorting procedures which in different situations behave differently.

The most important characteristic of any sorting algorithm is speed. The sorting time is usually proportional to the number of comparisons and rearrangements of elements in the process of sorting.

This article compares three sorting methods: bubble, quick and merge sorts.

Bubble sort. The algorithm is called so because, as a result of this sorting, records with large keys – "sink to the bottom", and records with smaller keys "float" like bubbles. In a sequence of N elements, every two adjacent elements are reversed, if the first one is smaller ("lighter") than the second [1]. The lightest element is "pushed out" to the end of the sequence after each pass. The procedure is repeated until the number of exchanges becomes zero. In practice, this is one of the slowest methods.

Quick sort is a greatly improved version of the sorting algorithm using direct exchange (for example, Bubble sort).

The general idea of the algorithm is next. An element of the array, called pivot, selects randomly (the correctness of the algorithm does not depend on the choice, but

efficiency may vary). All other elements are compared with the pivot and rearranged, dividing the array into two continuous segments: “elements, no more than pivot” and “no less” [2]. The same algorithm is recursive executed for all segments with length more than 1.

Since the pivot is chosen randomly, the execution speed will be different each time.

The effectiveness of this method can conventionally be divided into 3 parts:

- Best-case (each division produces segments of equal size)
- Average-case (each division produces unequal-sized segments)
- Worst-case (one segment is equal to 1, and the second N – 1)

Merge sort. This method also divide array into segments like previous one. However, instead of choosing a random element, the sequence is always divided in half until the length of all parts becomes equal to 1.

Next algorithm consists of three parts[3]:

1. Parts with a length 1 are already sorted.
2. One final part is made from the two adjacent sorted parts. This is called the merge procedure.
3. The method is repeated until one whole array is getting.

To merge the elements, parts of the array are compared (starting from the beginning). The smallest element is written to the final part. The next comparing element is taking from the same part. Then the final part is recorded instead of the previous two.

Since the array is always divided exactly in half, this method can be faster than quick sort in the case of worst-case. However, in sorted areas it works as slowly as on chaotic ones. In this case, it is defeated by other methods.

Conclusions:

- Now the bubble sort algorithm is used only if the number of elements is small due to its inefficiency. However, it is still popular as an algorithm for education.
- Merge sort is often slower than quick sort; however, the execution time is more linear. It can be used when there is an upper limit of the available time.
- The most common type is quick sort, which is usually the fastest, but its effectiveness may differ each time.

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COMPUTER VISION AND ITS APPLICATION IN THE MODERN WORLD

If you look at the photo of the crowd, you will most likely be able to see familiar faces on it, and distinguish them from strangers, determine their gender, age, understand in general terms where and when the shooting was done, and all this thanks to a rich personal experience received in your entire life. If the computer "looks" at this photo, then besides the sequence of data in the device's memory, it will see nothing [1]. However, like a person, a computer can be taught to see and distinguish everything in the image, analyze this information, and apply it in the future. And here we come to the aid of computer vision algorithms. In a simplified form, the main task of these algorithms is to split the image into fragments carrying information and to compare them with images already known to the program [2].

This approach makes it possible to achieve sufficiently accurate results for example when searching for pictures, for example, with minor computational costs. As human vision is not limited to the recognition of what is happening on a single photo, computer vision technology is not limited to just finding pictures on the Internet. Combining the capabilities of computer vision with the capabilities of neural networks, we can get a tool powerful enough to recognize handwritten text and translate it in real time, or analyze three-dimensional objects and transfer them to virtual space, and even more.

The merit of the widespread introduction of machine vision in different industrial areas can be seen in a significant reduction in costs of product quality control while receiving a significant increase in productivity (compared to the same work performed by man) without loss of quality. And all this is only a small part of the possible advantages of computer vision over conventionally simple human labor (such as sorting and simple quality control at work). And no, machine vision will not be able to notice a person, but it is able to optimize the same type of work, during which it is necessary to make a comparison and analysis of individual things, such as the raw materials supplied on the conveyor and the result of its processing.

This technology is already used in such industries as automotive (autonomous transport), design and architecture (analysis of real-world objects, and the creation of their 3D models for use in the design of buildings and interior), television and film production (capture of human movements, for creating further special effects), and even medicine (combining the results of MRI into a single three-dimensional model, as well as its subsequent analysis for non-standard deviations (in this way, you can determine malignant tumors and other formations at a very early stage, which can save a person's life)).

Computer vision technology is one of those cases where you can be unaware of what it is and where it is used, but at the same time every day see the result of its work, whether it is just a picture found on the Internet, or autonomous transport, which only due to only this technology is able to adapt to the constantly changing situation on the road, and able to prevent possible dangers to people's lives long before people could do it. The technology itself continues to evolve and find more and more applications in many complex tasks and conditions, which cannot but have a positive effect on the development of a multitude of industries in a positive direction.

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ARTIFICAL INTELLIGENCE IN DAILY LIFE OF HUMANITY

Today, many factories are actively using robotization, which helps to protect a person from danger during one or another job. But modern technology has gone beyond programmable machines. The technological process made it possible to introduce artificial intelligence into many services, which can perform many tasks instead of a person. But what is AI?

Artificial intelligence is the property of computers to perform those functions that are considered the strength of a person. The simplest example would be the selection of music or movies for the user, based on your preferences. Such services from Google as Youtube Music and Google Music actively use this in the selection of recommendations. Artificial intelligence is watching what kind of music you are listening to and learning how to select songs that the user will approve. This is the main part of the work of any artificial intelligence. It goes through the process of machine learning by observing the actions of a person and after viewing a variety of options for a person's actions, it selects the most optimal option.

AI is also often used in video games. Many people use third-party software to gain superiority over other players. This is prohibited by the rules, but people manage to bypass any protection that the developers install. "Valve" is actively working to integrate AI into its VAC security system. It also happens through machine learning. AI watches the game of those who use third-party software and learns to recognize

unfair play from fair. This approach will increase the quality of protection and correct a big drawback of the modern VAC system, which is that people are watching over games now. Artificial intelligence does not have the human factor, it is not subject to emotions and has more experience than man. The machine learning process includes millions of entries on which AI learns. The chance of error should be minimal, so that training is approached with responsibility [2].

Games and music are not the only directions of AI. The company Tesla, which produces electric cars, is actively experimenting with the introduction of unmanned control of their cars. Knowledge of the roads and the rules of the road and ways to deal with emergency situations that may arise along the way are invested in the vehicle. One of the objectives of the algorithm of an unmanned vehicle is to provide safety for passengers, but sometimes this can cause disastrous consequences. In Neuroethics, there is the so-called Trolley Problem [1]. Its essence lies in the fact that the trolley rushes along the rails, and there are five people on its way. But there is a siding on which there is also a person, but he is alone. From the point of human morality, it seems right to turn to a siding, but what about the point of view of AI? The autopilot Tesla provides first of all safety for the passenger, and the rest go into the background. That is why if a person in front of whom a pedestrian suddenly rushed out could still somehow unscrew a car, crashing into a wall, for example, then the autopilot cannot do this, since the passenger will suffer. This is the main problem of artificial intelligence, he evaluates everything from the point of view of logic and mathematics, when a person is still guided by morality. Therefore, so far, it has not been possible to introduce AI in many areas of a person's life, it may simply do wrong in terms of morality. But if you teach machine the moral, it will be able to perform the work where a person risks his life. It would be a real revolution in human life, however, neuroethics is still not at this level, so it remains only to dream [3].

In conclusion, I want to say that AI is really a revolutionary technology that each of us uses and may not even know about it, however, it is not at the level that we rely on the neural network for complex tasks, but so far we are moving in the right direction to make science fiction about utopia with humanoid robots come true.

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ARTIFICIAL INTELLIGENCE – A FRIEND OR AN ENEMY?

Artificial Intelligence (AI) is the ability of machines to learn, think, perform actions and adapt to the real world, expanding human capabilities and automating energy costs or dangerous tasks. Some experts think that artificial intelligence has sufficient potential to radically change the life of the whole society [1]. But the question remains what will these changes bring as a result?

In 2010, scientists at the University of Michigan found that artificial intelligence can evolve. They created a virtual race of Avidians who have computer code instead of DNA, which is constantly being improved. Since artificial intelligence can function autonomously, American scientists are confident that it is dangerous and must be isolated.

Despite all precautions, a number of researchers believe that it is impossible to keep artificial intelligence in check. For example, Elizer Yudkovsky, a researcher at the American Institute of Singularity, did the experiment to create artificial intelligence. It showed that even human-level intelligence can deceive a person and "escape" from captivity [2].

Scientific researchers note that in the near future, artificial machines will improve themselves, and their rapid development will be impossible to stop. Technologies will be able to surpass humans. They will manage research, develop weapons, calculations in financial markets. Researches think that such processes will increase the number of unemployed, lose people's sense of their own uniqueness and cause irresponsibility. Therefore it can become even the end of the human race [3].

Many technology innovators (Stephen Hawking, Bill Gates, Ilon Musk) fear that people may lose control of superintelligent machines, and artificial intelligence will do more harm than benefits [4].

On the other hand, the safe study of space, the depths of the ocean or the earth's core are not suitable for people or for ordinary machines. Any experiments and tests with the help of AI will be much faster and cheaper than a person can do. Artificial intelligence can not only manage hundreds of factories around the world at the same time and without stopping, but also carry out a quality assessment. This will significantly reduce the cost of production. It will also be possible to arrange work on hazardous and dangerous objects, where a high mortality and trauma are likely [5].

Many people worries that nowadays artificial intelligence can not only replace a person in the workplace, which many people are experiencing, but also help humanity as a whole. Modern artificial intelligence is already able to detect diseases in the early stages preventing the development of epidemics [6].

In any case, so far the benefits of AI are much more than harm, and there is no reason to think that “robots have plotted something bad against a human”. The main danger to a person is another person. And the benefit / harm of artificial intelligence will depend entirely on how people themselves dispose of new achievements of science and technology.

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CAN ARTIFICIAL INTELLIGENCE KILL DELIBERATELY?

On March 19, 2018, a 49-year-old woman was shot down by an unmanned vehicle. This is how the first fatal accident occurred with the participation of an unmanned vehicle, in which there is still no one to blame. The car was tested, and the driver was just in case of such situations. But the driver was distracted watching the show "Voice" when the bicyclist popped up on the road from the dark in the wrong place. Unfortunately, nobody could have prevented her death. And of course, that's a tragic and sad accident. And also that was the first one so it caused such a resonance [1]. But is this really an uprising of cars? Can artificial intelligence kill deliberately? And are unmanned vehicles dangerous?

The unmanned car is not distracted, does not fall asleep and will try by all means to avoid an accident. But if it’s impossible, it will try to minimize the damage. For example, knocking down the dog is a penalty of 5 points, an old man is 50, a mother with a baby is 100, to sacrifice a driver is also 100 points. The task of the machine is to collect as few penalties as possible [2].

The car is crammed with sensors, cameras, and radars. It literally sees the road. Computer vision paints a picture of the surrounding world, highlights the lanes, and determines the position of the car. Artificial intelligence notices objects on the road,

considers their size, speed, and direction of movement. Then it decides how the car will drive. All this happens in real time. The car is programmed to go around obstacles, it will try not to crash into anything if she sees something. But the key word here is to try [2].

We, the people, prescribe the rules for the car how to act in this or that situation. The car doesn't have to choose whom to save, and whom to donate. The person chooses the outcome. All this is similar to the classic problem of the trolley: several people are tied to the rails; they are driven by a trolley with one person inside. You should make a choice: to kill one person in order to save several, or not to do anything and give the trolley to move five. And there is no correct answer. You can act on the principle of least evil. Or vice versa – do not interfere. But anyway, it will be necessary to explain what is good and what is bad to the artificial intellect. But is it really worth being afraid of artificial intelligence? Can it enslave us? [2].

Battle robots already exist. They can find and capture targets, and try to destroy, for example, any formation, but the person is still pressing the trigger [2].

In general, taking over the world is very human goal. The car doesn't need this. All the news and talks about how artificial intelligence will get out of control is just a fiction of journalists who haven't fully plunged into the topic. But these thoughts sow panic and disinformation in us, in ordinary people.

On the contrary, artificial intelligence helps us live now. Every day you build routes in maps, enjoy a good selection of songs in the playlist and know the weather forecast. The world around us is becoming personalized and convenient.

People are always afraid of new technologies, but then they still replace traditional ones. We can prohibit everything and delay progress for a while, or we can test and try new technologies, making them safer every day [2].

Our world is constantly changing. To recognize a horse, a program needs to be mistaken a million times. To take over the world, it will need to play this scenario a billion times. During this time, the sun goes out, and humanity will move to other planets and possibly even galaxies.

But let's imagine all the same that artificial intelligence will want to take over the world. For this it needs consciousness. The problem of consciousness lies in the paradox of the situation: we, the people, possess consciousness, we have it, but we still don't know what it is.

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VIRTUAL REALITY IN MEDICINE

The concept of "virtual reality" was not known more than 30 years ago. Today VR technology is not just a speculative futuristic concept it is capable of solving real problems including the field of medicine.

Wayback as one of the startups is focused on Alzheimer's disease and dementia (acquired dementia). Memory loss is the main problem associated with these diseases. Dan Cole together with like-minded people created a series of films in virtual reality and called the project Wayback. Its goal is to stimulate the brain's work through the memorable moments of the past with the goal to awake long-term memories in patients and to provoke positive emotions. A series of experiments have shown that VR therapy allows people to regain the skills of meaningful communication.

David Axelrod is a cardiologist at Stanford Hospital Lucile Packard. He developed a VR heart model for imaging congenital malformations. The development has two practical purposes at once. It can be used as a textbook for students and as a visual demonstration for patients. If you are using controllers to control VR glasses, you can examine the heart from any angle. it can be done in order to see how blood flows through the heart, where the defect is located and how the defect affects the heart. Only with a touch of the button, you can "perform a surgical operation" and see exactly how the work of the most important organ will be restored. Virtual hearts are used to train pediatric cardiologists, which improves learning outcomes in comparison to traditional methods.

Several VR companies have been successfully helping cancer patients. Oncomfort, Start VR and KindVR have developed virtual reality applications that relieve stress in patients undergoing chemotherapy. During the procedure, patients wear VR glasses and they are offered to have a trip on the boat along the harbor, to explore the seabed, or to interact with koalas in the zoo. Such a distracting effect is more effective than painkillers: using VR the time spent concentrating on pain decreased by 48% while using opioids – only by 10%.

California VR startup IrisVision focused on the problem of macular degeneration. The yellow spot itself is part of the retina and is responsible for central vision. The headset developed by IrisVision allows visually impaired people to expand the peripheral vision and enlarge the image so the spots are essentially eliminated. Thus an innovative VR simulator was created and long and tedious rehabilitation turns into entertainment.

French startup KineQuantum offers VR-therapy in the form of a game. Its founders have developed several video games, the process of passing which correspond with

the traditional rehabilitation exercises. For example, to restore the shoulder joint patients are offered to shoot a bow.

In fact, there are many more projects offering solutions for practitioners, hospitals and patients and the technology such as virtual reality is finding its increasing use in medicine.

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