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CHANGES IN FREE HEPARIN AND PROTHROMBIN COMPLEX IN DIFFERENT LIGHT CONDITIONS

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ИЗМЕНЕНИЕ СВОБОДНОГО ГЕПАРИНА И ПРОТРОМБИНОВОГО КОМПЛЕКСА В РАЗЛИЧНЫХ УСЛОВИЯХ ОСВЕЩЕННОСТИ

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Abstract

The importance of the epiphysis in the neurohormonal regulation of the physiological function of the body and the factors of hemocoagulation are comprehensively studied at the Department of Human and Animal Physiology of Baku State University.

It was found that with prolonged activation and inhibition of the function of the epiphysis, the anticoagulation potential of the blood increases and decreases. In response to this, there is a reflex increase and decrease in clotting factors - the activity of clotting factors - factors of the prothrombin complex, free heparin, resulting in hyper- and hypocoagulation.

Аннотация

Значение эпифиза в нейрогормональной регуляции физиологической функции организма и факторы гемокоагуляции всесторонне изучаются на кафедре физиологии человека и животных Бакинского государственного университета.

Установлено, что при длительном активировании и ингибировании функции эпифиза противосвертывающий потенциал крови возрастает и снижается.В ответ на это наступает рефлекторное нарастание и снижение факторов свертывания -активность факторов свертывания – факторов протромбинового комплекса, свободного гепарина, в результате чего наблюдатся гипер- и гипокоагуляция.

Keywords: epiphysis, dark phase, light phase, prothrombin complex, free heparin.

Ключевые слова: эпифиз, темновая фаза, световая фаза, протромбиновый комплекс, свободный гепарин.

Проблемы, связанные со свертыванием крови, особенно тканевых факторов гемокоагуляции, были и остаются одними из наиболее увлекательных, сложных и актуальных проблем теоретической биологии и современной клинической медицины

Несмотря на всестороннее исследование нервно-рефлекторного и гуморально-гормонального механизма регуляции агрегатного состояния крови, тканевые факторы гемокоагуляции в различных органах и тканях изучены очень скудно, особенно роль эпифиза в регуляции гемостаза.

С позиций современной биоритмологии вопросам адаптации, нормы и гемостаза без учета роли эпифиза не возможно не придавать значения, особенно в зависимости от долготы светового и темнового режимов, а также после удаления эпифиза. Поэтому исследование тканевых факторов гемокоагуляции на фоне десятисуточного световых и темновых режимах, а также после удаления эпифиза в различных органах и тканях является актуальным вопросом нейрогормональной регуляции хронофизиологических процессов, обеспечивающих агрегатное состояние крови в организме.

Целью настоящего исследования являлось изучение изменений факторов гемокоагуляции в тканях селезенки, печени, сердечной мышцы, взрослых крыс при различных функциональных состояния эпифиза световом и темновом режимах, а также после его удаления.

Материал и методы исследования. Эксперименты проводились на 100 взрослых крысах-самцах линии Вистар.

Исследовали тканевые факторы гемокоагуляции в селезенке, печени, сердечной мышце взрослых крыс в норме и условиях десятисуточного светового и темнового режимов. Эпифиз удаляли модифицированным методом Д.М.Аулова (1969). Свободный гепарин определяли по Сирмаи, протромбиновый индекс определяли по Квику. Условия освещенности: в течение 10 дней животные содержались в постояннай темноте и 10 дней при постоянных световых условиях.

Экспериментальнрый материал статистически обработан.

Результаты исследования и их обсуждение. Экспериментальные данные показывают, что у интактных животных свободный гепарин в ткани селезенки 7,0±0,3 сек, в ткани печени – 14,0±0,4 сек, в ткани сердечной мышцы – 5,0±0,3 сек.; протромбиновый индекс – в селезенке - 213,0±4,9%, в печени - 123,0±5,2%, сердечной мышце - 105,0±6,4%.

В дальнейшем исследования проводились у животных, находившихся в различных условиях освещенности. Содержание животных в постоянной темноте в течение 10 дней показали, что свободный гепарин в селезенке, печени и сердечной мышце уменьшается (5,0±0,3сек; 7,0±0,4 сек; 3,0±0,1сек соответственно, Р+0,001); протромбиновый индекс в ткани селезенки уменьшается на 21,3%, в ткани печени не изменяется, а в сердечной мышце повышается на 63,8% (113,0±1,2%, 123,0±1,8%, 172,0±3,6% соответственно,Р +0,0001).

При содержании животных в 10 дневной световой фазе наблюдается повышение свободного гепарина 11,0±0,4сек (на 57,1%), в печени-12,0±0,3сек (на 24%), в сердечной мышце 6,0±0,2сек (на80%). В изменении протромбинового индекса наблюдается иная картина: в ткани селезенки протрормбиновый индекс составляет 255±12,6%, в печени 190,0±7,0%, в сердечной мышце 300,0±3,2%. Полученные результаты достоверные.

У эпифизэктомированных животных свободный гепарин в селезенке составил 13,2±0,2 сек, в печени – 200,0±14,2 сек, в сердечной мышце - 9,0±0,2сек,; протромбиновый индекс в селезенке 422,0±7,0%, в печени 300,0±4,2%, в сердечной мышце - 146,0±2,0%. Результаты исследования достоверные.

В результате исследования выявлено, что эпифиз участвует в суточном ритме организма. Эндогенный ритм функции эпифиза контролируется супрахиазматическими ядрами гипоталамуса, в норме связан с конкретным временем суток за счет превалирующего суточного цикла освещенности, играющего существенную роль в гемостазе организма.

Выводы: 1. В условиях темнового режима свободный гепарин во всех исследуемых тканях повышается,активность факторов протромбинового индекса нарастает в селезенке и сердечной мышце, в печени- держится на уровнк интактных животных.

2. В условиях светового режима свободный гепарин и активность факторов протромбинового индекса повышается во всех тканях.

3. У эпифизэктомированных животных в отличие от интактных животных наблюдается снижение свободного гепарина, активность факторов протромбинового индекса в селезенке и сердечной мышце, ослабевает в печени.

4. Эпифиз является регулятором суточного ритма организма во взаимодействии с хронофизиологическими реакциями гемокоагуляции.

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CHEMICAL SCIENCES

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COMPUTER MODELING OF POLYPHENOLSULFIDES DURING CUMENE OXIDATION

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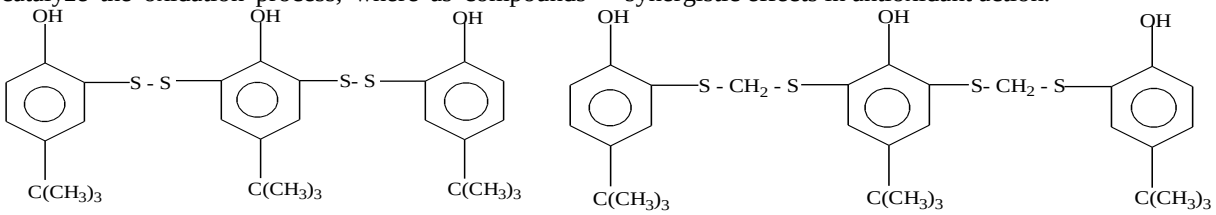
Abstract

The kinetic features of the decomposition of cumylhydroperoxide (ROOH) catalyzed by phenolsulfides (PS), experimentally studied earlier, have been investigated by computer simulation. Decomposition of ROOH in the presence of PS is a complex multistage autocatalytic process, in the course of which an effective decomposition catalyst is formed from the initial PS. In this process, there is a concentration effect of decreasing the time of complete decomposition of ROOH with increasing initial concentration and more complete utilization of PS at higher concentrations of ROOH.

Keywords: phenolsulfides, hydroperoxide, computer modeling, autocatalytic process.

The nature of transformations of hydroperoxides - the primary products of hydrocarbon oxidation has a strong influence on the kinetics and mechanism of the oxidation process as a whole, so studies on the effect of inhibitors and catalysts on the peroxide behavior pay much attention [1-3]. Additives that stimulate decomposition of peroxides with formation of free radicals catalyze the oxidation process, where as compounds that promote heterolytic breaking of the peroxide bond can have an inhibitory effect [3,4]. The latter include sulfur-containing compounds, known peroxide reducing agents [4,5]. Of great practical and theoretical interest are sulfur-containing antioxidants which combine different inhibitory functional groups in one molecule and under certain conditions exhibit significant synergistic effects in antioxidant action.



Polyphenolsulfides, combining several phenolic groups and sulfur atoms in the molecule, effectively inhibit the oxidation of hydrocarbons of different classes. A characteristic feature of the antioxidant action of polyphenolsulfides is their high catalytic activity in the decomposition of cumylhydroperoxide (ROOH) [6].

Decomposition of ROOH in the presence of PS is a complex multistage autocatalytic process, which indicates the formation of an effective decomposition catalyst (P) from the initial PS during the reaction with hydroperoxide. It was found that the transformation products of PS in this reaction inhibit the initiated oxidation of cumene, i.e., they have antiradical activity [6]. Thus, the antioxidant effect of PS includes chain breaking on the parent compound and the products of its oxidation by hydroperoxide, catalytic decomposition of hydroperoxide proceeding by a complex autocatalytic mechanism, a possible chain breaking on the products of PS transformation.

At present, data on the reactivity of many hydrocarbons and inhibitors in radical reactions have been collected and generalized in the literature, presented in the form of rate constants and temperature coefficients [7,8], and programs have been developed to solve systems with a large number of differential equations [9,10]. With the use of computer modeling, this makes it possible to conduct a kinetic analysis of the mechanisms of complex processes.

The kinetics of ROOH decomposition catalyzed by polyphenolsulfides has been analyzed in this work, taking into account the experimental results presented in [6,11] and obtained subsequently. Computer modeling was performed using the program [9], which has proved itself well for analyzing the kinetics of inhibited oxidation of hydrocarbons [12].

Typical S-shaped mutually intersecting ROOH catalytic decay curves obtained experimentally are shown in Fig. 1. The simplest scheme reflecting the autocatalytic action of PS is as follows [6]:

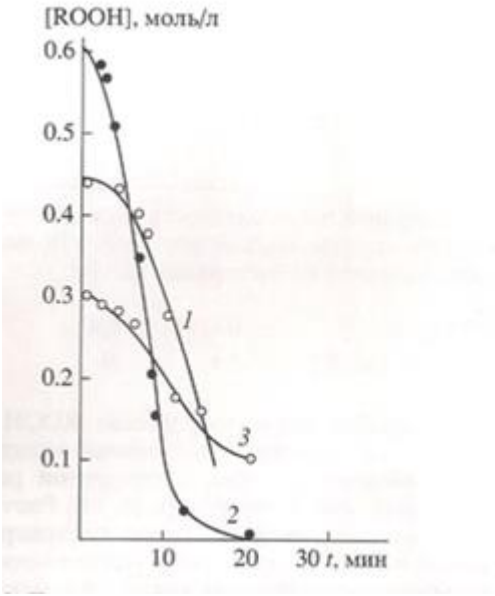


Fig. 1. Kinetic curves of ROOH consumption in the presence of PS: [PS]0=1-10-4, M; 110°C; initial concentration of ROOH in M: 1 - 0.6: 2 - 0.45: 3 - 0.3

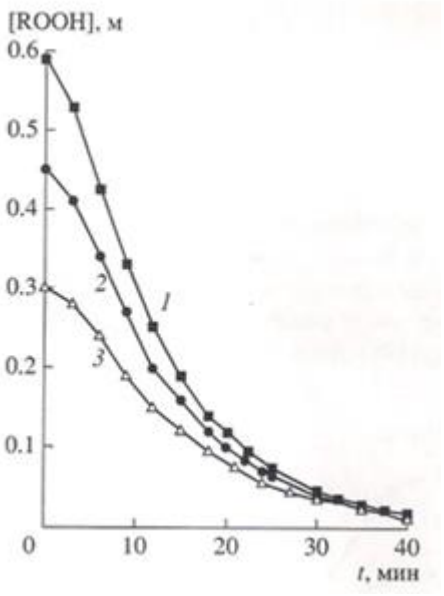


Fig. 2. Calculated kinetic curves of ROOH consumption according to (1): [PS]0=1-10-4, M; initial concentration of HPC in M: 1 - 0.6: 2 - 0.4: 3 - 0.3

Scheme 1

A) ROOH + PS $\rightarrow P_1$ + продукты k_a

B) ROOH+$P_1 \rightarrow P_1$+ продукты k_b

provided that the second stage of reaction (2) proceeds much faster than the first one, i.e. $k_b >> k_a$. k_b is the effective rate constant of stage B, ka is the effective rate constant of stage A; P_1 is the catalyst obtained in the reaction.

The equation for the rate of ROOH consumption can be obtained in analytical form

$$d[ROOH]/dt=k_B[ROOH]_0[PS]_0[\{1+k_A/k_B-\exp(-k_A[ROOH]_0t)\}. \quad (3)$$

From when $t \rightarrow 0$: $W_0 = k_A[ROOH]0[PS]_0$ in the diluted process after leaving $\exp(-kA[ROOH]_0t) <<1$,

$$W_{max} = k\kappa_B[ROOH]_0[PS]_0. \quad (4)$$

Figure 2 shows the calculated ROOH consumption curves for reactions A and B at the values of the constants k_A=0.01 and k_B=16 $(Ms)^{-1}$. Here, $k_B=W_{max}/([ROOH]_0[PS]_0)$ is the effective rate constant of ROOH decay and $k_B > k_A$. It can be seen that the calculated curves are S-shaped, the time-mass scale is the same as in the experimental curves. However, the hydroperoxide consumption time is almost the same for different initial concentrations, while the experimental curves clearly show that with increasing initial concentration of ROOH, the consumption time decreases and the curves mutually overlap.

Comparison of the calculated and experimental curves shows that the real catalytic system provides a more intense increase in the rate of ROOH consumption in the course of the process than the simplest scheme (1). This may be related to the formation of the sequence of catalysts of increasing activity. Synergistic effect of phenol and sulfo compounds in both inhibition of oxidation processes and decomposition of hydroperoxides is noted in literature [4,5,13]. Therefore, if a primary catalyst is added to reactions A and B of the reaction with phenol, which is formed from ROOH, the new scheme will have the following form:

Scheme 2

ROOH + $P_S \rightarrow P_1$ + Alk k=0.002 $(Mc)^{-1}$

ROOH + $P_1 \rightarrow P_1$ + PhOH + ac k=10 $(Mc)^{-1}$

PhOH + $P_1 \rightarrow P_2$ k=20$(Mc)^{-1}$

ROOH + $P_2 \rightarrow P_2$ + St k=100 $(Mc)^{-1}$

In this scheme Alk denotes alcohol formed during reduction of hydroperoxide with sulfide sulfur, PhOH and ac are phenol and acetone formed during acid-catalyzed decomposition of ROOH, St is α-methylstyrene, a large amount of which (>50%) was found along with phenol in the decay products of ROOH, catalyzed by PS (analysis was performed by GC-MS on a chromatomass spectrometer Nermag). Fig. 3 shows the calculated curves corresponding to the previous scheme. The curves mutually overlap, but not so clearly and at greater depths of transformation than the experimental curves (see Figs. 3 and 1).

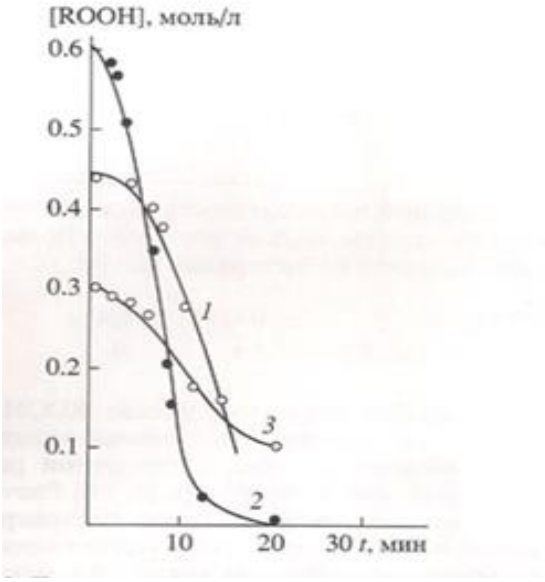


Fig. 3. Calculated kinetic curves of ROOH consumption according to Scheme 2. $[PS]_0$=1-10^{-4}, M; initial concentration of HPC in M: 1 - 0,6; 2 - 0,4; 3- 0,3

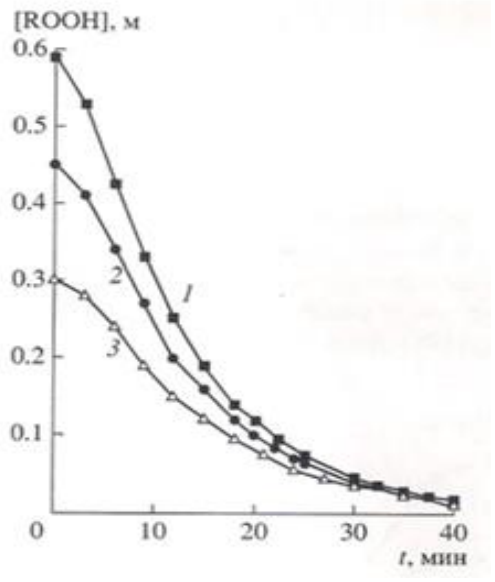


Fig.4. Calculated kinetic curves of ROOH consumption according to Scheme 3. $[PS]_0$=1-10^{-4}, M; initial concentration of HPC in M: 1 - 0.6; 2 -0.4, 3-0,3

The curves (Fig. 4) calculated according to the following scheme in which the oxygen stoichiometry of PS transformation and the wide range of sulfide sulfur oxidation from S^{2-} to S^{6+} are taken into account are closest to the experimental data.

Scheme 3

ROOH + PS + ROOH → P_1 + Alk k=0,05 $(M^2c)^{-1}$

ROOH + P_1 + ROOH → P_1 + PhOH + ac k=0,2 $(M^2c)^{-1}$

PhOH + P1 + ROOH → P_2 k=20 $(Mc)^{-1}$

ROOH + P_2 → P_2 + St k=80 $(Mc)^{-1}$

From Fig. 4 it is clear that these curves mutually intersect at points corresponding to relatively small degrees of transformation. Calculations show that by the end of hydroperoxide consumption, when [ROOH] = 0.01 M, a considerable amount of initial PS remains in the reaction mixture.

The amount of unexpended PS is the greater the lower the initial concentration of ROOH:

Table 1

[ROOH]0	0,6	0,4	0,2
% remaining	2,4	9,0	30,0

The initial PS remaining after ROOH decomposition can make a significant contribution to the antioxidant activity of the decomposition products noted in the literature [6,14]. Calculations show that new portions of hydroperoxide added after the end of ROOH decomposition are consumed without an induction period at the maximum initial rate (Fig. 5), which was also observed in the experiment [6].

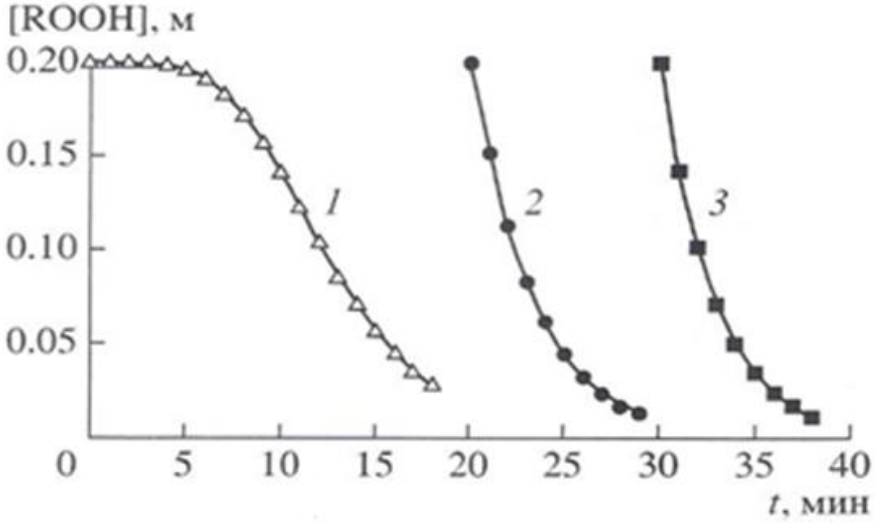


Figure 5. Calculated kinetic curves of ROOH consumption according to Scheme 3. Arrows marks moments of new ROOH injection: $[ROOH]_0$=0,2M; $[PS]_0$=1-10^{-4}, M; 1 - consumption of initial amount of ROOH; 2 - consumption of the first additive 0,2 M ROOH; 3 - consumption of the second additive 0,2 M ROOH

The table 2 shows the values of the maximum rates of ROOH consumption at different initial concentrations of hydroperoxide and PS.

The amount of unspent PS is the greater the lower the initial concentration of ROOH:

Table 2

[ROOH], M	$[PS]\cdot 10^4$, M	$\kappa_{ef} = w_{max}/([ROOH]_0[PS]_0)$	$w_{max} \cdot 10^4$ M/c
0,6	1	33,7	20,2
0,4	1	26,75	10,7
0,3	1	21,6	6,47
0,2	1	15,25	3,05
0,3	0,5	28	4,2
0,3	0,2	37,3	2,24
0,3	2	15,8	9,5
0,3	5	10,1	15,2

The calculation of the effective constant $k_{ef} = W_{max}/([ROOH]_0[PS]_0)$ shows that for the last variant (Scheme 3) the effective constant changes in a fairly wide range 23.3 ±12 $(Ms)^{-1}$. Nevertheless, it is close to the experimental value of 16 $(Ms)^{-1}$ [6].

Thus, the simplest scheme 1 is not suitable for describing the kinetics of polyphenol sulfide-catalyzed ROOH decomposition. The closest agreement with experimental data is achieved if decomposition catalysts are formed during the reaction of PS with ROOH, in the formation of which phenol formed during the decomposition of ROOH takes part (Scheme 3).

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EARTH SCIENCES

DIGITAL MODELING OF ANALYTICAL CONTINUATION OF GRAVITATIONAL FIELD

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Abstract
The article is devoted to the issue of digital modeling of the analytical continuation of gravitational anomalies, the solution of which plays an important role in the separation of a complex observed field and determining the location of a geological source. On the example of a two-dimensional homogeneous horizontal cylinder lying at a certain depth, with using the SURFER program, an analytical continuation of the gravitational field to the upper and lower half -space was performed and built 2D and 3D maps, which gives the most complete picture about the location of the geological object - source of anomaly.

Keywords: vertical gravity component, modeling, gravity model, digital modeling, two-dimensional cylinder, grid.

Introduction: The gravimetric method of exploration based on studying the distribution of gravitational fields created by individual geological structures and bodies having an excessive density of the rocks. This method of exploring is an important in the process of study the geological structure of areas promising for oil, gas and ore deposits. An important role is assigned to process modeling, synthesis at all stages of processing and interpreting gravity data.

At the stage of transformation of gravimetric data, a very important task is solved - the identification of local and regional anomalies associated with the corresponding geological structures and bodies. There are various methods for transforming gravity fields, among which the method of analytic continuation of fields in the upper and lower half-space plays an important role (Kerimov, 2015; Ermokhin, 2007; Michael et al., 2011; Maurizio et al.,2001; Strakhov,1990). At present, digital gravimeters are used in gravity prospecting and these devices measure the value of gravity with high accuracy. Therefore the transformation task is solved with using modern graphics programs in two-dimensional and three-dimensional versions based on the results of computer calculations of theoretical gravitational fields by means of the developed algorithms and programs which provides the most accurate field separation (Iskandarov, 2018(No.1); Iskandarov, 2018(No.1(21)); Iskandarov, 2006; Bychkov, 2005; Kadirov, 2000; Iskandarov,1991). This explains the relevance of scientific research ongoing in this direction. The purpose of these studies is digital modeling of analytical continuation of gravitational fields .

Means and methods: There are various methods of analytic continuation of potential fields, such as the method of analytic continuation to the upper half-space with respect to the Poisson integral, the method of analytic continuation into the lower half-space using the Gauss formula etc.. And also have been developed various algorithms and programs . Let perform an analytical continuation of the gravitational field from a homogeneous two-dimensional cylinder lying at a certain depth. As is known, the vertical component of gravity Vz from a horizontal circular cylinder is calculated by the formula (Mironov,1997) :

$$V_z = \frac{2G\lambda h}{x^2 + h^2}, \qquad (1)$$

where G - the gravitational constant; λ - linear density of the cylinder, [λ] = g / sm; h - the depth of the cylinder axis in km unit; x - the coordinate of the observation point along the profile in km unit. As known $\lambda = S \cdot \Delta\sigma = \pi \cdot R^2 \Delta\sigma$, where Δσ- the volume excess density in g/sm^3 unit; S - the cross-sectional area of a circular cylinder in sm^2 unit; R-radius of the cylinder in km unit.

Let us take the radius of a circular cylinder, occurring at a depth of h = 4 km, equal to 1 km, Δσ = 0,2 g/sм^3, that is typical of sedimentary deposits of the eastern part of the Middle Kura depression for Azerbaijan. With using modern graphics program, analytical continuation of the gravity field will be performed. At present the SURFER program is widely popular (Silkin, 2008) and one allows not only to represent the results obtained in a modern graphical interface, but also perform various mathematical calculations in the "Function" mode. In the beginning, it is necessary in the above formula to introduce an additional variable Z - the depth (or height) of the analytical continuation of the field from the model of a two-dimensional horizontal circular cylinder, which will not affect the form of the formula itself, but will only characterize the parameter of the analytical continuation of the field. Using this parameter, it is get the following formula:

$$V_z = \frac{2G\lambda(z + h)}{x^2 + (z + h)^2}, \qquad (2)$$

Where the parameter Z takes on a negative value if it is performing the analytical continuation of the field to the lower half-space, and takes on a positive value if it is performing the analytical continuation of the field to the upper half-space.

Results: In the beginning, the analytical continuation of the field was performed into the lower half-space. For this purpose with using the SURFER program in the “Function” mode, the Vz values were calculated at different depths Z, starting from zero (observation surface) to a depth of 6 km with a step of 0,3 km, as a result, it is obtained a “grid” of the calculated data based on which, various maps were built in 2D and 3D versions (Fig.1-4). As can be seen from the presented drawings, the analytical continuation of the field into the lower half-space allows you to emphasize the "special point" associated with the source of gravitational disturbances in the modern interface of the graphical editor. The intensity of the anomaly changes from zero to 18 mGal in the case of approaching to source (h = 4 km) and increases from -25mGal to zero in case of passing through a "special point" (see fig.1). The source of disturbances in various forms and variants clearly indicate on the remaining figures (see fig.2-4).

An analytical continuation of the field to the upper half-space to a height of Z = 4 km was carried out. To do this, the Vz values were calculated at various altitudes, ranging from zero (observation surface) to a height of 4 km with a step of 0.3 km, and as a result, a “grid” of the calculated data was obtained, on the basis of which, various maps were constructed in 2D and 3D versions (Fig.5- 6). As you can see from the color patterns of the analytical continuation of the field into the upper half-space constructed using the SURFER program, the intensity of the anomalies decreases sharply from 2.1 mGal to 0.8 mGal. And if you subtract this field from the observed on surface of the earth one, you can get the desired local anomaly.

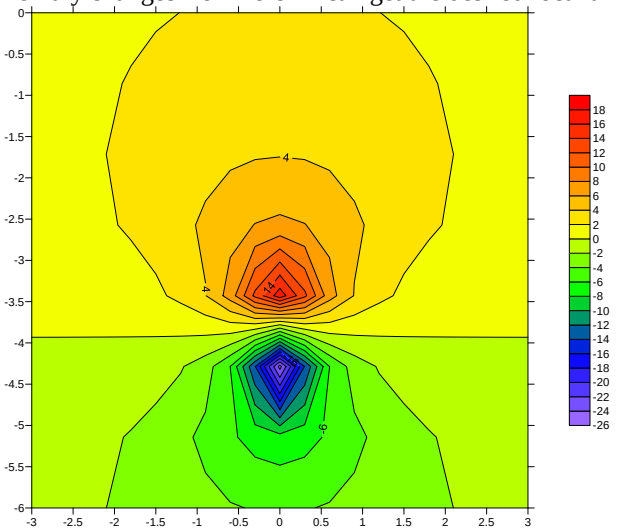

Fig.1. Analytical continuation of the gravitational field in the lower half-space (2D)

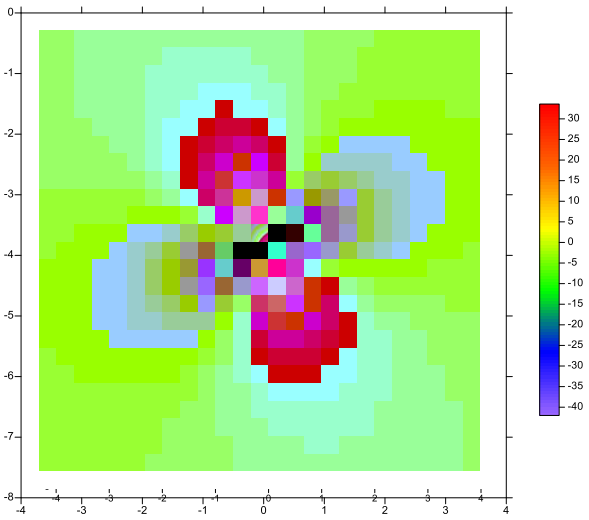

Fig.2. Analytical continuation of the gravitational field in the lower half-space (3D)

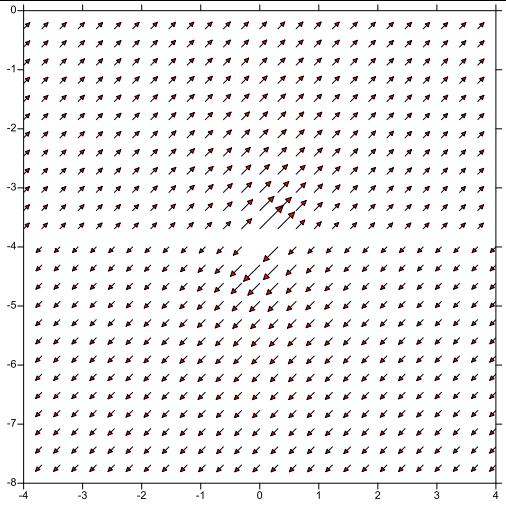

Fig.3. Polar vectors map of analytical continuation of the gravitational field in the lower half-space

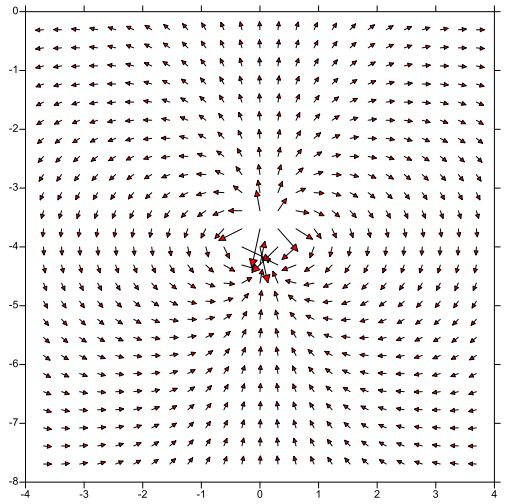

Fig.4. Vectors map of analytical continuation of gravitational fields in the lower half space

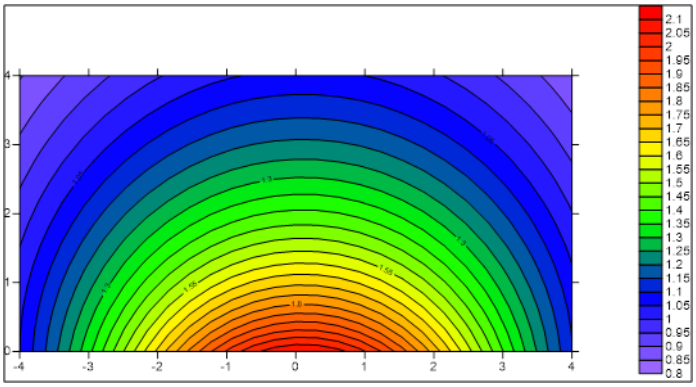

Fig.5. Analytical continuation of the gravitational field in the upper half-space (2D)

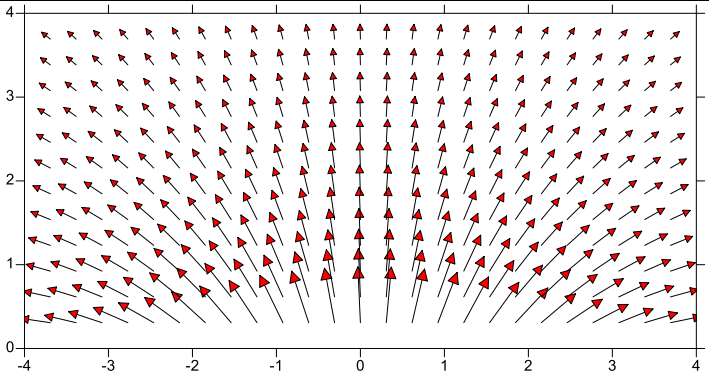

Fig.6. Vectors map of analytical continuation of gravitational fields in the upper half-space

Conclusion:

1. Using the SURFER program in the "function", "grid" and "map" modes, a digital modeling of analytical continuation into the lower half-space of the gravity field of a homogeneous horizontal cylinder, lying at a certain depth, was performed, which allowed us to determine the location of the source of anomalies.

2. The analytical continuation of the digital model of the two-dimensional horizontal cylinder gravity field to the upper half-space was also performed on the computer, which made it possible in the modern interface visually to trace the decrease gravitational field intensity with distance from the source.

3. Completed research show the effectiveness of the analytical continuation of gravitational fields in finding local anomalies associated with geological structures and possible mineral deposits.

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ECONOMIC SCIENCES

THE IMPACT OF INVESTMENT ON THE DEVELOPMENT OF INNOVATION

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Abstract
Innovative development of any country depends on financial issues. In this context, regulation of foreign capital inflows can give a positive impetus to the development of innovation in national economies. The methods of state regulation of capital exports are a key factor in increasing its role in capital exports.

Keywords: Investment, innovation, new technologies, public investment policy, international experience.

One of the methods of regulating capital exports - the investment policy of the state - is a form of behavior of government structures, which is calculated to be subject to a balanced economic load for a certain period of time and to achieve the set goal through capital investment. It consists of two components [3, p. 138]:

Direct participation of the state in the investment process - public investment is 1 percent of gross domestic product (GDP) (33 percent falls on the social sphere, 20 percent on the stimulation and support of private investment, and 10 percent on important areas of production);

- State regulation of the investment process - is to stimulate investment activity and, as a result, economic growth.
- Factors determining the role of foreign capital and key issues of investment policy include:
- Administrative-legal methods of influence of state bodies and organizations on investment activity in the country.
- Expanding the volume and increasing the efficiency of investments by improving their structure;
- Transformation of public investment into a locomotive of management of increasing investment activity in the country and structural transformation of the economy.
- The object of the state's investment policy is all complex sectors of the economy that ensure the process of reproduction and scientific and technical development.
- The methods of regulating investment activity in the conditions of market relations are as follows:
- Establishment of investment regulators in a market economy;
- Economic methods of stimulating investment activity by the state;

Factors that enhance the impact of capital exports on innovative activities can be divided into two groups - passive and active.

The passive method is related to directing entrepreneurs to choose the most efficient investment options by developing indicative investment plans. At the same time, there is a problem of determining the effective structure of investments in the country's economy.

Means of substantiation of effective investment plan and priority directions of capital investments: dynamic model of inter-sectoral balance; other dynamic and semi-dynamic models of development of the country's economy; Investment processes are determined by a system of balance sheets that reflects its various aspects, including documents such as the balance of fixed capital, the balance of capital investments.

The active method is related to direct public investment, as well as measures taken by the budget and tax authorities, which are also aimed at expanding the investment activity of entrepreneurs.

Ways to increase the efficiency of investment activities are:

- Creation of favorable conditions for entrepreneurial activity;
- Direct participation of the state in effective and important projects for the country;
- Actual value brought in international practice, the same norm of profitability; application of criteria of financial efficiency of investments as a cost recovery period;
- Stimulation of the system to strengthen the investment activity of the special unit through tax incentives.

It should be noted that the main factors influencing the export activity of capital exports and foreign investment activity include: centralization and distribution of foreign capital; activation of new productive forces in the economy; integration of production activities of local and foreign economic entities; organizational factors of implementation of investment programs; use of direct and port verb investments.

It should be noted that characterizing a market economy from the point of view of what issues it can and cannot solve, it regulates economic and social processes in terms of entrepreneurship and, in particular, the innovative activities of enterprises, as well as the interests of society and individuals does not have the ability. The market economy does not provide a socially equitable distribution of income, does not guarantee the right to work, does not focus on protecting the environment, does not support the vulnerable, and so on.

Private business is not interested in investing in areas that do not bring high returns to this organizational structure, but these areas are simply necessary for society and the state (for example, geological exploration, academic science, agriculture, ecology, etc.). It should be noted that the market economy does not solve some

pressing problems. That is, the impact of capital exports on these areas is negligible. A very serious issue for the state - the protection and enforcement of the rights of producers and consumers in existing markets. Entities must be protected by law in order to carry out normal economic activity. First of all, property rights must be ensured. An owner who is not sure of the inviolability of his property will not use his creative and material potential to the full, fearing that he will lose his property. Therefore, it is very important to have legislation that guarantees property rights. Ensuring the necessary rule of law in the country is the duty of the state, which, in turn, is the basis for the development of investment and innovation activities.

If the state does not provide the necessary conditions, the country's economy will not be able to develop and function innovatively, and the economy will not be able to export capital in this regard. In other words, state regulation allows the removal of insurmountable obstacles using the market mechanism.

The world experience of developed market economies shows that the role of the state in economic conditions, especially in times of crisis, decreases in conditions of stability and revival, but never stops. In all cases, the state must maintain the basic rule, that is, to influence entrepreneurship, investment activities and the country's economy in such a way that the foundations of the market are not violated and crises are not allowed.

In order to perform the functions of regulating the economy, the state innovates or influences the country's economy through economic (indirect), administrative (single) methods through the issuance of existing legislation and decrees and improvements, as well as certain economic, as well as capital export.

Economic methods of state influence on capital exports and investment activities are more useful than direct (administrative) methods for the implementation of state regulation measures, although sometimes it is difficult to distinguish between these two methods. The economic policy used by the state as a key factor in regulating the economy, as well as the innovation process, is quite diverse, but its main tools are: taxes; state participation in investment activities; creation of free economic zones; redistribution of income and resources; hard work; use of credit and financial mechanisms to create favorable conditions for attracting foreign capital, etc.

Administrative methods of influence are used by the state in cases when economic methods are not useful or sufficiently effective in solving this or that problem. In order to create normal conditions for entrepreneurship and investment activities, stabilization of the economy and freight traffic, the state must pursue appropriate fiscal, investment, scientific-technical, price, depreciation, credit-financial and other policies, in the implementation of which the state but also uses a complex of administrative methods.

The international movement of capital has a multifaceted impact on the economies of exporting and importing countries. State regulation in this area includes the following:

- Regulation of inflow of foreign investments into the national economy (size, shape, territorial and area distribution);
- Regulation of capital outflow from the country.
- It should be noted that entrepreneurial capital can do the following by penetrating the national economy:
- Significant depletion of national resources insufficient for investment;
- Introduction of new technologies, equipment and thus increase active participation in innovation;
- Improving the quality of products and the skills of the workforce by inviting foreign specialists, experts and consultants.

But at the same time, first, when foreign entrepreneurial capital is invested in the national economy, the repatriation of income continues and the moment of "investment depletion" comes, ie the amount of capital inflow and outflow is equal; second, foreign entrepreneurial capital is invested in areas of the national economy where income is maximized and therefore the sector develops proportionally; Third, ecologically “dirty” foreign production imported from developed countries with its strict environmental standards to less developed countries may also enter the country.

In modern conditions, the state takes the following measures to regulate foreign capital inflows, which accelerate the development of innovation:

- Foreign direct investment in economic areas where the participation of foreign capital is considered either wasteful, dangerous competition for national producers, or a threat to national security is either prohibited or restricted;
- Organizes the stimulation of foreign capital flows by creating a favorable general investment climate in the country or in specific areas or regions where foreign capital is needed.

The conditions for foreign investment, which increase innovation activity, are assumed to be: joint participation of national and foreign capital; Mandatory conduct of research and development work; creation of additional jobs, etc.

At the same time, the state seeks to attract foreign capital by providing various benefits, including tax benefits. Sometimes, many regions with strong economic potential do not ensure its effective use today. However, one of the key issues in increasing the inflow of foreign capital to stimulate the country's innovation activity is the inventory of assets of local organizations (natural, financial, production, social and other potentials) and the current monitoring of resources. However, attention should be paid to the state and municipal property of the country, as well as the development of priorities for its efficient use.

It should be noted that the development of market economy relations requires a direct impact on socio-economic processes. Because the issue of more efficient use of regulatory elements in the context of market economy or relations is on the agenda.

It should be noted that there are objective contradictions between the interests of capital importers and exporters. The former are interested in allocating their free funds in the most profitable way, while the latter

try to obtain the cheapest, if possible, on preferential terms or free of charge.

Capital imports for host countries have the following positive effects [5, p.125]:

- Problems of local production, limited resources and their efficient use are eliminated;
- create new jobs;
- foreign capital brings new technologies, effective management;
- accelerated the pace of scientific and technological progress;
- exports of goods expand capital exports become a site that promotes the export of goods abroad;
- capital inflows help improve the country's balance of payments.

Negative effects of capital imports:

- The inflow of foreign capital removes local capital from profitable areas. This could threaten the country's unilateral development and economic security;
- Uncontrolled import of capital may be accompanied by environmental pollution;
- Capital imports are often associated with the entry of obsolete goods into the market of the recipient country, as well as goods produced as a result of poor quality;
- Imports of credit capital increase the country's foreign debt.

Impacts for capital-exporting countries include:

- the export of capital abroad without attracting foreign investment slows down economic development;
- capital exports have a negative impact on employment;
- capital flows have a negative impact on the country's balance of payments.

It should be noted that the loss of workers means the export of foreign direct investment jobs from the country. Taxpayers find themselves less profitable because it is more difficult to tax the profits of the NSC, and the government is forced to transfer lost tax revenues to other taxpayers or reduce social program costs.

However, in order to conclude that the country as a whole has won, investors must be considered to belong to this country. If investors do not have the right to vote as authorized citizens of their homeland, their investment income must be deducted from direct investment in the amount of the nation's earnings. In this situation, the home country suffers losses as a result of the inflow of direct investment and, of course, must limit it.

Conclusion

The export of capital from Azerbaijan means an artificial decrease in investment reserves and demand for foreign loans, a decrease in tax revenues, a decrease in foreign exchange earnings and income from foreign economic activity, and a decrease in the country's foreign exchange reserves. The outflow of capital from the country does not take advantage of the profit, and as a result, the total money supply in the country decreases. This process leads to a decrease in stability in all segments of the money market, money circulation and aggravation of the problems of the national economy.

At the same time, it can be said that the relevant ministries and departments of Azerbaijan are not able to fully address the problem of the threat of foreign capital outflow. The current situation necessitates the involvement of additional state forces and financial resources in order to prevent the negative effects of the export of Azerbaijani capital abroad.

Given the extremely weak impact of the capital export process on the economic situation in Azerbaijan, the development and adoption of a program aimed at organizing its flow in accordance with the trend of efficiency and creating conditions for national entrepreneurs to return capital abroad is becoming a priority. In order to identify ways to solve this problem, we think it is necessary to identify the main features, causes, forms, dimensions and development trends of this process. Of course, the design of this program should take into account the factors that affect the development of innovation. As a result of our research, these factors include innovation potential, human capital, management potential of government agencies, access to education abroad, etc.

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IMPORTANCE OF INTANGIBLE ASSETS IN THE DIGITALIZATION

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Abstract

This article studies the increase in the share of intangible assets in comparison with the tangible assets of the company due to the introduction of the latest technologies in the modern economy. The purpose of this article is to discuss the development trend of the use of digital assets like software and the conditions accompanying their growth, such as digital transformation and tax incentives. The first prerequisite for the emergence of the concept of digital assets dates back to 1990, when the second stage of the digital revolution began in the period of 1990–2000, the emergence of digital interconnections. (Alf J. Isakssona, Iiro Harjunkoskib, Guido Sandd, 2017) [1]. The first section discusses the main ways to invest in digital assets when creating a new business model. The second section describes the role and place of intangible assets as elements of intellectual property in the tax system of the country. The third section discusses the most significant areas of tax incentives for investment in the integrated development of an organization's intellectual capital in the field of IT innovation. The experience of Western countries in the development of methods of external tax assistance to expand investment in intangible assets and the development of digital companies is analyzed.

The information base is based on: scientific articles of specialists on this topic, regulatory documents in the tax area, and data from monitoring assessments of experts from the world community, published in international scientific journals. To reveal the topic, the methods of empirical analysis were used: observation and comparative analysis.

Keywords: intellectual property, digital technologies, digital economy, digital assets, software IT innovation, tax incentives.

Introduction

The impact of the pandemic on the digitalization of economic sectors around the world

The current trend is that various areas of business continue to recover from the effects of the COVID-19 pandemic. It is well known that every management of the company, despite the potential assistance from the state, tried to mitigate the negative impact on its business. Unfortunately, the impact of the virus was too strong for many companies, leaving thousands of unemployed workers and a large number of businesses shutting down. Especially the consequences of the pandemic were more strongly reflected in certain industries such as airlines, tourism, and the hotel business. Where the basic principle of the conceptual requirement in accordance with IFRS 1 was broken, the recognition of the transaction is taken into account on the basis of going concern [2]. As a result of such negative influences - disrupted customer turnover, lack of future cash flows, and depreciation of assets, companies and other consequences of the pandemic were forced to close their businesses.

On the other hand, as entire countries faced restrictions and general social distancing measures, and consumers around the world avoided contact with people, due to the spread of the virus, the retail industry has struggled to adapt by implementing digital transformation in business. This current situation arose primarily as a result of retailers' efforts to retain customers by meeting the growing online demand for products and goods. As a result, they were implementing large changes at a rapid pace and required new technical solutions to help them cope with the transition. Since they had no choice but to serve customers almost exclusively digitally, they had to adapt quickly—and they did. Consumers have become active users of accessible mobile applications such as Allegro, eBay, or software such as Retail Cloud, etc. Nowadays, the success of a business depends on the degree of digitalization of the existing company.

These changes are not limited to sales, that is, those companies that stayed afloat had to act quickly to support their remote workforce and all the accompanying business operations. Digital operations are more important than ever, and many transformative changes have been made over the past year. As mentioned above, although "the pandemic has led to a 4.4% contraction in the global economy," [3]. At the same time, one trend is gaining force around the world: digitalization.

According to the scorecard: "conditions of supply, conditions of demand, institutional environment, innovation, and changes in digitalization over time (measured by the growth rate of the digitalization score over 12 years, 2007–2019). It offers an analysis of the economies of 90 countries in terms of the level of achievement of digital progress in their economies. Where the digital planet results in an "atlas" and divides the economy into four distinct zones: "Stand Out, Stall Out, Break Out, and Watch Out" [4].

According to the analysis, it is determined that the area of «Outstanding Economies» includes both economies with a high level of digitization and with a strong impulse to further develop their digital capabilities. The leading economy in this category in Singapore. The US is also showing significant impetus for an economy of this size and complexity, ranking second in digital evolution after Singapore. In turn, Germany ranks sixth in this World Ranking and demonstrates both adaptability and public support for innovation.

The Economy «Rip Zone» is characterized by an economy with limited existing digital infrastructure, but which is rapidly digitizing. China has a special place in this group: its digital evolution is significantly higher than that of all other economies, thanks in large part to a combination of rapidly growing demand and innovation. According to the DESI (Digital Economy and Society Index 2020), Germany is ranked 1st among EU countries for 5G launch readiness, has already launched many measures to promote digitization, and stimulates IT security initiatives, supercomputers, artificial intelligence, and blockchain [5].

Faced with new challenges and constraints, companies are working to increase their maneuverability and mobility, increase automation, and maintain more operations in real-time. Booming digital technology is also likely to require a renewed focus on business model transformation and ecosystem development.

1. Keyways to invest in digital assets when creating a new business model

In the global community, due to the current situation and the continuing trend of growth in the process of digitalization. Such as the need to use a reliable infrastructure and platform, the cloud to maintain a user base for remote communication, equipped with connected devices, effective and mobile management of business processes - this opens the way for investment in software and services. Therefore, while IT companies worked with employees, partners and stakeholders to scale up digital adoption long before the virus hit, "the pandemic has served as a positive catalyst that has helped significantly accelerate the transition to remote working" [6]. Nowadays, the role of IT companies in terms of implementing a business model is growing, on the one hand, as a representative of business consulting - how to use a cloud basis (IT programming) to automate organizations, on the other hand, as a developer of the same software, in order to reduce costs and efficiency gains. This business can be classified as a knowledge-intensive business service (KIBS). KIBS provide knowledge-intensive inputs to the business processes of other organisations [7].

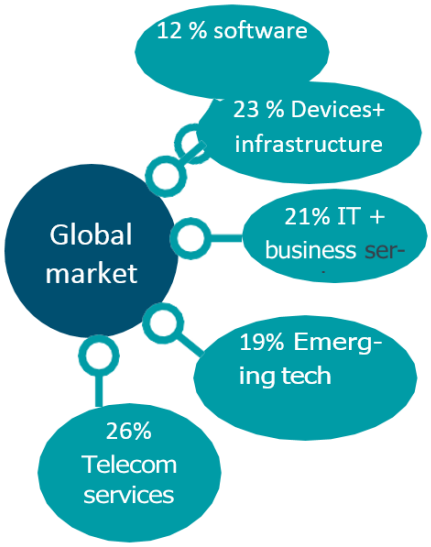
However, in practice, such digital transformations require the fulfillment of serious financial conditions, such as a change in the income statement, due to huge investments in technology to support the online business model. A company may run into big financial trouble in the pursuit of big monetary innovations. Since it is difficult for the financial system to evaluate intangible assets as liquid assets, in the case of unjustified investments, those who invested in intangible assets do not have physical assets left to sell to recover costs. Therefore, it is difficult for companies with a large share of such assets to attract bank loans, especially if such firms have just entered the market and their revenues are not very high. As a result, the "intangible economy" may be cut off from debt markets and traditional bank lending and forced to finance investments from other sources, such as retained earnings or attracted capital [8].

Hence, it is necessary to determine the attraction of direct investment in technology development and economic efficiency, on which the calculation depends (return on investment). The most successful businesses will be those with the balance sheets and analytical insights to let boom through smart tech investment or by reinvesting equity capital. Accordingly, the digital transformation should be perceived as a project and not as business growth, as all the steps and procedures for organizing its implementation are inherent in the realization of something new. A company cannot start a transformation without defining a deadline and an expected level of return on investment, respectively, the calculation of which depends on the type of investment, i.e., attracted or reinvested. The implementation of the above-mentioned ways requires compliance with the Law on Accounting of Intellectual Assets and other forms of approval by states in accordance with the legal provisions of the country (Poland, Germany, Kyrgyzstan).

2. The role and place of intangible assets as elements of intellectual property in the business model

Nowadays innovative companies, including those engaged in IT programming, know that changes in the economy, including globalization and digitization, have increased the importance of an intellectual property. Previous studies show advanced technologies as elements of intellectual capital from the detailed presentation of E. Brooking [9]. In addition, Researchers such as (Kaufmann and Schneider 2004) fully explained most definitions (indications) about IC (IA) provide a good account of the variety of terms and definitions for each kind of IA in their literature [10]. Nevertheless, the role and classification of intangible assets still have not been properly recognized in the tax system.

The bulk of technology spending is related to purchases made by companies or corporations, which can be classified by certain types of technology purchases as exclusively supporting the business model. “Software and services account for 12%, communication services (telecom services) - 26%, the remaining 19% cover various developing technologies that include items of hardware, software and services such as the Internet of Things (IoT), drones and many automation technologies, etc., ” [11] as illustrated in Picture 1.



Picture 1. The main elements of the information technology industry [12].

The picture clearly shows that whatever area it covers, any business nowadays needs assets (digital, intangible, tangible) to work. In this new uncertain environment, across the global market economy, demand for devices such as laptops and other networking infrastructure, as well as other crucial components, has increased.

In the digital business, companies seek to take advantage of any technological advantage that can provide efficiency and innovation supported by cloud services – software – as - a - service (SaaS), platform- as – a - service (PaaS), or infrastructure – as - a - service (IaaS) [13]. These intangible assets are usually non-physical assets that are used in the long term, are often intellectual assets, and as a result, it is difficult to assign value to them because of the uncertainty of future benefits. For example, digital assets act as a type of intangible asset, which is due to the registering of information about objects that do not have a tangible form, as a result, digital businesses create market value in the online environment without having a physical presence in it. And their scale is due to the fact that their intellectual property can have a country of origin as well as a country or even an entire development network, such as Amazon and others.

Nowadays, each company, especially aimed at business, focused on the implementation of IT programming, defined as intangible assets, both in accounting and in tax accounting, covers the entire large part of the business value and the value of transactions that the company conducts, which represents the intellectual property of the enterprise. Nevertheless, according to Rudner (1966), the value of classification is related to its ability to act as a heuristic that is useful for the interpretation of a substance [14]. For business and tax purposes, it is necessary to define the role of intangible assets. Since once a project is completed or a transaction is completed, and therefore income is generated, taxation never lags. So, understanding what intangible assets are and how to value them is a key part of business valuation. Why is it difficult to define what intangible assets are? Perhaps it would be more appropriate to classify them instead, as classification is less stringent than definition. Nevertheless, classification also implies defining it. Next, before explaining their role and ways of valuation in the business process, let us look at their basic specifics:

-First type of classification (identification) of intangible assets by their physical nature.

It is common knowledge that assets can be physically appreciable—tangible, like the equipment or computer you use for business or office equipment, and intangible, like intellectual property—software, know-how, copyrights, patents. In practice, some intangible assets may be contained in (or placed on) a physical medium, such as a CD-ROM (in the case of computer software), legal documentation (in the case of a license or patent), or a tape [15]. As a result, most standard computer software is classified as an intangible asset because of its non-physical nature. However, accounting rules specify that there are certain exceptions where software acquired by a firm meets certain criteria and allows computer software to be classified as PP and E (property, plant, and equipment). For example, if the software is part of a weapon system, it would not be capitalized but would be included in the value of the investment in that weapon system.

-Second type of identification of intangible assets by their capitalization nature.

Intangible assets that have not been acquired cannot be capitalized on the tax balance sheet and, therefore, are not subject to amortization as the costs of creating intangible assets have been capitalized in accordance with IAS 38. They are amortized through profit or loss, but at the same time, they are taken for deduction for tax purposes at the time of their origination. Accordingly, if a company creates an intangible asset internally, its costs are expensed immediately and not amortized.

Consequently, before generating the company's financial statements, it must be taken into account that if the business creates an intangible asset, all expenses on the way to creating the intangible asset is expensed, and the intangible asset is not shown on the balance sheet and does not have a registered book value. Intangible assets appear on the balance sheet only if they have

been acquired and are shown on Form No. 1 under intangible assets, which will appear under non-current assets. That is, it all depends on whether the software was acquired for use or developed for sale.

Upon acquisition, the assets should be shown on the balance sheet in terms of their liquidity, or their ability to quickly turn into cash by their grouping. Also, a company can calculate its profitability (rentability) by the intended use of its assets. The financial ratio, called the net return on assets, is a good indicator of how efficiently a company is using its assets in the business process. And the depreciation expense for the current year is shown in the company's statement of comprehensive income or on Form No. 2, "Income Statement."

3. The specifics of tax incentives for digital assets as intellectual capital objects in developed countries

In the context of such a digital transformation, strategic ways have been developed for the effective development of intellectual property in the form of digital assets that need to be tested. However, in practice, it is impossible to determine how fast digital assets are developing in the economy.

In developed countries, this problem is solved by the state through direct financing or the provision of tax incentives. It is tax incentives that should be considered as the most promising, providing conditions for the development and active use of the intellectual capital of organizations without significant restrictions on market freedoms.

For intellectual capital objects, different countries apply different tax concessions or incentives by type of expenditure, on existing projects to activate IT innovation.

For example, Poland-provided employees creating new programs or apps may take a 50% tax-deductible expense meaning that only half of their income will be subject to taxation. It is a significant reduction, used widely by software developers to attract specialists with higher net earnings while mitigating gross employment costs. Importantly, the company using this tax regime must implement a policy regarding the 50% tax-deductible expense.

Sole traders (B2B)

Sole traders performing services as sole traders in Poland can benefit from a newly introduced law, 'IP Box'. The concept of IP Box is preferential taxation of income achieved from the creation or improvement of qualified intellectual property rights (e.g. web-based apps, new functionality to existing programs, developing software). The preferential tax rate in case of sale of such qualified intellectual property right is only 5% instead of 19% or 18/32% where progressive rates apply. In order to benefit from these incentives, taxpayers must fulfill certain conditions including retaining documentation of the projects [16].

Chinese tax policy stimulates domestic innovation and competitiveness of the economy in high-tech sectors, through the provision of enterprises and projects that produce intellectual property tax holidays. «Key enterprises engaged in intellectual property design and software development may be exempted from income tax for the first five years and then subject to a 10% income tax rate in the following years» [17].

Thus, international experience speaks of the provision of a number of tax incentives by countries, such as tax holidays at a tax rate of 0% or 50% tax deductions in terms of the creation and use of intangible assets. This trend is determined by the fact that tax incentives are assessed as state assistance to business entities in promoting themselves in the market through modernization and the use of digital technologies. That is, the tax policy of each country is aimed at supporting innovation.

To choose the right tax regime for a company or an individual, it is necessary to amend tax legislation on the part of the state tax services of the countries. By the type of intellectual property, new lightened forms of tax requirements are applied in the taxation system, which makes it possible to dispense with additional tax burdens for digital business owners. This is important primarily for the control of legal problems, that is, for legal regulation on the one hand of tax services (agents), and on the other hand, for compliance with legal norms on the part of taxpayers (companies). As a result, when deciding on emerging issues of taxation of intellectual property, special attention should be paid to the analysis of all the facts and circumstances, and taxpayers should often contact the necessary authorities to solve tax problems. Such problems occur in many countries: for example, "Development of judicial practice on the inclusion of payments for know-how in the customs value of imported goods" [18] (RF). "The waiver of the amortization claim for intellectual property rights due to tax base disregard is not sustainable" [19]. (India), etc. Unlike the countries mentioned above, in the United States, the Taxpayer Advocate Service (TAS) is actively supporting the resolution of such issues. TAS is an independent organization within the IRS that helps taxpayers and protects taxpayer rights. Their job is to ensure that each taxpayer is treated fairly, and TAS can help you solve problems that you cannot solve with the IRS. And most importantly, their service is free [20]. Kyrgyzstan has lagged behind other countries on these issues. For instance, when completing a tax return, cell 255 of the tax declaration indicates the number of depreciation charges calculated by Article 200 of the Tax Code of the Kyrgyz Republic. Notably, fixed assets and intangible assets owned by the organization and put into operation to generate income, whose value exceeds 100 units of account, are subject to depreciation. As a result, the minimum unit of account in Kyrgyzstan is 4782 KGS [21], which means that depreciated assets whose value reaches the threshold equal to 4782*100 = 478200 have a value of 4371 € when converted to Euro. At the same time, there are no relevant characteristics regarding the useful life and nature of the use of these assets, and there is no main criterion in the tax code of the Kyrgyz Republic, the most important for taxation, which determines the object of intangible assets [22]. Also, there is no such developed tax policy of the countries that are aimed at supporting innovation as mentioned above.

Consequently, modern fiscal policy is important for each state in enhancing innovation, i.e. in such an environment of effective incentives, there is an expansion of digital business and, accordingly, an increase in the number of companies focused on the productive use of IA objects.

Conclusion

This article discussed that during the pandemic, there was an increase in the share of digital intangible assets compared to the tangible assets of the company due to the introduction of the latest technologies into the modern economy. As a result, in the world, because of the effects of the COVID-19 pandemic and due to innovation in practice. There was an increase in the use of various intangible assets such as cloud enterprises, multifunctional software, and software for developing and sharing between departments, which requires determining the identifiability of intangible assets to increase economic benefits and skillfully using tax incentives to thrive in a digital business environment. Also, the main ways of investing in digital assets when creating a new business model, which is implemented by attracting or reinvesting capital, are considered. An international experience of tax incentives for innovation-oriented enterprises is given.

Hence, the following situation has now emerged: there are a large number of different options for describing digital assets in the works of such scientists as (T. Stewart, 1997) [23], and (E. Brooking, 2001) [24], as elements of intellectual capital, while there is no general, systemic classification of digital assets. This uncertainty raises a question when determining tax goals for the tax service and, on the other hand, when obtaining tax benefits for a company. Accordingly, the need for tax incentives from the state is determined by the fact that such components of intellectual property as digital assets are difficult to accurately assess, are subject to investment risk, and are quite costly. A general conclusion can be drawn about the need for further development of digital businesses to increase and effectively use the intellectual property of organizations, develop a new systemic approach to solving this problem, and create an appropriate legislative framework, which requires further study and research.

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DIRECTIONS TOWARD VALUE-ADDED TAX IMPROVEMENT IN GEORGIA

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Abstract

On the basis of modern literary resources and factual materials, current article focuses on a value-added tax (VAT) due to the fact that the country follows the strategy of approaching European Union and further - gaining membership of it. One of the fundamental requirements of EU intergration is existance of a value-added tax (VAT). Another circumstance that should be taken into account is the fact that there is Assosiacion Agreement formed between European Union and Georgia that will strengthen relationship between Georgia and EU from the point of development of optimal payment policy.

Association agreement consists of 8 titles. The article draws our attention upon articles of chapter 3 of title 5 which are concerning taxation, in particular, Article 282 whcich implies that parties are obliged to cooperate in terms of tax collect and monitoring, mechanisms of tax avoidance, especially, the issue of tax evasion (carousel fraud).

Keywords: payment policy, indirect payment, value-added tax, carousel fraud, fiscal functions, regulatory function.

Introductions: Taxation is important instrument and has a fundamental effect on economic activity performers and social life levels as well(Shanava & Vanishvili, 2021).

From the functional viewpoint, taxes are divided into two parts: fiscal and regulatory. Fiscal function is essential one which implies formation of necessary financial resources for implementation of governmental functions and their accumulation in the budget and other central funds of bankroll finances. Regulatory function of taxes is expressed via payment by government for influence on social production process.

Consequently, there are two functions derived: incentive and disincentive. Disincentive function is performed by taxes directly as a result of influence on request provisioned while incentive one – through other tax benefits (subsidy, grants etc.).

There direct and indirect taxes. Value-added tax belongs to the direct one which finally puts a burden on a costumer(Gechbaia et al., 2017).

Taxation regime can vary in different countries, for instance, value-added tax in two countries may be 20%, however, in one country taxation may occur on everything while in another, there could be some subsidies provided on different products and services.

In case implementation of scientifically proven tax policy, successful country will be the one which could establish taxes with the least negative pressure on economics and enable business development in the country (Vanishvili & Sreseli, 2022).

Results and discussion: It is proven through research and economic practices that value-added tax (VAT) is indirect tax imposed commonly by government which is collected on every stage of distribution and production of products and services in the budget. For every country, VAT is one of the important taxes introduced by French economist Maurice Lauré in 1954(Vanishvili & Lemonjava, 2016).

VAT was established in Georgia in 1992. Unfortunately, at that period our country did not have experience of tax functioning mechanism and particular problems occurred during the starting stage of its administration. After that, many changes were introduced in calculation and collection of VAT, tax rates and determination numbers of deductible amount of VAT (Vanishvili et al., 2021).

As a result of experience of European Union, each country can prioritize particular product/service and government imposes subsidies on them. For instance, in Germany tax is not charged on international transport (automobiles, railway and submarine). Likewise, there are no taxes on international and sea transport, daily and weekly press editions in Belgium etc(Vanishvili & Lemonjava, 2017).

In accordance with current Georgian Legislation physical (natural) or legal person is able to register voluntarily or through obligatory rule as a taxpayer if the total amount of taxable transactions carried out exceeds 100 000 GEL during 12 consecutive calendar months. Georgian legislation differentiates three types of taxpayers who possess: Deductible value-added tax; VAT with the right of deduction; VAT without right of deduction.

According to the current Tax Code of Georgia exemption from value-added tax is divided into two groups: a) exempt without the right of deduction b) exempt with the right of deduction (so called VAT at "zero percent");

In addition, there are operations in the country that are not considered to be granted value-added tax, consequently, the issue of their exemption does not exist. They include: a)money provision; b) any service which implies transfer of the ownership rights over money; c) working on hiring; d) providing products (services) out of Georgia; e) operations of temporary import, export, re-export and import out of Georgia (article 13, article 16, article 161).

An excise taxable transaction is excisable object of value-added tax such as import, export, re-export etc. Current calculation is specific. For instance, in accordance with the Tax Code of Georgia, during

import process products with the value of 300 GEL and over are granted value-added tax while during temporary import 0,54% per each incomplete month but not more than 18%.

In order to mobilize amounts of money in the budget of government, one of the most important taxes is VAT and this is the reason why its mobilization and administration is fundamental in the budget. The following table gives information about mobilization of Tax revenue in the Joint budget of Georgia.

Table 1

Indexes of mobilization of tax revenue in the Joint Budget of Georgia during 2020-2021 (Thousands of GEL)

Title/years	2020	2021
Total tax revenue	10 964 412,5	13 379 960,6
Tax revenue	3 326 735,1	3 775 673,8
Profit taxation	919 440,6	1 015 296,1
Property tax	483 665,9	510 729,7
VAT	4 837 233,4	6 029 547,0
Excise tax	1 619 392,3	1 868 783,7
Import duty	74 369,0	86 361,9
Other taxes	-	93 568,3

Current statistical analysis present the figures which reveal the fact that in 2020 value-added tax composed 44,1% in the Joint Budget Tax revenue while in 2021 the figure increased up to 45,2%. Also, an important part is played by tax revenue while the third place is obtained by the excise tax. It should be noted hereby that 90% of tax revenue is derived from these three taxes into the Joint budget of Georgia.

It should be taken into account that in order to reach solid improvement in economic processes and taxation environment, Georgia has signed Association Agreement which gives obligations and our country faces great challenges. In particular, obligation mentioned above is connected with Value-added Tax and implies that since January 1,2022 on EU territory, main directive of value-added tax 2006/112 EG was altered by a new one. These new regulations refer to trade among companies of EU countries only while directives of companies of non EU countries are regulated unaltered (Vanishvili & Katsadze, 2021).

As a result of taxation principles, there are three types of taxes differentiated: progressive, regressive and proportional. As a consequence of taxation revenue maximization, we assume that value-added tax should be transformed from proportional to progressive not through shock therapy but gradually. In as much as value-added tax is indirect tax, taxable turnover should be considered as an initial base, for instance, in 12 months. For the purpose, it is necessary to establish limits for regulating bound of value-added taxpayer registration. This type of bound varies in EU. For instance, in Greece it consists of 10 000 € for small enterprise, 17 500 € in Germany, 6 713 € in Denmark etc. We assume that it is considerable to lower VAT registration limit of 75 000 GEL for small businesses in Georgia.

As for the VAT deduction, example of Great Britain can be followed in this case, particularly, VAT Flat Rate Scheme. In compliance of this scheme, there are relevant rates established for economic activity types, for example, advertisement 11%, computer services 10,5% etc.

Conclusion: Nowadays, middle class does not actually exist in Georgia due to the fact that lower class is spender and that is why proportional tax system is not correct method for tax burden distribution. Consequently, it is necessary to work out progressive tax system which will enable to heighten well-being level without increasing tax burden.

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MATHEMATICAL SCIENCES

ON THE STABILITY OF THE DIFFERENCE ANALOGUE OF THE BOUNDARY VALUE PROBLEM FOR A MIXED TYPE EQUATION

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ОБ УСТОЙЧИВОСТИ РАЗНОСТНОГО АНАЛОГА ГРАНИЧНОЙ ЗАДАЧИ ДЛЯ УРАВНЕНИЯ СМЕШАННОГО ТИПА

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Abstract

In this paper, we consider a difference problem for a mixed-type equation, which reduces the problem of integral geometry for a family of curves satisfying certain regularity conditions. The study of difference analogues of integral geometry problems has specific difficulties associated with the fact that for finite-difference analogues of partial derivatives, the basic relations are performed with a certain shift in the discrete variable. In this regard, many relations obtained in a continuous formulation, when transitioning to a discrete analog, have a more complex and cumbersome form, which requires additional studies of the resulting terms with a shift. Another important feature of the integral geometry problem is the absence of a theorem for the existence of a solution in the general case. In this regard, it is assumed that the solution of the problem of integral geometry and its differential-difference analogue exists, i.e. the problem is conditionally correct. The stability assessment obtained in the work is of great practical importance in solving problems that are important in applied terms.

Аннотация

В данной работе рассмотрена разностная задача для уравнения смешанного типа, к которой сводится задача интегральной геометрии для семейства кривых, удовлетворяющих некоторым условиям регулярности. Исследование разностных аналогов задач интегральной геометрии имеет специфические трудности, связанные с тем обстоятельством, что для конечно-разностных аналогов частных производных основные соотношения выполняются с некоторым сдвигом по дискретной переменной. В связи с этим многие соотношения, получаемые в непрерывной постановке, при переходе к дискретному аналогу имеет более сложную и громоздкую форму, что требует дополнительных исследований возникающих слагаемых со сдвигом. Еще одной важной особенностью задачи интегральной геометрии является отсутствие теоремы существования решения в общем случае. В связи с этим предполагается, что решение задачи интегральной геометрии и ее дифференциально-разностного аналога существует, т.е. задача является условно корректной. Полученная в работе оценка устойчивости имеет большое практическое значение при решении важных в прикладном отношении задачах.

Keywords: ill-posed problem, boundary value problem, mixed-type equation, stability estimation, differential-difference problem, quadratic form.

Ключевые слова: некорректная задача, краевая задача, уравнение смешанного типа, оценка устойчивости, дифференциально-разностная задача, квадратичная форма.

Введение

Задачи интегральной геометрии состоят в нахождении функции или более сложной величины (дифференциальной формы, тензорного поля и т. п.), определенной на некотором многообразии, через ее интегралы по некоторому семейству подмногообразий, через ее интегралы по некоторому семейству подмногообразий меньшей размерности.

Некоторые обратные задачи для кинетичеких уравнений, широко используемых в физике и астрофизике, тесно связаны с задачами интегральной геометрии. Задачи интегральной геометрии относятся к некорректным задачам математической физики, основы которой были заложены в работах [1]-[3] и эти задачи связаны с многочисленными приложениями (задача компьютерной томографии, обратные задачи акустики и сейсморазведки).

Отметим, что необходимость исследования дифференциально-разностных и конечно-разностных аналогов задач интегральной геометрии впервые было высказано академиком М.М. Лаврентьевым и сформулировано им как новое перспективное направление. Поэтому, исследование дифференциально-разностных и конечно-разностных аналогов задач интегральной геометрии является актуальной проблемой.

Впервые М. М. Лаврентьевым и В. Г. Романовым в работе [4] было показано, что ряд обратных задач для гиперболических уравнений сводятся к задачам интегральной геометрии. В дальнейшем В. Г. Романовым были получены теоремы единственности и оценки условной устойчивости решения задач интегральной геометрии для довольно общего семейства кривых на плоскости, инвариантного относительно группы вращения [5], а также для семейств кривых и гиперповерхностей в n-мерном пространстве, инвариантных относительно параллельных переносов этих объектов вдоль некоторой плоскости [6].

Весьма общий результат по единственности и оценкам устойчивости для специального семейства кривых был получен Р.Г. Мухометовым. Эти оценки устойчивости основаны на сведении задачи интегральной геометрии к эквивалентной ей краевой задаче для уравнения в частных производных смешанного типа [7].

Постановка задачи

Пусть D- плоская, ограниченная, односвязная область, имеющая гладкую границу Г:

$$x=\xi(z),\ y=\eta(z),\ z\in[0,l],\quad \xi(0)=\xi(l),\ \eta(0)=\eta(l) \tag{1}$$

где z – длина кривой Г. В $\overline{D}$ заданы гладкие кривые уравнениями

$$x=\varphi(x_0,y_0,\theta,s),\quad y=\psi(x_0,y_0,\theta,s) \tag{2}$$

где (x_0,y_0) – точка, из которой выходит кривая под углом θ, переменный параметр s есть длина дуги. Множество определения функций φ и ψ есть множество

$$T=\left\{(x_0,y_0,\theta,s)/(x_0,y_0)\in\overline{D},\ \theta\in[0,2\pi],\ s\in[0,\tilde{l}\,(x_0,y_0,\theta)]\right\},$$

где $\tilde{l}\,(x_0,y_0,\theta)$ – длина части кривой, выходящей из точки (x_0,y_0) под углом θ и лежащей между (x_0,y_0) и точкой пересечения кривой с границей.

Пусть множество кривых (2) будет таково, что его можно рассматривать как двупараметрическое семейство кривых $K(\gamma,z)$, удовлетворяющее следующим условиям[7]:

а) через любые две различные точки из $\overline{D}$ проходит единственная кривая $K(\gamma,z)$; каждая кривая семейства $K(\gamma,z)$ пересекает Г в точках $(\xi(z),\eta(z))$ и $(\xi(\gamma),\eta(\gamma))$, другие точки не лежат на Г; длины всех кривых равномерно ограничены;

б) $\varphi\in C^3(T),\ \psi\in C^3(T)$, причем все производные этих функций равномерно ограничены в Т;

в) $\frac{1}{s}\frac{D(\varphi,\psi)}{D(\theta,s)}\geq c_1>0$, где c_1 – постоянная,

г) $\varphi(x,y,0,s)=\varphi(x,y,2\pi,s),\quad \psi(x,y,0,s)=\psi(x,y,2\pi,s),$

аналогичные равенства справедливы также для производных от этих функций до третьего порядка включительно.

Пусть $U(x,y)\in C^2(\overline{D})$ и

$$V(\gamma,z)=\int\limits_{K(\gamma,z)}U(x,y)\rho(x,y,z)ds;\quad \gamma\in[0,l],\quad z\in[0,l] \tag{3}$$

Задача интегральной геометрии (3) заключается в отыскании функции $U(x,y)$ в области $\overline{D}$ по данным кривым $K(\gamma,z)$ и функции $V(\gamma,z)$.

Если семейство $K(\gamma,z)$ удовлетворяет условиям а)-г), то задача (3) эквивалентна следующей граничной задаче

$$\frac{\partial}{\partial z}\left(\frac{\partial W}{\partial x}\frac{\cos\theta}{\rho}+\frac{\partial W}{\partial y}\frac{\sin\theta}{\rho}\right)=0,\qquad (x,y,z)\in\Omega_1 \tag{4}$$

$$W(\xi(\gamma),\eta(\gamma),z)=V(\gamma,z),\qquad V(z,z)=0\qquad \gamma,z\in[0,l] \tag{5}$$

где $\rho(x,y,z)$ - некоторая известная функция, $\Omega_1=\Omega\setminus\{(\xi(z),\eta(z),z): z\in[0,l]\}$, $\Omega=\overline{D}\times[0,l]$,

$K(x,y,z)$ - часть кривой из семейства $K(\gamma,z)$, соединяющая точки $(x,y)\in\overline{D}$ и $(\xi(z),\eta(z))$,

$$W(x,y,z)=\int_{K(x,y,z)}U(x,y,z)\rho(x,y,z)ds$$

$\theta(x,y,z)$ - угол между касательной к $K(x,y,z)$ в точке (x,y) и осью x, переменный параметр s - длина кривой.

Функции $W(x,y,z)$ и $\theta(x,y,z)$ обладают следующими дифференциальными свойствами [7]:

Лемма 1. Функция $W(x,y,z)\in C(\Omega)$ и имеет непрерывные производные до второго порядка включительно на множестве Ω_1.

Лемма 2. Производные W_x, W_y, W_z ограничены в Ω_1, а W_{xz}, W_{yz}, W_{xy} в окрестности любой точки вида $(\xi(z),\eta(z),z)$ могут иметь особенность типа $\left[(x-\xi(z))^2+(y-\eta(z))^2\right]^{-\frac{1}{2}}$.

Лемма 3. Функция $\theta(x,y,z)$ дифференцируема на множестве Ω_1 и производная θ_z в окрестности любой точки вида $(\xi(z),\eta(z),z)$ имеет особенность типа $\left[(x-\xi(z))^2+(y-\eta(z))^2\right]^{-\frac{1}{2}}$.

Предположим, что требования к семейству кривых $K(\gamma,z)$ и плоскости D, необходимые для приведения задачи (3) к задаче (4), (5) выполнены. Предположим также, что любая прямая, параллельная оси абсцисс или ординат, может пересекать границу области D не более чем в двух точках.

Пусть

$$a_1=\inf_{(x,y)\in D}\{x\},\quad b_1=\sup_{(x,y)\in D}\{x\},$$

$$a_2=\inf_{(x,y)\in D}\{y\},\ b_2=\sup_{(x,y)\in D}\{y\},$$

$$h_j=(b_j-a_j)/N_j,\ j=1,2;\mathrm{h}_3=l/N_3$$

где N_j, $j=1,2,3$- натуральные числа.

Пусть ε удовлетворяет условию

$$0<\varepsilon<\min\{(b_1-a_1)/3,(b_2-a_2)/3\},$$

$$D^{\varepsilon}=\{(x,y)\in D:\min_{(\alpha,\beta)\in\tilde{A}}\rho((x,y),(\alpha,\beta))>\varepsilon\},$$

$$R_h=\{(x_i,y_j),\ x_i=a_1+ih_1,y_j=a_2+jh_2,\ i=0,1,...,N_1;\ j=0,1,...,N_2\}.$$

Окрестностью $Ш(ih_1,jh_2)$ точки (a_1+ih_1,a_2+jh_2) будем называть множество, состоящее из самой точки (a_1+ih_1,a_2+jh_2) и четырех точек вида $(a_1+(i\pm1)h_1,a_2+(j\pm1)h_2)$.

D_h^{ε} – множество всех точек (a_1+ih_1,a_2+jh_2) лежащих в $D^{\varepsilon}\cap R_h$ вместе со своей окрестностью $Ш(ih_1,jh_2)$.

Γ_h^{ε} – множество всех точек $(a_1+ih_1,a_2+jh_2)\in D_h^{\varepsilon}$, таких, что пересечение $Ш(ih_1,jh_2)$ с множеством $(D^{\varepsilon}\cap R_h)/D_h^{\varepsilon}$ непусто. Тогда,

$$\Delta_h^{\varepsilon}=\bigcup_{\Gamma_h^{\varepsilon}}Ш(ih_1,ih_2),\qquad D_h=R_h\cap D.$$

В дальнейшем предполагаем, что коэффициенты и решение задачи (4)-(5) обладают следующими свойствами:

$$W(x,y,z)\in C^3(\Omega^{\varepsilon}),\ \theta(x,y,z)\in C^2(\Omega^{\varepsilon}),\quad \Omega^{\varepsilon}=\overline{D}^{\varepsilon}\times[0,l],$$

$$\rho(x,y,z)\in C^2(\Omega),\rho(x,y,z)>C^*>0,\frac{\partial\theta}{\partial z}>\left|\frac{\partial\rho}{\partial z}\cdot\frac{1}{\rho}\right|.$$

Поставим следующую разностную задачу (зависящую от параметра z): найти функции $\Phi_{i,j}(z),\ U_{i,j}$, которые удовлетворяют уравнению

$$\Phi_{\underset{x}{0}} \frac{A}{C} + \Phi_{\underset{y}{0}} \frac{B}{C} = U_{i,j}, \quad (a_1 + ih_1, a_2 + ih_2) \in D_h, z \in [0,l] \tag{6}$$

и граничному условию

$$\Phi_{i,j}(z) = F_{i,j}(z),\ (a_1 + ih_1, a_2 + jh_2) \in \Delta_h^{\varepsilon},\ z \in [0,l] \tag{7}$$

здесь

$$\Phi_{i,j}(z) = \Phi(x_i, y_j, z) = \Phi(a_1 + ih_1, a_2 + jh_2, z),$$

$$U_{i,j} = U(x_i, y_j) = U(a_1 + ih_1, a_2 + jh_2), i = \overline{0, N_1},\ j = \overline{0, N_2};$$

$$\Phi_{\underset{x}{0}} = (\Phi_{i+1,j} - \Phi_{i-1,j})/2h_1,\ \Phi_{\underset{y}{0}} = (\Phi_{i,j+1} - \Phi_{i,j-1})/2h_2,$$

$$A = \cos\theta_{i,j}(z), \quad B = \sin\theta_{i,j}(z), \quad \theta_{i,j}(z) = \theta(a_1 + ih_1, a_2 + jh_2, z), \quad C = \rho(a_1 + ih_1, a_2 + jh_2, z).$$

Отметим, что в этой постановке информация о решении задается не только на границе Г, но и в некоторой ее ε - окрестности, что связано с наличием особенностей типа $\left[(x-\xi(z))^2 + (y-\eta(z))^2\right]^{-\frac{1}{2}}$ у производных $\theta_z, W_{xz}, W_{yz}, W_{xy}$ в окрестности любой точки вида $(\xi(z), \eta(z), z)$ [7].

Оценка устойчивости решения дифференциально-разностной задачи

Теорема. *Предположим, что решение задачи (6)-(7) существует. Пусть при всех* $(x_i, y_j) \in D_h$ *функция*

$$\Phi_{i,j}(z) \in C^1[0,l], \quad \Phi_{i,j}(0) = \Phi_{i,j}(l),$$

$$F_{i,j}(z) \in C^1[0,l], \quad F_{i,j}(0) = F_{i,j}(l),$$

а функции $C = \rho(a_1 + ih_1, a_2 + jh_2, z).\ \theta_{i,j}(z)$ *удовлетворяют условиям*

$$\theta_{i,j}(0) = \theta_{i,j}(l),\ \frac{\partial\theta}{\partial z} > \left|\frac{\partial\rho}{\partial z} \cdot \frac{1}{\rho}\right|.$$

Тогда при всех $N_j > 9,\ j = 1,2$ *имеет место оценка*

$$\sum_{D_h^{\varepsilon}} U_{i,j}^2 h_1 h_2 \le c_3 \int_0^l \sum_{\Delta_h^{\varepsilon}} \left[F_{\underset{x}{0}}^2 h_1 + F_{\underset{y}{0}}^2 h_2 + \left(\frac{\partial F}{\partial z}\right)^2 (h_1 + h_2) \right] dz, \tag{8}$$

где c_3 *– некоторая положительная постоянная, зависящая от функции* $\rho(x, y, z)$ *и семейства кривых* $K(\gamma, z)$.

В оценке предполагается, что при уменьшении h_1 и h_2 параметр ε также может уменьшаться, поскольку c_3 не зависит от ε (параметр ε выбрали исключительно для устранения особенностей, присутствующей в исходной непрерывной задаче). Поэтому, чем мельче будет сетка, тем уже может быть область, в которой сосредоточена особенность.

Доказательство. Пользуясь методикой, предложенной в работе [8] умножим обе части (6) на $2C(-B\Phi_{\underset{x}{0}} + A\Phi_{\underset{y}{0}})\frac{\partial}{\partial z}$, запишем получившееся равенство в виде

$$J_1 + J_2 = 0. \tag{9}$$

Здесь

$$J_1 = J_2 = C(-B\Phi_{\underset{x}{0}} + A\Phi_{\underset{y}{0}})\frac{\partial}{\partial z}(\Phi_{\underset{x}{0}} \frac{A}{C} + \Phi_{\underset{y}{0}} \frac{B}{C}).$$

Используя формулу дифференцирования произведения функций преобразуем J_1:

$$J_1 = \frac{\partial}{\partial z}\left[\left(-B\Phi_{0x} + A\Phi_{0y}\right)\left(A\Phi_{0x} + B\Phi_{0y}\right)\right] +$$
$$+AB\frac{1}{C}\frac{\partial C}{\partial z}\Phi_{0x}^{\,2} - \frac{1}{C}\frac{\partial C}{\partial z}A^2\Phi_{0x}\Phi_{0y} +$$
$$+\frac{1}{C}\frac{\partial C}{\partial z}B^2\Phi_{0x}\Phi_{0y} - \frac{1}{C}\frac{\partial C}{\partial z}AB\Phi_{0y}^{\,2} + \frac{\partial \theta}{\partial z}A^2\Phi_{0x}^{\,2} +$$
$$+AB\Phi_{0x}\frac{\partial}{\partial z}\left(\Phi_{0x}\right) + \frac{\partial \theta}{\partial z}AB\Phi_{0x}\Phi_{0y} - A^2\Phi_{0x}\frac{\partial}{\partial z}\left(\Phi_{0y}\right) +$$
$$+\frac{\partial \theta}{\partial z}AB\Phi_{0x}\Phi_{0y} + B^2\frac{\partial}{\partial z}\left(\Phi_{0x}\right)\Phi_{0y} +$$
$$+\frac{\partial \theta}{\partial z}B^2\Phi_{0y}^{\,2} - AB\Phi_{0y}\frac{\partial}{\partial z}\left(\Phi_{0y}\right) \qquad (10)$$

Раскрывая скобки в J_2 имеем

$$J_2 = -AB\Phi_{0x}\frac{\partial}{\partial z}\left(\Phi_{0x}\right) - \frac{\partial \theta}{\partial z}AB\Phi_{0x}\Phi_{0y} + \frac{1}{C}\frac{\partial C}{\partial z}B^2\Phi_{0x}\Phi_{0y} -$$
$$-B^2\Phi_{0x}\frac{\partial}{\partial z}\left(\Phi_{0y}\right) + \frac{\partial \theta}{\partial z}B^2\Phi_{0x} + \frac{1}{C}\frac{\partial C}{\partial z}AB\Phi_{0x}^{\,2} +$$
$$+A^2\Phi_{0y}\frac{\partial}{\partial z}\left(\Phi_{0x}\right) - \frac{\partial \theta}{\partial z}AB\Phi_{0x}\Phi_{0y} - \frac{1}{C}\frac{\partial C}{\partial z}A^2\Phi_{0x}\Phi_{0y} +$$
$$+AB\Phi_{0y}\frac{\partial}{\partial z}\left(\Phi_{0y}\right) + \frac{\partial \theta}{\partial z}A^2\Phi_{0y}^{\,2} - \frac{1}{C}\frac{\partial C}{\partial z}AB\Phi_{0y}^{\,2} \qquad (11)$$

Подставляя эти выражения J_1, J_2 в (9) и обозначая $D = \sin 2\theta = 2\sin\theta\cos\theta = 2AB$, $E = \cos 2\theta = \cos^2\theta - \sin^2\theta = A^2 - B^2$, из (10), (11) получаем

$$\left(\frac{\partial \theta}{\partial z} + \frac{1}{C}\frac{\partial C}{\partial z}D\right)\Phi_{0x}^{\,2} - 2\Phi_{0x}\Phi_{0y}\frac{1}{C}\frac{\partial C}{\partial z}E + \left(\frac{\partial \theta}{\partial z} - \frac{1}{C}\frac{\partial C}{\partial z}D\right)\Phi_{0y}^{\,2} +$$
$$+\Phi_{0y}\frac{\partial}{\partial z}\left(\Phi_{0x}\right) - \Phi_{0x}\frac{\partial}{\partial z}\left(\Phi_{0y}\right) + \frac{\partial}{\partial z}\left[\left(-B\Phi_{0x} + A\Phi_{0y}\right)\left(A\Phi_{0x} + B\Phi_{0y}\right)\right] = 0 \qquad (12)$$

Нетрудно заметить, что

$$\frac{\partial}{\partial z}\left(\Phi_{0x}\right) = \left(\frac{\partial \Phi}{\partial z}\right)_{0x}, \qquad \frac{\partial}{\partial z}\left(\Phi_{0y}\right) = \left(\frac{\partial \Phi}{\partial z}\right)_{0y},$$
$$\left(uv\right)_{0x} = u_{0x}v + uv_{0x} + \frac{h_1^2}{2}\left[u_x v_x\right]_{\bar{x}},$$

где

$$f_x = \frac{f_{i+1} - f_i}{h_1}, \quad f_{\bar{x}} = \frac{f_i - f_{i-1}}{h_1}.$$

Тогда

$$\Phi_{0y}\left(\frac{\partial \Phi}{\partial z}\right)_{0x} - \Phi_{0x}\left(\frac{\partial \Phi}{\partial z}\right)_{0y} = \left[\Phi_{0y}\left(\frac{\partial \Phi}{\partial z}\right)\right]_{0x} - \left[\Phi_{0x}\left(\frac{\partial \Phi}{\partial z}\right)\right]_{0y} -$$
$$-\frac{h_1^2}{2}\left[\Phi_{0yx}\left(\frac{\partial \Phi}{\partial z}\right)_x\right]_{\bar{x}} + \frac{h_1^2}{2}\left[\Phi_{0xy}\left(\frac{\partial \Phi}{\partial z}\right)_y\right]_{\bar{y}},$$

из (12) получаем

$$J_3+\frac{\partial}{\partial z}\left[\left(-B\Phi_{\underset{x}{0}}+A\Phi_{\underset{y}{0}}\right)\left(A\Phi_{\underset{x}{0}}+B\Phi_{\underset{y}{0}}\right)\right]+\left[\Phi_{\underset{y}{0}}\frac{\partial\Phi}{\partial z}\right]_{\underset{x}{0}}-\left[\Phi_{\underset{x}{0}}\frac{\partial\Phi}{\partial z}\right]_{\underset{y}{0}}-$$
$$-\frac{h_1^2}{2}\left[\Phi_{\underset{yx}{0}}\left(\frac{\partial\Phi}{\partial z}\right)_x\right]_{\bar{x}}+\frac{h_2^2}{2}\left[\Phi_{\underset{xy}{0}}\left(\frac{\partial\Phi}{\partial z}\right)_y\right]_{\bar{y}}=0 \qquad (13)$$

в котором

$$J_3=\left(\frac{\partial\theta}{\partial z}+\frac{1}{C}\frac{\partial C}{\partial z}D\right)\Phi_{\underset{x}{0}}^{\ 2}-2\Phi_{\underset{x}{0}}\Phi_{\underset{y}{0}}\frac{1}{C}\frac{\partial C}{\partial z}E+\left(\frac{\partial\theta}{\partial z}-\frac{1}{C}\frac{\partial C}{\partial z}D\right)\Phi_{\underset{y}{0}}^{\ 2}$$

Рассматривая выражение J_3 как квадратичную форму относительно $\Phi_{\underset{x}{0}}$ и $\Phi_{\underset{y}{0}}$, нетрудно убедится в том, что определитель этой квадратичной формы равен

$$\left(\frac{\partial\theta}{\partial z}\right)^2-\left(\frac{1}{C}\frac{\partial C}{\partial z}\right)^2$$

Тогда из условия

$$\frac{\partial\theta}{\partial z}>\left|\frac{1}{C}\frac{\partial C}{\partial z}\right|$$

вытекает положительная определенность квадратичной формы J_3.

Используя неравенство

$$ax^2+2bxy+cy^2\geq\frac{2\left(ac-b^2\right)}{a+c+\sqrt{(a-c)^2+4b^2}}(x^2+y^2),$$

которое справедливо для положительно-определенной квадратичной формы $ax^2+2bxy+cy^2$, имеем

$$J_3\geq\left(\frac{\partial\theta}{\partial z}-\left|\frac{1}{C}\frac{\partial C}{\partial z}\right|\right)\left(\Phi_{\underset{x}{0}}^{\ 2}+\Phi_{\underset{y}{0}}^{\ 2}\right) \qquad (14)$$

Учитывая (6) и $A=\cos\theta,\ \ B=\sin\theta$ находим

$$\Phi_{\underset{x}{0}}^{\ 2}+\Phi_{\underset{y}{0}}^{\ 2}=U_{i,j}^2C^2+\left(B\Phi_{\underset{x}{0}}-A\Phi_{\underset{y}{0}}\right)^2 \qquad (15)$$

Учитывая, что

$$C=\rho(x,y,z),\qquad \rho(x,y,z)>C^*>0,\qquad \left(\frac{\partial\theta}{\partial z}-\left|\frac{1}{C}\frac{\partial C}{\partial z}\right|\right)>0, \qquad (16)$$

нетрудно убедится, что существует такое $c_2>0$ и имеет место неравенство

$$\int_0^l\left(\frac{\partial\theta}{\partial z}-\left|\frac{1}{C}\frac{\partial C}{\partial z}\right|\right)C^2dz\geq\frac{1}{c_2^2}>0 \qquad (17)$$

Далее, суммируя по i, j с использованием условия (7) и интегрируя по z с учетом формул (14), (15), (16), а также периодичности функций $\Phi_{i,\,j}(z),\theta_{i,j}(z)$ по z и неравенства $|ab|\leq(a^2+b^2)/2$, из равенства (13) после несложных преобразований получаем оценку

$$\sum_{D_h^\varepsilon}U_{i,j}^2h_1h_2\leq c_3\int_0^l\sum_{\Delta_h^\varepsilon}\left[F_{\underset{x}{0}}^2h_1+F_{\underset{y}{0}}^2h_2+\left(\frac{\partial F}{\partial z}\right)^2(h_1+h_2)\right]dz,$$

в которой c_3 зависит от функций $\rho(x,y,z)$ и семейства кривых $K(\gamma,z)$. Итак, теорема доказана.

На основе полученной оценки устойчивости разностного аналога граничной задачи для уравнения смешанного типа оказывается возможным осуществить ее численное решение с помощью разностных методов. Соотсветствующая оценка имеет большое практическое значение при решении важных в прикладном отношении задачах.

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MEDICAL SCIENCES

THE IMPACT OF COMORBIDITIES IN PATIENTS WITH NON-HODGKIN LYMPHOMA

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Abstract

Aim of the study. To determine the impact of comorbidities in new Non-Hodgkin's lymphoma patients.

Materials and methods. The descriptive study was performed on a group of 57 new patients with age>18 years diagnosed with indolent and aggressive non-Hodgkin Lymphoma (NHL) established according to the International Histological and Cytological Classification of Hematopoietic and Lymphatic Tissue Pathologies (2016), in the Oncological Institute of the Republic of Moldova during the 2020 year. The lymphoma stage was assessed according to the Ann Arbor staging system.

Outcomes. Studying the clinical data of the outpatient records, we observe that the aggressive NHL has a significant impact on the level of function and capacity of self-care which in association with different types of comorbidities than indolent NHL. Comorbidities are influence in the success of treatment, and the quality of life. The BMI (Body Mass Index) of the patients does not determine a significant impact on the course of the disease. Patients with comorbidities have a longer hospitalization than those without. Moreover, patients with more than 2 comorbidities have the longest hospitalization which significantly increases the costs of care.

Conclusion. Comorbidities on patients with NHL have a significant impact. By its presence dependent treatment option, patient compliance, the quality of life and mortality as well. So it is important to diagnose the patient in the early stage of cancer and to improve the evolution of chronic diseases as much as possible.

Keywords: Non-Hodgkin's lymphoma, comorbidities, chronic diseases, quality of life.

Introduction.

Non-Hodgkin's lymphoma is a group of malign lymphoid diseases with varied biologically, morphologically structures. They present one of the most widespread malignancies of the haematopoetic system, which occupies a high place in the structure of all malignant tumours, the incidence of which is constantly increasing [1, 2]. As the population ages, chronic comorbid diseases significantly decrease cancer patient quality of life. The concept of quality of life has become important in establishing health strategies for patients with hematological malignancies. It has a negative impact on aged populations, influencing the diagnosis of cancer and its treatment [3]. More and more studies show that the number and severity of patient's comorbidities with cancer strongly increases the risk of death from non-cancerous causes and may also influence cancer-specific survival [4]. In comparison with other benign haematopoetic desorders and chronic myeloproliferative neoplasms, NHLs are the high stage of DALYs (disability-ajusted life-years). With age, the NHL morbidity increases, with the maximum incidence being 45 and 65 years old, which significantly affect the working-age population.

Materials and methods. The study included 57 patients with indolent and aggressive NHLs treated in the Oncological Institute of the Republic of Moldova during 2020 year.

Results. The impact of comorbidities in patients with non-Hodgkin lymphoma was evaluated at 57 new adult patients diagnosed with indolent and aggressive NHLs: men-25 (44%) and women-32 (56%). The ratio between women and men was 1.7: 1. According to the results of our study, people older than 50 years were diagnosed more frequently with NHL. Regarding the age of the patients, it is observed that most of them were between 61-70 years old (31.5%) and 41-50 years old (19.5%). Females predominate in most age groups especially 18-30 and 61-70 years then men who have a higher incidence in the age categories 31-40 and 41-50 years. Analyzing the clinical data of the outpatient records, it was determined the predomination of the advanced stages (III and IV) of NHL (75.5%) then early stages (I and II) of NHL (24.5%).

Moreover, 67% of patients show B symptoms of intoxication (fever, weight loss more than 10% in the last 6 months, night sweats), which demonstrates the high aggressiveness of this malignancy.

We did not notice the significant numerical difference in the stratification of patients according to the place of residence (village/town), which confirms the results of the latest studies on the structure of morbidity due to hematological malignances in the Republic of Moldova.

According to the results of our study, we did not find significant alterations in the capacity of self-care in patients with indolent NHLs (80% of them have ECOG status 0 and 1), but in patients with aggressive NHL, a significant difference was determined especially in patients with ECOG 4 status, which proved to be higher in aggressive NHL (24.5%) than in indolent NHL (4%). So we determined that the aggressive type

of NHL has a significant impact on the level of capacity of self-care which in association with different types of comorbidities will influence the success of treatment, and the quality of life as well.

Analyzing the BMI of the patients included in the study we observe that 51% of patients had a normal BMI (BMI = 18.50-24.99), which demonstrate that the level of BMI as comorbidity does not determine a significant impact on the disease. About 31.5% of patients who had an overweight (BMI = 25.00-29.99) we can suspect that in these patients, there will be a significant impact on the treatment option, on the quality of life, and mortality as well [5].

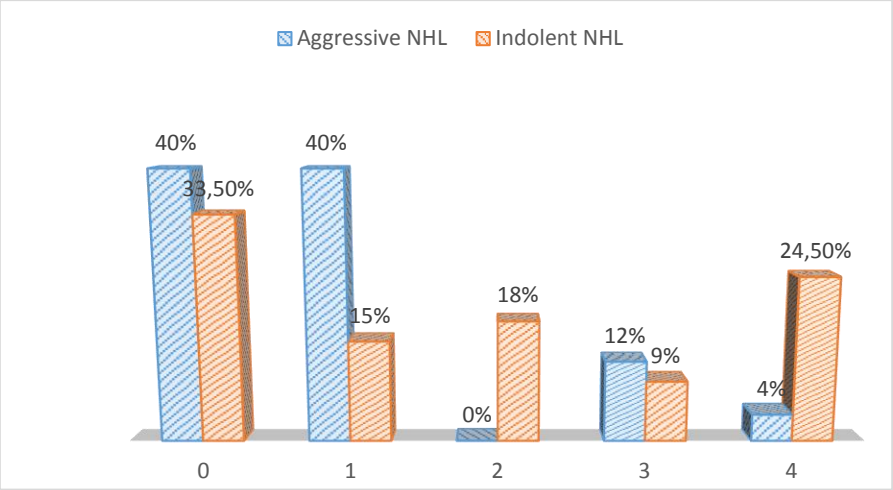

Figure 1. Distribution of patients according on ECOG performance status and NHL type.

It was determined that the incidence of comorbidities increases from the age of 41. (Figure 2) Cardiovascular and digestive systems comorbidities marked the highest incidence. Diabetes tends to affect more patients aged 61-70 years (39%). Respiratory system pathology has been identified in most patients except those aged 18-40 years, more prevalent in those aged 51-60 years. Obesity has also affected 17% in the 51-60 and> 70 age groups, and the human immunodeficiency virus tends to affect the young population with age among 41-50 years.

We also aimed to determine the impact of comorbidities on the average duration of hospitalization.

According to the results, patients with comorbidities have a longer hospitalization than those without. Moreover, patients with more than 2 comorbidities have the longest hospitalization which significantly increases the costs of care.

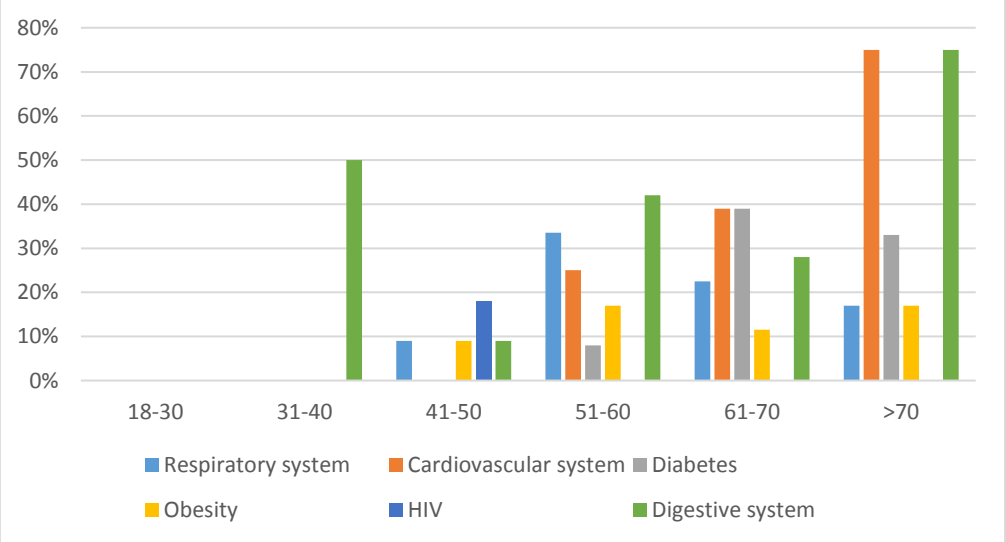

Figure 2. Comorbidities distributions by organ systems and age categories on patients with NHL.

Discussions and conclusion

Depending on gender, we found that NHLs have developed more frequently in women (56%) than in men (44%) with a mean age of 59 years, with the predominance of NHL patients in the advanced stages was appreciated (75.5%). The incidence of NHL is increasing and is even higher among the elderly population [6]. A major importance in treatment decisions in advanced malignancy is the performance status, which is basically the assessment of the level of function and the patient's ability to self-care. Because many clinical decisions, especially those related to treatment, are based primarily on this status, it is very important to carefully evaluate the performance status of each patient. ECOG (Eastern Cooperative Oncology Group) performance

status uses 5-points score to assess the performance status and is considered a simple tool to use in daily clinical practice [7]. In our study, patients with indolent NHL showed better independence (40% had ECOG 0 status and as many ECOG 1) than patients with aggressive NHL (24.5% detected with ECOG 4). The incidence of comorbidities increases starting with the age of 41 years. Comorbidities from the cardiovascular system (Hypertension, Atrial fibrillation) and digestive system (Duodenal and Gastric ulcer, Hepatitis) marked the highest incidence affecting more females than males. Diabetes tends to affect more patients between the ages of 61-70 (39%). Pathology of the respiratory system has been found in most patients except those aged 18-40 years, mostly affecting the male sex. Patients with obesity (14 %) and Overweight BMI (31,5%) have a significant impact on the treatment option, on the quality of life, and mortality as well. The human immunodeficiency virus tends to affect the young population aged 41-50 years. Of these, all were diagnosed with HIV ware male. Patients with comorbidities have a longer hospitalization than those without. Moreover, patients with more than 2 comorbidities have the longest hospitalization which significantly increases the costs of care.

Comorbidities on patients with NHL have a significant impact. By its presence dependent treatment option, patient compliance, the quality of life and mortality as well. So it is important to diagnose the patient in the early stage of cancer and to improve the evolution of chronic diseases as much as possible.

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ABORTION RATES AMONG UNIVERSITY STUDENTS IN UDMURTIA

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ЧАСТОТА АБОРТОВ СРЕДИ СТУДЕНТОВ ВУЗОВ УДМУРТИИ

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Abstract

This article is devoted to one of the most pressing problems of modern health care - artificial termination of pregnancy. It discusses the causes of pregnancy termination in female students, the frequency and ways to prevent abortions.

Аннотация

Данная статья посвящена одной из самых актуальных проблем современного здравоохранения - искусственному прерыванию беременности. Обсуждаются причины прерывания беременности у девушек-студенток, частота распространения и пути профилактики абортов.

Keywords: abortions, contraception, high educational institutions of the Udmurt Republic.
Ключевые слова: аборты, контрацепция, вузы Удмуртской Республики.

Характер рождаемости в РФ определяется распространением малодетности, откладыванием рождения первого ребенка на более поздний возраст, сокращением числа женщин и семей, желающих иметь детей. В такой социально-демографической ситуации аборт приобретает особую значимость [1]. Искусственный аборт в целом остается традиционным методом регуляции рождаемости в России, что обусловлено социально-экономическими факторами, общим уровнем культуры населения, состоянием службы планирования семьи [6].

Показатели абортов по Удмуртской республике на 1000 женщин фертильного возраста снижаются. С 2018 по 2020 гг. составили: 19,4; 16,4; 14,2 соответственно.

Аборт является одной из наиболее частых причин материнской смертности и заболеваемости. В РФ удельный вес умерших после аборта в структуре материнской смертности составляет 13–25%, что превышает показатели экономически развитых стран. Частота гинекологических и репродуктивных осложнений после хирургических видов аборта достигает 53% и более. Неоспорим тот факт, что, каким бы ни был аборт, он негативно влияет на состояние здоровья женщины, в том числе и на репродуктивную функцию [4].

К сожалению, слово «аборт» твердо стоит в связке со словом «женщина». Почему-то ответственность за данное деяние лежит на женской половине населения, хотя в процессе учувствуют двое. Часто женщина, понимая, что рискует, идет на незащищенные сексуальные отношения именно потому, что мужчина не хочет думать о контрацепции и не желает брать ответственность за последствия [2].

Проблема искусственного прерывания беременности в XXI веке актуальна как никогда, что обусловлено низким уровнем полового образования. Девушки, прерывавшие беременность, либо совсем не предохранялись, либо пользовались методом прерванного полового акта.

В России только 25% женщин детородного возраста используют современные методы контрацепции. Следовательно, 75% женщин подвергают себя риску нежелательной беременности. Нормальное функциональное состояние репродуктивной системы - показатель здоровья женщины. Сохранение репродуктивного здоровья женщин и обеспечение безопасного материнства — приоритетная задача современной медицины во всем мире [3, 5].

В исследовании принимали участие 180 пациенток женских консультаций г. Ижевска Удмуртской Республики, ранее сделавших аборт в возрасте от 18 до 26 лет и обучающиеся в высших учебных заведениях Удмуртской Республики – в Ижевской государственной медицинской академии (ИГМА) – 40,5%, в Удмуртском государственном университете (УдГУ) – 30,5%, в Ижевском государственном техническом университете (ИжГТУ) – 29%.

По результатам авторского анонимного анкетирования было установлено, что наиболее часто аборты производились в возрасте 19-22 лет. Огорчает, что считают аборты допустимыми 82,2% респонденток.

Из числа опрошенных в общежитии проживают 31,1%, с родителями 27,2%, на съемной квартире 26,7% и лишь 15% в собственной квартире. Имеют постоянного полового партнера 81,7%, в то время как 18,3%, живущих половой жизнью, предпочитают свободные отношения.

Желание иметь детей высказали 87,8% опрошенных девушек, в том числе 65% в возрасте 25-27 лет, 25% - до 25 лет, 10% - после 27 лет; 12,2% - не планируют стать матерью.

Следует отметить, что для 88,3% девушек рождение ребенка – это в первую очередь создание семьи, для 3,9% - штамп в паспорте, 7,8% - средство от одиночества. Большинство из сделавших аборт, не имели постоянного партнера.

Студентки в 72,3% имеют вредные привычки. Лидирующую позицию занимает алкоголь – 42,3%; при этом студентки ИГМА в среднем употребляют алкоголь 1-2 раза в месяц, а студентки УдГУ и ИжГТУ 3-4 раза в неделю. Также 24,4% курят, одной пачки сигарет им хватает на 2 дня, т.е. 10 сигарет в день; изредка употребляют наркотические вещества – 5,6%. У 48% девушек вредные привычки появились до 18 лет, у 52% - после 18.

Первая беременность в возрасте до 16 лет наступила в 6,1%, 16 – 18 лет – 12,2%, 19 – 22 лет – 46,1%, 23 -26 лет – 35,6%. Каждая вторая жалеет о своей первой беременности. Чаще всего респондентки из ИЖГТУ делали аборт в сроке до 6 недель, студентки из УДГУ и ИГМА - в сроке от 6 до 12 недель. 25,5% опрошенных воспользовались медикаментозным абортом, 74,5% - хирургическим абортом.

С целью контрацепции 51,7% респонденток использовали презервативы, 27,7% - прерванный половой акт, 12,6% - гормональные методы, 6,6% пользовались календарным методом. У 61% девушек половые партнеры были против контрацепции, у 39% - за.

На вопрос о вреде аборта для организма женщины 80% респондентов дали положительный ответ, 15% - затруднялись ответить, 5% считают, что данное вмешательство не вредно.

Проанализировав знания об осложнениях после абортов мы выяснили, что 62,3% девушек знают о бесплодии, невынашивании последующей

беременности, нарушении менструального цикла, внематочной беременности, 30,1% - имеют представление о нескольких осложнениях, однако 17,6% не знают ни одного из них.

На вопрос: «В случае наступления у Вас беременности в ближайшее время, каков будет её исход?» 48,9% девушек ответили – роды; 27,8% - прерывание беременности, 23,3% - затруднялись с ответом. Основными причинами, по которым выбирают аборт в случае наступления беременности, являются: 32,8% - молодой возраст (психологическая незрелость), 28,1% - из-за нехватки времени, в виду учебы, работы, 10,3% - финансовые обстоятельства, 9,5% - не хотят детей, 7,9% - имеют нежелательного партнера для рождения ребенка, 7% - не устраивают жилищные условия, 5,4% - осуждение родителей.

Что касается осведомленности в финансовой поддержке государства, такие как материнский капитал за первенца, за рождение ребенка в студенческой семье, 39,8% - знакомы с ними; 60,2% - не знают об этом. После ознакомления с финансовой стороной вопроса, 83,9% девушек изменили свое мнение об абортах, о их профилактике, 16,1% - остались при своем мнении; 8% считают, что рожают ребёнка для себя и для этого не обязательна поддержка государства; 4,3% уверены, что государство не исполнит свои финансовые обязательства; 3,8% девушек не хотят иметь детей.

После сопоставления результатов опроса студенток вузов г. Ижевска об их отношении к аборту было выявлено, что необходимо более широкое просвещение молодёжи о вреде аборта и обучение методам и способам планирования беременности. Профилактика абортов и их осложнений — важная медико-социальная проблема. Неоценимую роль в этом отношении играет рациональная контрацепция, значение которой для профилактики нежелательной на определенном этапе беременности трудно переоценить.

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PEDAGOGICAL SCIENCES

DISTANCE EDUCATION AS A METHOD OF EFFICIENCY OF EDUCATION UNDER VARIOUS FORM FACTORS

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Abstract
Article discusses the concept of "distance education", analyzes system of distance education at the Tashkent State Transport University, positive and negative aspects of the DL system.

Keywords: distance education, Moodle, HEMIS

Introduction

Currently, teaching disciplines using computers is of great importance [1-3]. The possibilities of computer technology can be effectively used in student-centered development, creative abilities of students. Teachers use the computer not only when preparing methodological materials for the lesson, but also when using the necessary computer programs for teaching the subject, in the course of individual work with students. It should also be noted that the distance learning method based on videoconferencing technology is one of the methods financially requiring a little more money than other distance learning methods, since it requires a high-quality channel, special devices.

Theoretical basis

Many countries use modern distance learning (DL) based on Information and Communication Technologies (ICT) to train quality personnel in the education system [4]. The experience of the education system shows that the opportunities for a radical improvement in the quality of personnel are expanding through the use of the Internet and ICT in the learning process as a means of acquiring, storing, transferring new knowledge and practical decision-making [5]. Tashkent State Transport University "keeps up with the times" and makes it possible to overcome the abyss in the form of territorial remoteness for the student to gain knowledge. The distance education system is inextricably linked with information technology [6]. It is thanks to them that the student receives the necessary information, supplements and improves the already accumulated knowledge, contacts with teachers and classmates [7].

There are also organizational and economic advantages of distance education, for example, no rooms, blackboards, tables and other educational supplies are needed for learning. Financial expenses will be mainly spent on the production of teaching materials and Internet traffic. Naturally, the costs will decrease over time. The more understandable and detailed the educational and methodological materials, the more useful it is for the student [8].

The distance learning system at TSTU appeared in 2020 due to the pandemic. Currently, at TSTU, education can be obtained remotely through training programs, including information, technical, economic sciences and logistics services, etc.

TSTU mainly uses systems, Moodle (dynamic learning environment for Object-Oriented Dynamic Lear modules, focused on the object-module Environment) and HEMIS (Higher Education Management Information System, higher education management information system). The Moodle system is an educational platform that provides the creation of individual training courses with the integration of teachers, administrators and students into a single secure and integrated system. Used by universities, schools, companies and independent educators in over 200 countries.

HEMIS (Higher Education Management Information System) - Higher education management information system provides electronic educational services to administrative workers, professors and students by automating the main activities of higher educational institutions. The information system performs the functions of an information bridge between higher educational institutions and the Ministry of Higher and Secondary Specialized Education and contributes to a sharp reduction in the amount of various information received from higher educational institutions, the rejection of paper forms and the digitalization of the management system.

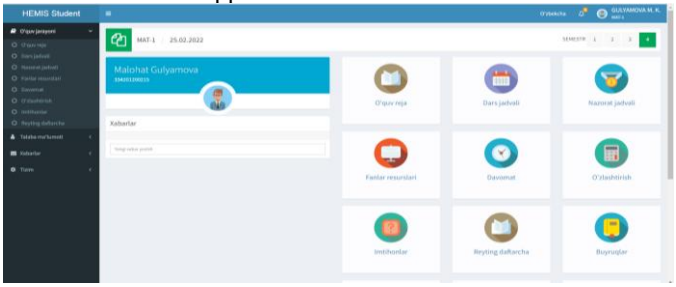

Fig 1. Home page of the HEMIS system account

It should be noted that, like the advantages of the distance education system, there are a number of significant disadvantages. The main disadvantage is the lack of a "live" dialogue between the professor and the student, which, in turn, has a significant impact on the completeness of knowledge.

In general, distance learning at the Tashkent State Transport University gave students the opportunity to work independently, gain independent knowledge and gain self-control. This, in turn, will help them become professionals in their field in the future. There were also opportunities to study teaching methods in foreign universities and exchange experience with them.

Conclusion

In general, introduction of a complex of distance education in TSTU is a comprehensive benefit. Education system of TSTU has all conditions for the implementation of this complex and is provided with computer, information and communication technologies, connected to the Internet. The widespread introduction of these technologies into the education system will help to solve many problems in a timely manner. It should be noted that the use of ICT in the education system at the Tashkent State Transport University has produced both economic and social benefits. Therefore, the improvement of theoretical, methodological and other aspects in this direction based on the requirements of the time is one of the urgent tasks of today.

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APPLICATION OF PROJECT WORK IN THE PROCESS OF LEARNING ENGLISH AT THE SENIOR STAGE OF SCHOOL

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Abstract

This article is devoted to the study of the essence of the project method, the stages of work on the project and the features of the organization of project activities in English lessons in secondary school, as well as determining the effectiveness of using the project method in teaching English to secondary school students.

Keywords: general education school, monologue, project, communication, creative approach

Introduction

The only way,
leading to knowledge is an activity...
Bernard Shaw

The modern education system is being updated and this is happening along with various social changes. In accordance with the requirements of modern society, there is a need to improve the quality of knowledge, as well as the level of education of the student. The purpose of modern technologies is to increase the efficiency of the educational process. Today, the main task of a modern English teacher is to develop the student's personality and critical thinking, to activate creative development and, at the same time, the skills of mastering certain language means. According to this, the educational institution needs research and development, implementation and effective use of the latest teaching technologies. In terms of implementation, the "project methodology" is one of the effective methods of teaching English [3].

This technique is characterized as one of the most effective ways of teaching English by searching for information from authentic materials, as well as improving intercultural communication skills, which allows it to be used in all areas of the educational process.

In the era of information communication, the ability to communicate and understand each other in the real world is becoming increasingly important. One of

the advantages of the lesson-project is cooperation, which allows you to form a student's personality as an active participant in communication. Project activity is a great way to motivate students to work with the outside world, connections and materials, as well as to increase motivation for cooperation.

According to N.I. Myron, "The great goal of education is not only knowledge, but above all actions" means "project methodology" in high school will require a creative approach from the teacher and students. The main idea of the project work is active communication in the studied language in an individual or group form, through research activities. This is the organization of the English language learning process. The work on the implementation of the project makes it possible to develop the creative approach of each student, for example: to create an individual presentation, draw a poster, make a film or design a paper model. [10]

According to Yu.V. Ryndina, this method is "a flexible model for organizing the process of teaching a foreign language, since it allows students to focus their attention not on the language itself, but on the problem, shift the emphasis from the linguistic aspect to the substantive one: independently identify the problem, formulate a hypothesis for its solution, search for the necessary information using various information resources, plan possible solutions to the problem, draw conclusions, analyze the results obtained in a foreign language" [12].

When using the project method, such forms of work as: thematic educational projects; Olympiads, contests; thematic conferences are used. Special methodological techniques such as "brainstorming", "judging weaknesses", debates, writing essays with their revision, editing and publication, conducting various problem seminars, debates, discussions in the form of a "round table", mathematical and economic "battles", performing various types of tasks requiring analysis, comparison, comparison, exercises, constructing material [1] are effective and allow students to acquire interpersonal and business communication skills, business interaction and mutual understanding. The components of the use of the project method in the learning process are "a system of acts of mutual action of training and trainees; the activity of the teacher to regulate the interaction of individual students and groups in order to create positive interpersonal relationships, the creation of an emotional fund [4].

Working on a project in English lessons is a combination of independent work with a pair or group form of project activity, assumes knowledge from different fields of education, penetration of the English language into other activities.

The use of the project method in the process of teaching English allows students to form linguistic and regional knowledge, simultaneously develop skills and abilities in the process of listening, speaking, reading, writing, as well as improve various aspects of the language, teach speech etiquette, and also provides many opportunities to think and talk about yourself, your life, interests, hobbies.[2]

The process of communication in the English lesson allows students to improve the skills of foreign language communicative competence. Educational projects allow us to work together, which carries the cohesion of the collective spirit, the activation of cognitive activity, the development of successful communication skills (the ability to listen and hear each other, build a dialogue) and learn from the experience and knowledge of student leaders.

The implementation of project work leads to the purposeful use of the English language, a successful approach to learning includes:

1. increasing the level of motivation of students;

2. integration of four types of speech activity: listening, speaking, reading and writing;

3. autonomous study of the project topic disposes students to become more responsible for their learning;

4. the presence of the final result of training, where students clearly demonstrate the final product;

5. implementation of the project objectives and, consequently, work on authentic text material as a process of teaching English;

6. improving interpersonal relationships through working in a group or in a microgroup.

Thus, both the fundamental principles of communication and language learning are combined in the learning process [5].

The advantage of working on a project is its adaptability. Every project is the result of hard work.

* collecting information and preparing texts;

* selection of visual material and design of drawings and diagrams;

* selection of visual sources;

* conducting interviews and surveys.

Project work brings a sense of achievement, which makes it personally oriented. This feature of the project makes it ideal for the teaching of English in mixed classes, which allows each student to work at their own pace [1].

I. A. Fateeva identifies the following requirements that need to be considered while working with the method of projects:

- consideration of a significant problem, which requires integrated knowledge for its solution (for example, the creation of a number of reports from different parts of the world, United by a common theme; the study of the problem

- demographic growth of the world's population; the impact of precipitation; the impact of slang on the state of modern English);

- theoretical, practical, moral, cognitive significance of the results obtained after applying the project method (for example, the publication of a newspaper, magazine or other printed publication with reports; writing an essay)—

- independent work of students;

- structuring the main part of the work on the project with an indication of the results;

- application in practice of research methods that are based on the use of a certain sequence of actions: finding a problem and determining the resulting research tasks (it is possible to use such methods as a

"round table" and "brain attack"); putting forward possible hypotheses for solving these problems; joint discussion of research methods (statistical, observations, experimental); discussion and selection of the design of the outcome of the work (protection of the abstract, presentation, report, etc.); systematization of the collected results and their analysis; registration of results, summing up; voicing conclusions obtained as a result of the work done [7].

Many projects allow students to work together, which not only develops individual skills, but also implements the process of cooperation in groups. In group work, everyone should bear their own burden of responsibility and, equally, participate in a joint project in order to achieve the best results for the team. Another advantage of group projects is the opportunity for students to apply their knowledge of English in life situations. It is recommended to use a wide range of communication skills in project activities, which enables students to use all areas of knowledge, as well as the opportunity to develop comprehensively [6].

With the help of the project methodology in the lesson, several goals can be achieved at once: to expand the vocabulary of students, consolidate the studied lexical and grammatical material, create a festive atmosphere in the lesson and decorate the foreign language classroom with students' works.

The variety of means of expressing meaning leads students to free creativity. This is a successful methodological finding in terms of simplicity – the key to the construction of project tasks, where the language element is presented sparingly - to an advanced level, where it plays a leading role. At the same time, the project work has unique opportunities for truly communicative teaching of a foreign language, even when relying on minimal language material.

Mastering a foreign language in the process of project work gives students the true joy of learning, familiarization with a new culture. When performing project work, which can be presented orally or in writing, it is necessary to adhere, in my opinion, to the following recommendations:

Firstly, project work gives students the opportunity to express their own ideas, it is important for the teacher not to control and regulate too explicitly, it is desirable to encourage students' independence.

Secondly, project work is mainly open, so there can be no clear plan for their implementation. During the execution of project tasks, you can also enter some additional material.

Thirdly, most projects can be carried out by individual students, but the project will be as creative as possible if it is carried out in groups. This is especially important, for example, when selecting images for collages and other work of this kind. Some projects are carried out independently at home, part of the lesson is spent on some of the project tasks, the whole lesson is spent on others, so it is also advisable to keep old magazines, scissors, glue in the classroom. The third recommendation once again emphasizes the importance and effectiveness of educational cooperation

Also, when working on a project, all the student's analyzers are involved, which makes training more effective. In addition, awareness of the actions performed with the active position of the child contributes to the development of independence and better assimilation of the material [2].

The main stages of the training project:

1. Search engine.
2. Analytical.
3. Practical.
4. Presentation.
5. Control.

If we step by step consider the project activity of students, the product of which is a monologue, then we can note the coincidence of most of the project actions with the actions necessary to create a monologue at each stage. At the search stage, it is necessary to determine the problem of the project, from which the theme and purpose of the project follow. At the same time, the theme and purpose of the project will be the theme and purpose of the monologue [9].

At the next — analytical — stage, students are divided into project groups, the tasks of project activity are determined, which will coincide with the action plan when creating a monologue. In addition, a teacher plays an important role in this tap, whose task is to inform students about sources that may be useful to them.

Table 1

Comparative characteristics of the stages of work on the project and on the creation of a monologue

Project activity	Stages of work	Monologue statement
Definition of the topic, problems and objectives of the training project	1. Search engine	Definition of the topic and purpose of a monologue statement
Distribution to project groups	2. Analytical	Drawing up a plan for a monologue statement, defining the tasks of the project activity of the statement and the action plan for the preparation of a monologue statement
Collection and analysis of information, registration of work results, preparation of the project product	3. Practical	Collecting and processing information, making a monologue statement
Public presentation of the project product	4. Presentation	Public speech with a monologue
Evaluation of project activity and project product	5. Control	Evaluation of a monologue utterance

At the practical stage, the main work of students on the project takes place. It is the longest and most time-consuming. Students work with information sources, collect and process the material that they plan to use when composing their monologue, turn to personal experience, and then draw up the results of the work. In addition, one of the tasks of the student is to choose the appropriate means of communication so that his monologue is coherent and sounds logical, and check the grammatical design of the text. Students are also preparing for the presentation of the product of their project activities, that is, a monologue. The next stage of the training project is presentation. At this stage, the finished product of project activity — a monologue - is presented to the attention of students and teachers [4].

The main features of the project activity is the orientation towards achieving a specific practical goal – a visual representation of the result, whether it is a postcard, a wall newspaper or the compilation of puzzles, crosswords, etc. The guys enthusiastically start working on the project, discuss its content and nature, goals.

The work on the project pursues the following goals:

- formation of respect for the language and culture of native speakers;
- fostering activity in solving communicative and cognitive-search tasks;
- introduction to the independent performance of tasks, work with reference literature, foreign sources of information;
- introduction to active participation in the dialogue of cultures;
- development of language skills and sustained interest in learning a foreign language;
- development of general academic skills (work with a textbook, a collection of exercises, a reading book, reference literature, a dictionary);
- formation of skills to analyze and compare information and facts of native and foreign-language culture.[13]

Currently, there are some criteria for determining the types of projects:

-by the nature of the dominant activity: research (to solve a research problem or problem), applied - with a clear result of activity and telecommunications - with the use of computer telecommunications.

-by nature-subject-content area-mono and meta-subject projects

-by the number of participants-individual and group

-by duration of execution - short-term, medium-term and long-term.

Work on each project involves going through 5 stages:

- Problem
- Design
- Information retrieval
- Product
- Presentation. Sometimes there is a sixth stage-the project portfolio.

In teaching a foreign language, the project method can be used in close contact with the curriculum on almost any topic.

In my work, I often use the project method, starting with the simplest in junior grades and ending with a more meaningful one in high school. For example, in senior stage, my students created projects about world-famous stadiums, where they not only presented unusual and interesting stadiums, but also presented samples of various architectural forms in their game. The students were also interested in a project about various musical styles. Of course, preparing for projects in high school does not require one day, but students like to work on projects, because everyone can not only show their knowledge of the language, but also express themselves creatively. This type of work allows students to exercise independence, and the role of the teacher is reduced to providing assistance in planning work, monitoring and advising students during the project. It is considered important that the project activity that introduced generation training has become an effective part of the time and effort spent.

Conclusion

The use of the project method in educational activities has proved its effectiveness in the practice of teaching a foreign language in all types of activities: reading speed increases, the quality of text translation improves, oral and written language skills improve, the horizons of students expand, communication skills develop, the desire to independently acquire and use new knowledge. Practice shows that learning together is not only easier and more interesting, but also much more effective. Active involvement of students in project activities, in particular, contributed to the achievement of positive educational results.

The essence of the project methodology is that students are given the opportunity to design the content of communication themselves, starting from the very first lesson. These classes are not limited to the acquisition of certain knowledge, skills and abilities, but are aimed at practical actions of students, affect their emotional sphere, create a psychological climate, relaxed and natural behavior of students and provides motivation for learning. It is also very important that children learn to cooperate while working on the project, and learning in cooperation brings up in them such moral values as mutual assistance, desire and ability to empathize; improves the general culture of communication and social behavior in general, forms the creative abilities and activity of students, i.e. there is an inextricable process of learning and education, and leads students to practical knowledge of a foreign language. The project method is an integral part of teaching English to schoolchildren at the initial stage, and during further mastering it. One of the main tasks of teaching foreign languages is to solve such an important problem as the development of independent work of students, focusing them on active creative assimilation of material, the ability to think logically and make decisions on their own promptly.

The use of innovative technologies in teaching not only develops children's motivation, not only makes lessons more diverse and interesting, but also promotes

self-development. The design methodology is an effective innovative technology that provides:

1. a significant increase in the level of proficiency in language material and speaking as one of the types of speech activity;

2. increasing the level of internal motivation of students;

3. increasing the level of independence of students, the level of team cohesion;

4. improving the overall intellectual development of students.

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ORGANIZATION OF THE ENGLISH LANGUAGE LESSON TAKING INTO ACCOUNT THE PSYCHOLOGICAL AND PEDAGOGICAL PECULARITIES OF THE MIDDLE STAGE OF THE GENERAL SCHOOL

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Abstract

In this article, an attempt was made to consider the psychological and pedagogical peculiarities of students and their consideration in the organization of foreign language lesson at the middle stage of the secondary school. A brief psychological and pedagogical characteristic of the students of the middle school age is given.

At the middle stage of educational process, basic knowledge and skills in the field of a foreign language are formed, on the basis of which further learning will be based, as well as great attention is paid to maintaining interest in the subject, which is also the key to its subsequent successful assimilation.

Adolescence is characterized by the desire to communicate with peers, the manifestation of their independence. This is the period when children's dreams about the future are replaced by reflections about it, taking into account their own capabilities and circumstances in life.

The main new formation of this period is a change in the relationship between concrete-figurative and abstract thinking, in favor of the latter, which is manifested in the fact that emotions are often stronger than the impact of words. Therefore, when organizing the educational process, the teacher needs to create a situation of success and maintain students' interest in the subject, thereby creating conditions for effective learning of a foreign language. The article presents some types of success situations and techniques for their creation, also the analysis of methodological literature allowed us to note which points need to be taken into account in order to support the interest of adolescents in learning a foreign language.

Keywords: adolescence, psychological and physiological characteristics, the situation of success, the joy of learning, the student's interest, methods, differentiation of interests, the student's personality

Introduction

Knowing the main object/subject of one's activity - the student and the use of this knowledge when planning and conducting a lesson, bearing in mind at the same time: knowledge of training, learning ability, educational opportunities in the zone of immediate development of a particular student, interests in a certain period of study, health status, social and psychological status in the group is one of the main requirements for a modern lesson. That is, it is absolutely necessary to know your student. The effectiveness of educational process depends on how much the teacher takes into account the psychological, pedagogical, individual and age characteristics of students in the learning process.

Each student has individual personal characteristics (individual personal abilities, intellectual activity, level of self-esteem, working capacity, etc.). Nevertheless, all students in each age period are characterized by common features.

There are many age-related periodizations. Their authors are P.P. Blonsky, L.S. Vygotsky, D.B. Elkonin, J. Piaget. This paper describes the features of the middle stage of education - adolescence in the process of teaching foreign languages in a general school. There is no clear definition of the boundaries of adolescence in the psychological and pedagogical literature, they are not defined equally by different researchers and cover the period from 10 (11) to 16 (17) years (L.S. Vygotsky, A.V. Mudrik, I.S. Kon, G.S. Abramova, V.S. Mukhina, D.B. Elkonin, D.I. Feldstein, etc.). Traditionally, adolescence is associated with the education of children in the middle school. These are children from 10-11 to 14-15 years old.

The main part

Teaching a foreign language in primary school ensures continuity with the preparation of students in secondary school, on the one hand, and, on the other hand, provides opportunities for continuing secondary education both within the walls of the school and in special vocational secondary educational institutions. This stage of learning a foreign language is characterized by the presence of significant changes in the development of middle stage students.

L.S. Vygotsky attributes to the main psychological formations of this age the arbitrariness and awareness of all mental processes, as well as their intellectualization and internal mediation. "Due to the transition of thinking to a new, higher level, all other mental processes are being rebuilt, memory becomes rational, and perception becomes thoughtful," writes D.B. Elkonin.

Psychological and physiological features of this age:

– *The need for "adult communication"*. The emergence of a sense of adulthood in a teenager is one of the central psychological formations of this age. It is determined by shifts in physical and puberty, the development of social functions, the expansion of rights and responsibilities in the family. Conditions that require independence from the child, assistance to adults, and a respectful tone of treatment from adults contribute to this.

– *Transformation of teenagers' communication into an independent type of activity.* Communication goes far beyond studying, it becomes much more meaningful, more complex, more diverse than that of younger schoolchildren. Communication with peers is more valuable for teenagers than communication with parents, loved ones. Frank conversations occupy a large place in the communication of teenagers.

– *The need to assert yourself, to take a worthy place in the team.* This is one of the most important, fundamental needs of teenage childhood. If for preschoolers the opinion of parents was the most authoritative, then for teenagers the opinion of peers, the collective of the class is the most significant. Teenagers react very painfully to every fact that harms their prestige in the eyes of their comrades.

– *The emergence of the need for active cognitive activity.* The transition in teaching from one to several teachers makes it possible for a teenager to compare them with each other and develop new criteria for evaluating their activities. If the attitude of younger schoolchildren and younger teenagers to the subject depends on the attitude to the teacher and getting marks, then older teenagers are attracted by the content of the subject, the ability of the teacher to present it and the ability to create a situation of success.

The leading pedagogical idea in working with adolescents is to create a situation of success in the most significant activities that enable positive self-affirmation of the individual; the formation of value attitudes, the prevention of deviations in behavior and moral development.

How to prepare a modern English lesson for middle-stage students? In order for the level of preparation of the lesson to be high enough, it is necessary that the teacher during the preparation tried to make it a work of art, so that the lesson would give students not only knowledge and skills, but also arouse genuine interest in children and form their creative consciousness. It is necessary to think over the forms of organization of work in the lesson. In a modern lesson, individual, group and pair work should be present to a greater extent. When planning a lesson, it is necessary to take into account the differentiation of students in order to create a success situation for each of them.

Mastering a foreign language at school involves intensive activity of the student. One of the factors of ensuring the student's working capacity is the appropriate motivation. Among the aspects that increase the level of motivation, it is necessary to highlight, first of all, the constantly maintained interest of students in the process of mastering a foreign language, its effectiveness, as well as the use of various teaching methods that meet the needs of middle-level students in the novelty of the studied material and the variety of exercises performed. The use of various teaching methods contributes to the consolidation of language phenomena in

memory, the creation of more persistent visual and auditory images, maintaining the interest and activity of students.

A.S. Belkin, doctor of pedagogical sciences, professor, indicates several types of success situations. The most effective type of success situation can be considered a situation of the type "Joy of knowledge". Of course, it also occurs in younger schoolchildren, but it is most effective in adolescents and older students.

The joy of learning is devoid of any secondary, momentary, ambitious moments, it is inherently altruistic. Educational work is related to the activities of the student and the student. Cognition as an independent process can also be based on self-education, self-knowledge. The most ideal from a pedagogical point of view is when knowledge and educational work interpenetrate each other, rely on each other.

The deficit of the joy of learning is born first of all by the deficit of the joy of teaching, when the teacher sees the meaning of his activity only in the final result, and not in the process of achieving it.

There are three approaches of a teacher to knowledge: 1) considers them as an illustration; 2) transmits, transforms; 3) sees them as an important source of self-development, interaction with students. In other words, knowledge is needed by a third, truly erudite group of teachers in order to develop children and improve themselves.

Teenagers have a lot of techniques for creating a "joy of learning" situation. We can single out some of them, the most interesting, promising and non-standard.

"Eureka"

The essence of the reception is to create conditions under which a student, while performing an educational task, unexpectedly reveals previously unknown possibilities to him. He should get an interesting, original result that opens up a new perspective of knowledge for him. The merit of the teacher is not only to notice this deeply personal discovery, but also to support the student in every possible way, to set new, more serious tasks for him, to inspire him to solve them.

"Deliberate mistake"

"While presenting the proof of the theorem, I deliberately make a mistake in the entry, add a line and, after pausing, run my eyes through the class in the hope of seeing someone who discovered this error. The attention of the guys is still riveted to the notebooks: they are finishing a line. But then a hand was raised. This is Lena, she very rarely answers from the spot. But here, apparently, she decided...

"You've made a mistake," she says timidly.

- Well done, Lena, - I praise her, - please tell us the line in which you found a mistake, and we'll all look for it together.

The entire class is included in the search. But this is not the main thing, the main thing is that the guys will continue to listen to the proof even more carefully, trying not to miss another "mistake". After all, we are used to the fact that only a teacher can point out mistakes to students. When such an opportunity is given to a student, you need to see how proud his face shines: I found a mistake with the teacher himself!"

The "Deliberate mistake" technique can be applied, taking into account age, only on the material known to students, which is used in the proof as a reference knowledge.

The situation of "Imaginary success"

We are talking about those students who are quite satisfied with their low results, although their capabilities allow them to have more serious successes. The satisfaction of the child in such a case may indicate either a clearly underestimated level of claims, a persistent lack of confidence in his own strength, or a weakness of cognitive interests, a mental retardation of the individual, a desire to be content with minimal results achieved with minimal effort.

It is hardly necessary to prove that the "joy" of a slacker or a student with an intellectual complex who does not believe in his own strength (not to be confused with mental retardation, with mental development delays, "with the complacency of a moron" - according to L. S. Vygotsky!), have nothing in common with a really pedagogically significant situation of success.

Overcoming the situation of imaginary success is not connected with the condemnation of the student, but with the creation of real conditions under which the student achieves real results. In other words, where real success is created, there are no illusions.

Every teacher understands, along with creating success situations, how important it is to constantly maintain interest in the subject. Often he is faced with the fact that students, not seeing the need to study this subject, not imagining the possible scope of its application, ask: "Why do I need a foreign language?" or they claim that you can live without a foreign one. Here is my father, for example..."

It is necessary to build the educational process in such a way that the disclosure of the significance of the subject permeates, firstly, the educational process itself, that is, exercises, texts for reading and listening, conversations for the semantics of new lexical units and the presentation of grammatical structures, served as the basis for the production of handouts and so on, secondly, was an integral part of extracurricular work through various kinds of extracurricular activities; and most importantly, in both cases, it is necessary to use the professional intentions of students.

If, for example, in a lesson on improving speech skills, texts are given about how people spend their free time, then one of them may be about a Moscow engineer who devotes all his free time to learning foreign languages. And the preliminary question to the text will be: "Is it worth spending free time on a foreign language?" When completing the task "Tell us what hobbies famous people had", which is being prepared at home, you can include information about how great people studied a foreign language.

The differentiation of students' interests by fields of knowledge, which appears in adolescents already in grades 6-7, provides an additional opportunity to introduce them to a foreign language. Knowing, for example, that Miras N. is fond of music, in conversations about theater, cinema or free time, you can offer him a

clipping from a foreign newspaper about one of the most popular ensembles for individual reading. Knowing that Dias A. loves technical modeling, but at the same time has a completely negative attitude to a foreign language, you can do otherwise - leave a clipping from a magazine about a new model on the teacher's desk (or start reading in front of everyone), pre-equipped with some creative task. Having seen and become interested in this, the student will not refuse to read and complete the task.

Each student is an individual. Each of the students has properties that are different from the other. Knowledge of all these properties is accumulated by the teacher. An experienced teacher always knows how a student treats a foreign language, what subjects he likes, what he does outside of school, what his professional intentions are, his status in the classroom, etc. These data are included in the special methodological characteristics of the class, which the teacher always has at hand.

Conclusion.

Foreign language lessons at the middle stage of educational process have a certain specificity, which follows from the age characteristics of students, and from the tasks facing this period, and from the content, and from the psychological and pedagogical fact that this period begins studying. The middle stage, being intermediate, on the one hand, retains the features of the primary school (especially in the fifth grade), and on the other hand, it represents a new stage in the development of students' skills and abilities in a foreign language.

The process of teaching a foreign language should take into account the personality of the student, his needs, motives, intelligence and other individual psychological characteristics. Taking into account the psychological, pedagogical and individual characteristics of students makes it possible to introduce new technologies into the educational process with greater efficiency, increase the effectiveness of learning, form strong and deep skills, develop students' creative abilities, increase the level of independent activity of students in the classroom, develop students' personal qualities.

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THE ROLE OF PLOT TEXTS AND STORY TEXTS IN TEACHING READINGS

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Abstract

The aim of this article is to reveal the role of story and plot texts in teaching reading. To reveal the psychological characteristics of middle school students and give practical recommendations on the use of plot texts in teaching reading in a foreign language. To offer exercises for mastering the structural and compositional features of journalistic and popular science texts. And also consider all the stages of using plot texts.

Keywords: teaching reading, learning reading, school students, middle stage, plot texts, story texts, foreign language, reading skills, types of exercises.

Teaching reading involves achieving a detailed/complete and accurate level of understanding of the main and secondary facts contained in the text. These reading proceeds slowly, as the school student, having a mindset for long-term memorization, resorts to repeated reading, translation, and sometimes to the written fixation of the content, delves deeper into the essence of the communicative situation.

It is advisable to conduct a learning reading on texts that have cognitive value and informative significance, which are quite difficult in terms of language. Analysis plays an auxiliary role. The language form of the text contains many guidelines and hints, using which the school student can overcome language difficulties independently in the future.

Research in the field of age psychology suggests that school students in grades 7 and 8 have more mature thinking than school students in grades 5-6. Seventh and eighth graders are eager to find out the cause of certain phenomena, they are not inclined to take everything on faith as willingly as it was before.

Grade 7 can be conditionally called transitional from the initial stage of language learning to the senior. If in grades 5-6 the leading role belongs to oral speech, and in grades 9-10 – reading, then in grades 7-8 oral speech and reading occupy an equal position. This is possible primarily because students already possess significant language material that allows them to use narrative and descriptive texts for reading that correspond to the age characteristics of school students. Reading in the 7th grade acquires features that bring it closer to reading the vernacular: school students receive new information as a result of reading [4].

Understanding words in context requires a certain number of sentences so that the meaning of a given word is clearly manifested. The ability to guess the meaning of a word from its description in the language being studied is often useful when reading popular science literature, where a description of a device, instrument, phenomenon, etc. may occur. Sometimes, in both narrative and descriptive texts, there is a need to explain the reality. In this case, the situation itself should prompt the correct choice of the meaning of the word.

According to the methods of orientation to the communicant, texts are divided into discontinuous-fable and continuous-fable.

The plot is the underlying material of the text, the plot is what is made of this material and how it is reflected in the text [7].

In continuous-plot texts, the development of the topic is not interrupted by author's digressions and is minimally provided with background information.

In discontinuous plot texts, the development of the plot is interspersed with background information and author's digressions.

Researchers distinguish three plans of a discontinuous plot text:

- background - includes the background of the event, various background information, explanations;
- plot - conveys the development of events,
- author - offers author's assessments, associations, digressions.

When creating a translation text, the translator has to make a decision about choosing a functional and semantic type of text: description, narrative, reasoning. Description answers the question: which one?, narration answers the question: what did you do?, reasoning answers the question: why?

The plot text allows you to apply the following control technique: describe the appearance of a particular actor, the place where the action takes place, say a few phrases about the people who appear in the story, etc. This technique is intended to clarify to what extent students have understood the facts set out in the text.

If the text is fable and not very long (20-25 lines), then school students can convey its main content in a foreign language. In this case, however, there is a danger that weaker school students will not cope with the retelling of the text, but not because they did not understand it well, but because they do not have sufficiently developed expressive oral speech skills. Therefore, this technique should be used carefully.

The main requirement for texts is that texts should be informative, entertaining, accessible, and reflect an adequate picture of the world. They should correspond to age characteristics; they should set a meaningful

speech plan and ensure the implementation of practical, educational and developmental learning goals. On their basis, the analytical and synthetic phase of reading activity is carried out.

Practical recommendations on the use of plot texts

Types of exercises for mastering reading skills

Pre-text stage

Exercises in working with the title of the text.

1. Read the title and tell me what (about whom), in your opinion, will be discussed in the text.

2. Read the title and tell me what, in your opinion, is the main content of the text.

3. Translate the title and answer the questions:

A) By what word of the title can it be established that we are talking about ...?

B) What phrase suggests that ...?

C) By what word did you determine that this is information about ...?

4. Translate the title with the dictionary and tell me which prefix gives the words a negative meaning.

5. Read the titles of the texts. Suppose what specific facts can be discussed in the texts. Review them.

6. Tell me what, in your opinion, the author's goal was, including in the title words that are not repeated in the text.

7. Come up with a title that can combine the three named facts.

8. Read the title of the following text and think about what it is associated with in your view. If you are interested in the title, read the text further [1].

An approximate algorithm for school students to work with the title before reading any text.

1. Carefully read the title and highlight the keyword in it (most often it is expressed by a noun).

2. Review the text and pay attention to how often the dominant title word you have highlighted occurs in the text.

3. Find substitute words for the dominant word and the entire title in the text.

4. Rephrase the title using synonymous words from the text.

5. Find in the text of the sentence with varying repetition of the dominant word in the title.

6. Tell me if the keywords you have highlighted and their substitutes are the most informative elements in the text.

7. Re-read the title and tell me what will be discussed in this text.

Exercises for mastering the structural and compositional features of journalistic and scientific (popular science) texts.

Mastering the structure of newspapers and recognizing genres of newspaper materials

1. Find the main information message in this issue of the newspaper. Tell me what event is described in it. Find other materials on this issue in the newspaper.

2. Find the second most important information message of the issue; tell us what event it tells about and what other newspaper materials are devoted to this event

3. find non-commented informational articles in the newspaper (informational articles with commentary elements, commented informational articles); tell us what issues they are devoted to.

4. Find editorial articles in the newspaper (articles by specialists, regular columnists of the newspaper); tell us what issues they are devoted to.

5. Find interesting materials for you that the newspaper publishes under the headings ....

. 6. View the page of the newspaper, magazine, set of texts and select texts on the topic ....

7. View the newspaper (magazine). Tell me in your native or foreign language the content of the most interesting text on the topic.

8. Make a selection of articles on this issue from several newspapers.

Mastering the structural and compositional features of scientific (popular science) texts.

1. Review the text. Determine its character (description, reasoning, narration).

2. Review the text and tell me if it contains, from your point of view, interesting information.

3. Read the opening sentences of the first and last paragraphs. Formulate the question that is covered in the article.

4. Check whether the border of the introductory part of the text is correct; if not, correct the errors.

5. Select the introductory, main and final parts of the article from the texts printed on separate cards. Make an article out of them.

6. Highlight the introductory and main parts in the text.

7. Determine whether the main idea is repeated in the text, how many times, in which structural components (title, introductory or main part) it is formulated.

8. Check whether the border of the final part of the text is correctly marked. If not, give your own version.

9. Highlight the introductory, main and final parts in the text.

10. Find the final part of the text. The title and the introductory part of the text are given; the main part is divided into separate semantic pieces.

11. Make a general idea of the content of the text by title (table, drawing, formula, introductory and final parts).

12. Read the first sentences of the paragraphs and name the issues that will be considered in the text.

13. Read the last paragraph of the text and tell me what content can precede this conclusion.

14. Read the first paragraph (introduction) to yourself and try to guess what will be discussed in this text.

15. Review the text, familiarize yourself with the drawing (the table described in the text), make a plan of the main content of the text.

16. Review the text and draw a sketch of the object under construction described in the text.

17. Skim through the text. Match the first sentence of the text with the title. Install:

1. do they express the same thought

2. whether they express the general content of the text [3].

18. Read the second sentence of the first paragraph and the first sentences of all subsequent paragraphs. Exclude from them those that do not express a new thought.

19. Make a structural and semantic scheme of the text according to the following sample:

1. The purpose of the message (first-order predication)

2. elements of the general content:

a) the main stating theses (second-order predication)

b) secondary elements (predications of the third, fourth and subsequent orders)

Such schemes of the semantic structure of the text can also be the basis for writing abstracts [2].

Text stage.

Exercises to determine the topic of the text.

1. Without reading the text, specify the structural component in which the theme is expressed. Read this part of the text, name the topic. In the row of titles, underline the one that is taken from the message about …

2. Distribute the titles according to the specified topics.

3. Tell me if the topic is expressed in the title of the text.

1. Determine the structural component of the text that contains the topic (introductory part, main part)

2. Determine which problem is discussed in the text.

3. Read the title and tell me what the text is about.

4. Name the issues that are considered in the editorial articles and articles of specialists in this issue of the newspaper.

5. list the topics of information messages placed on the ... newspaper page (under the heading ...) [5].

Exercises for semantic prediction of the text content.

When composing exercises of this group, it should be remembered that there are two categories of signal words that contribute to anticipating the movement of the author's thoughts:

A) words indicating the movement of the author's thoughts in the narrative;

B) words indicating a change in the direction of thought, a turn of thought, a denial of the previous statement.

1. Write out the signal words from the text and determine which part of speech they belong to.

2. Identify the signal words from the following, followed by the development of the previous position.

3. Identify the signal words from the following, followed by a presentation of the new material.

4. Establish to which semantic category these signal words belong:

a) repetition of thought;

b) clarification of the thought;

c) output;

d) change of point of view.

5. Come up with the end of the sentence after identifying the signal word.

6. Determine which of these signal words are followed by information that can be skipped if the reader's goal is to understand only the most important information.

7. Determine which of these signal words can be followed by the main idea in the text.

8. Review the words highlighted in the text. Assume what the text is about.

9. To better understand the text, review it. Match the subjects given in the left column with the corresponding predicates from the right.

10. Review several articles on the topic.. and prove that …

11. Review the text again. Determine its compositional-speech form (it can be a message, narrative or reasoning).

12. Supplement the information obtained from the text. For this purpose, look through the relevant newspapers and magazines in the foreign language being studied [8].

The post-text stage.

Exercises to control reading comprehension

1. Tell me what issues are addressed in the text.

2. Tell me what problem arises from the content.

3. Put a few questions to the text and ask them to your friend, then answer his questions.

4. Confirm the point of view stated in the text using your own example.

5. Express your opinion about what you have read,. Please provide additional information that you know. Give examples, facts similar to those described in the article.

6. Think about how and where you can use the information extracted from the text.

7. Determine whether you need to familiarize yourself with the text in more detail in order to use the information received in your future professional activity [6].

In order to work with the text to become productive, it is necessary:

-Carefully build the algorithm of the lesson, think over its course to the smallest detail.

- Clearly set tasks for students.

-Focus on the level of readiness of students and their educational motivation;

-Do not forget about a differentiated and personality-oriented approach.

The listed techniques of working with text are the main ones, but far from the only ones. Their use is largely determined by the teacher's experience, his desire to work creatively and look for new effective ways to solve problems in the classroom. The choice of certain techniques also depends on the level of preparedness of students and their educational motivation.

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METHODS OF TEACHING READING TECHNIQUES IN FOREIGN LANGUAGE

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Abstract

The aim of this article is to draw attention to the special role of reading in teaching a foreign language, as well as to understand what methods exist at the moment and what practical results they lead to. Scientists distinguish several types of reading: learning, introductory, viewing and search. The article specifically talks about learning reading.

The article examines the works of the founders of the theory of learning reading, examines the main definitions, analyzes different points of view and shows methods of teaching reading techniques.

Keywords: methods of teaching reading, student's vocabulary, reading mechanisms, letter-sound relations, listening and writing under dictation, sound-speech code, letter-sound correspondence.

Reading is a speech activity aimed at visual perception and understanding of written speech.

To understand a foreign language text, it is assumed that you have a set of phonetic, lexical and grammatical informative features that make the recognition process instantaneous.

In the real act of reading, the processes of perception and comprehension proceed simultaneously and are closely interrelated, the skills and abilities that ensure its process are conventionally divided into two groups: a) related to the "technical" side of reading (they provide perceptual processing of the text (perception of graphic signs and their correlation with certain meanings or the transcoding of visual signals into semantic units) and b) providing semantic processing of the perceived - the establishment of semantic links between linguistic units of different levels and thereby the content of the text, the author's intention, etc. (these skills lead to the understanding of the text as a complete speech utterance).

It is known that the reader's eye normally performs short jumps, between which there are stable fixations on the object in order to extract information. Observations of eye movements show that they are divided into two types:

1) search, installation and corrective movements;
2) movements involved in the construction of the image and recognition of the perceived object.

If we turn to the speech mechanisms of reading, then, as well as in oral communication, speech hearing, prediction and memory will play a huge role here, although they manifest themselves somewhat differently. The role of speech hearing in the reading process is determined by the peculiarity of the sound-letter system of printed text.

Probabilistic forecasting - "mental overtaking in the process of reading" - as an integral component of active mental activity also determines the success of perception and understanding in any kind of reading.

Forecasting contributes to the creation of an emotional mood among students, readiness for reading.

The success of probabilistic forecasting depends on the relationship between known and unknown words, on the degree of familiarity with the topic, on the ability to use an instant choice of solutions from a number of probabilistic hypotheses. Hypotheses are one of the search mechanisms.

Understanding of the content occurs on the basis of a number of complex logical operations, the result of which is the establishment of links in the text and the

transition "from expanded words to semantic milestones".

The stepwise nature of understanding in relation to a foreign language was described by 3.I.Klychnikova, which identified four types of information extracted from the text and seven levels of understanding [3].

The first two levels (the level of words, the level of phrases) indicate an approximate understanding. By learning the meaning of words and phrases in context, the reader gets an idea of the topic to which the text is dedicated. The operations performed by a novice reader are distinguished by a certain complexity. It arises not only because of the quantitative discrepancy between the reader's vocabulary and the vocabulary present in the text, but also because many words are used figuratively and do not have motivation. Polysemous words, homographs, antonyms and synonyms are also very difficult.

The third level (understanding sentences) is more perfect, although it is also fragmented. Perceiving a sentence, the student must dissect it into separate elements, establish a connection between them and their role in the utterance, identify grammatical homonyms, especially in service words, etc.

The author associates the fourth and fifth levels (understanding of the text) with the types of reading and with what types of information the content extracted from the text belongs to.

The sixth level is the understanding of meaningful and emotional-volitional information, the seventh is the understanding of all four types of information, including motivational-volitional.

The last two levels should indicate that the technical ones are fully formed. To fulfill this last communicative task, the reader must be able to generalize, find a connection between semantic pieces, highlight the most important, "go into the subtext", achieve completeness, accuracy and depth of understanding. As a result of all these operations, the reader evaluates the text in a broad social and cultural context, and the reading itself is characterized by maturity.

Reading is considered as a receptive speech activity, which consists of the perception and comprehension of written speech. Unlike the perception of oral speech, when reading, information comes not through the auditory, but through the visual channel. Accordingly, the role of various sensations also changes. Visual sensations play a crucial role in reading. Both listening to speech and reading are accompanied by pronouncing the perceived material in the form of internal speech, which becomes a full expanded speech when reading aloud. Therefore, motor sensations play an important role in reading. The reader hears himself, therefore, auditory sensations are a mandatory element of reading. They make it possible to check the correctness of your own reading. However, when reading, they play a subordinate role in contrast to listening to speech, where they dominate [4].

Simultaneously with the perception of what is being read, its comprehension also occurs. These two sides of the reading process are inextricably linked. The availability of conditions for understanding the text depends on the quality of perception of the text. Errors in perception, such as the assimilation of words similar in form, incorrect reading of words, lead to distortion of meaning. At the same time, a wrong understanding of the meaning leads to a false guessing of the form of the word, etc.

Understanding the content of what is being read is based on the same psychological processes as understanding when listening.

But some features peculiar only to reading still need to be noted. Reading comprehension is carried out in somewhat more favorable conditions, which are determined by the greater distinctness of visual images compared to auditory ones and the longer duration of their impact. At the same time, the content of the material when reading is usually more complicated. The topic of oral speech usually covers subjects close to the speaker, directly related to him. When reading, the range of questions is much wider, especially at the middle and senior stage of learning a foreign language. For texts borrowed from popular science, political and fiction literature of the country of the studied language, it is characteristic, in particular, to turn to topics reflecting the life and history of this country, which leads to familiarization with facts, subjects that are not in the reader's experience.

At the present stage of society's development, the role of reading in English is clearly increasing.

Thus, reading today is not only one of the means of learning – a source of new words entering the student's vocabulary and a starting point for a variety of statements of a dialogical and monological nature. Reading in English has also become perceived as one of the main goals of learning – a source of new intellectual and aesthetic information that will significantly enrich the student's personality if the learning process develops his ability and habit to use this source.

Knowing this, many scientists, such as Harold Palmer ("Oral Method"), Michael West ("Direct Method", which allows you to accumulate a dictionary and create a base for the development of reading and oral speech skills), Charles Fries, Robert Lando tried to understand the mechanisms of reading, to come up with a universal method by which it would be easy and fast to teach a child to read in a foreign language.

It is necessary to understand what methods exist at the moment and what practical results they lead to.

The first method is linguistic. This method involves learning to read based on words that are often used and that are read the way they are written. Bloomfield (the discoverer of this method) suggests first learning to read in words that are often used and that are read as they are written. By reading words that are read as they are written, a child who learns to determine the correspondence between letters and sounds [8].

The second method is the so-called "whole-word" method (whole-word method). The method of "whole words" is that children are taught to recognize words as whole units without explaining to them the letter-sound relations. The training here is based on the principle of visual recognition of whole words, without dividing them into letters and syllables. In this method, neither

the names of letters nor the letter-sound ratio are taught. This method is known as the Doman method – Glenn Doman builds all learning to read only on it [5].

The third method is "whole-language". It is very similar to the whole word method. One of the characteristic features of this method is that phonetic rules should not be explained to the learners to read. The connection between letters and sounds is learned through the process of reading, implicitly. If a child reads a word incorrectly, it is not corrected. The philosophical view of this teaching is that learning to read, as well as mastering a spoken language, is a natural process and children are able to comprehend it themselves [2].

The fourth method is the Pitman Alphabet. This method is based on the English alphabet, expanded to 44 letters. Each letter of this alphabet is pronounced only in one way, that is, all words are read as they are written. Capital letters in this extended alphabet are written in the same way as small ones, only in a larger font. As the child learns to read, the letters are replaced with ordinary ones [10].

The fifth method is the Moore method. Here it all starts with the fact that the child is taught letters and sounds, using a computer with special software that "pronounces" sounds or names of symbols. After the child learns the names of letters and symbols (punctuation marks and numbers), he is shown certain letters on the screen, he types them on the keyboard and the computer "pronounces" these letters, converting them first into short simple words, and then composing sentences from them. This method also includes oral speech, listening and dictation writing[9].

The sixth method is the Montessori method. Montessori gave children letters of the alphabet and taught them to identify them, write and pronounce. Later, when the children were already able to connect sounds into words, she taught them to connect words into sentences [3].

Recognizing that there is no general methodology for teaching reading in English, proponents of the phonetic method say that there are important elements that make up reading, and they need to be mastered by everyone who wants to learn to read well. These elements turn out to be the same for the English language – this is the sound-speech code and the letter-sound correspondence [1].

Summing up, we can say that reading in a foreign language as a type of speech activity and as an indirect form of communication is, according to many researchers, the most necessary for most children at the initial stage of learning. That is why learning to read in English acts today as a target dominant.

Researchers note the particular importance of the process of learning to read at the middle stage, since at this stage the child has the basic skills and abilities to learn English. It is also impossible not to admit that all of the above methods of teaching reading are not ideal, they all have some drawbacks. When these methods cease to be difficult linguistically, they often lose their relevance in terms of content and do not fit into the problems of educational material.

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TEACHERS' PERCEPTION IN THE USE OF COMMUNICATIVE LANGUAGE TEACHING

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Abstract

This paper investigates Kazakhstani English instructors' perception of communicative language teaching at English classes. For such purpose, interview questions were designed and conducted among 10 English language teachers. These instructors were interviewed in order to define their perspectives on communicative language teaching and how they use it in classes to help learners improve their speaking skills. The most popular CLT approaches, according to a case study, are role plays, dialogues, group and pair work; however, the usage of CLT is still should be improved in Kazakhstan, since this methodology requires a lot of efforts from teachers as well as learners.

Keywords: CLT (communicative language teaching), FLT (foreign language teaching), CLT approach, GTM (grammar translation method)

Introduction

CLT (communicative language teaching) is a second language teaching method that has become popular in recent times across the world. When questioned about their curriculum in their classrooms, the majority of language instructors claim to employ communicative curriculum. However, further examination of the specifics reveals that CLT is interpreted differently by each of them, and they regard it as a technique that incorporates discussions rather than grammatical instruction.

A lot of research on CLT misconceptions have been conducted in past few decades (Wen Wu, 2008; Thompson, 1996). The new research, on the other hand, looks at how Kazakhstani language instructors see communicative language teaching. The justification for the approaches, methodology and activities they utilize in class is explored in perspective of this study topic.

Overall, "communicative competence" is the focus of CLT (Jack C. Richards, 2006; Hymes, 1972; Savigon, 1972). In this field of research, communicative language teaching might play the role of an approval seal placing on the path CLT had ahead in order to achieve the goal of a new coming method called CLT to emerge in the 1970s.

CLT and its background

Numerous experts asserted achieving communication skills as the primary issue of the novel approach, such as Christopher Candlin, Henrry, and Widdoson, based on Chomsky's approach, which shows language features of creativity and the upcoming requirement of focusing on communication in language learning instead of language structure**.** The art of state approach is known as communicative language teaching (CLT), and it takes a discussion and humanity-focused approach to English teaching methods and language learners. They searched for an acceptable curriculum that might satisfy the objective of CLT as articulated by several researchers: "communicative competence" (Jack C. Richards, 2006). As a result, they've changed the definitions of the teacher's function, the learner's role, language learning and teaching the target language, the classroom setting, and the procedures that must be used to maximize the learning process.

Yalden (1983) divided the growth of various types of curriculum content into eight categories. The interactive method that outlines skills like integrated process of training, offers meaningful context in language classes, and highlights learners' needs and interests is a common theme in all of these communicative language teaching curriculum (Michael P. Breen and Christopher N. Candlin, 1980; Munby, 1976). Even though primary focus is on target language exposure (Finocchiaro and Brumfit, 1983; Jack C. Richards, 2006), teachers are allowed to utilize native language to facilitate communication or maintain learners' motivation. Furthermore, there are still a lot of misconceptions concerning communicative curricular ideas, such as the idea that using your native tongue in English classrooms is not allowed (Wen Wu, 2008; Geoff Thompson, 1996; Prabhu, 1987). Learners are not expected to remember dialogues, but rather to use them as models. A communicative curriculum also includes stimulations, role plays, group and pair work and task-based activities that are aimed at developing communicative skills (Jack C. Richards and Rodgers, 2001; Stemler, 2001; Erdem, 2010).

Class size, grammar-based assessments, and teachers' limited access to actual language were all highlighted as barriers to utilizing CLT in a research done in Vietnam. Another study revealed that EFL countries like South Korea need to consider changing their fundamental approach to teaching before CLT can be incorporated, because the high prevalence of using grammar-translation method in Korea does not provide a foundation for the learner-centered, problem-solving and fluency-focused activities necessary by CLT (Li, 1998:66, as mentioned in Wei, 2011). Many decades have passed since the CLT approach was introduced in Korea, according to Vasilopoulos (2008), despite educational reform and the passing of time, many people

remain suspicious about communicative methodology's efficiency in Korean English language classrooms.

The urge for CLT adoption in China was not coincidental; it sprang from a pressing educational need. This issue stemmed from the old grammar-oriented method's poor teaching results (Liao, 2000). The CLT method was met with several obstacles in China, according to Liao, who quotes Hird (1995) as noting that instructors thought it was impossible to embrace CLT due to China's unique characteristics. Instructors' unwillingness to teach communicatively and test pressure centered on grammar were among these traits... And then perhaps it's for the best, since China's English language education environment is significantly different from the one that originated and developed the communicative method. According to the facts mentioned above, to plan and deliver successful lessons that improve learners' speaking skills completely depend on instructors' level of knowledge and communicative competence.

According to Akram and Mehmood (2011: 175), an experimental research was undertaken in Pakistan to determine the value of including the communicative method into ELT teacher training programs. They claim that CLT boosts students' confidence and offers teachers a sense of accomplishment in that they were effective in getting pupils to utilize the foreign language in their conversations. CLT clarifies the expression... The communicative approach approach is superior to all other language teaching methods in general, and the Grammar Translation Method (GTM) in general, because the GTM focuses on teaching about language rather than language itself, whereas the communicative language teaching creates a direct link between experience and expression.

Despite the fact that some issues remain, the analysis of linked literature on CLT gives adequate confirmation of its utility in English language instruction. In this case, it is necessary to assess the viability of using a communicative approach in non-native nations where conventional ELT technique is still in use.

The Research Method and Participants

This study used a qualitative research, namely a case study. To get a more in-depth understanding of English instructors' perspectives on communicative language teaching in Kazakhstani context. The descriptive research method was created to quantitatively analyze the research topic underlying the work. It was conducted among ten English teachers from ten different schools in Almaty city. All of the teachers work in secondary schools and have a significant experience. All of them were female. The teachers were interviewed about the use of CLT in their classes. Pseudonyms were utilized for the teachers. During the interview, the teachers were not asked any theoretical questions. The questions were neutral as followings:

1. What is the place of CLT (communicative language teaching) in your teaching?

2.What kind of communicative methods(approaches) do you use to conduct effective lessons?

3. What issues do teachers have to face developing learners' speaking skills?

4.What kind of approaches are beneficial to develop learner's speaking skills?

5. What features do teachers need to improve learners' communicative competence?

The idea was to get their thoughts and see if they complied with the findings in the literature review. The data from the interviews were thoroughly collected and analyzed. In the last section of the study, the interview evaluation was discussed and debated.

Results

The teachers in the study asserted that CLT is a part of each updated English lesson, but this depends on teacher's language and methodological competence. Nowadays, the state program and textbooks are based on CLT methodology. Each lesson requires detailed planning and choosing effective methods.

The first question about the place of CLT in teaching did not surprise the respondents, but some of them challenged to answer that question, because todays FLT methodology mostly use integrated methods of teaching foreign language. Therefore, textbooks are designed using mixed types of approaches. That's why they could not differ CLT methods from other approaches of FLT.

The second question about the types of communicative methods made the topic more understandable, because the respondents started to differentiate the features of CLT and gave clear answers. According to the interview results the most popular kinds of CLT are role plays, dialogues, information gap activities and surveys. However, some of the respondents claimed they did not know that they had been using CLT methods.

The third question about the problems in developing learner's speaking skills defined several issues as followings:

- lack of confidence in making speech;
- lack of language level of both learners and teachers;
- lack of responsibility in learning language;
- lack of time and language resources.

The forth question about beneficial approaches for developing learner's speaking skills showed that each teacher has methods which they use repeatedly at each lesson. The usage of CLT in FLT is still needed to be improved.

The fifth question of the interview revealed that teachers need some special features to improve learners' communicative competence. They are as the followings:

-teachers should have high language competence;

-teachers should be competent in speaking themselves;

-teachers should be competent in CLT methodology;

-teachers should be able to create cozy speaking environment;

-teachers should be able to organize each communicative activity with effective strategies.

There are a lot of features which should have a teacher to improve communicative competence of learners, the mentioned reasons above are taken from the answers of respondents of the study.

Conclusion

Despite the fact that CLT methodology has a long history in FLT it still needs to be introduced to teachers in Kazakhstan. Language teachers use some of CLT methods not recognizing its methodological background. The study showed that the most popular communicative methods are role plays, dialogues and group works in the target country. These findings point that the other CLT approaches and strategies should be implemented in FLT lessons by Kazakhstani teachers, because the effectiveness of CLT methodology has long been proved by different scientists all over the world.

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THE STATE OF THE PROBLEM IN THE PEDAGOGICAL THEORY OF SCHOOL PRACTICE

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DER ZUSTAND DES PROBLEMS IN DER PÄDAGOGISCHEN THEORIE DER SCHULPRAXIS

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Abstract

The concept of "culture" in the philosophical encyclopedic dictionary is interpreted as a specific way of organizing and developing human life, represented in the products of material and spiritual labor, in the system of social norms and institutions, in spiritual values, in the totality of people's relations to nature, to each other and to themselves.

Anmerkung

Der Begriff „Kultur" im philosophischen Lexikon wird als spezifische Art der Organisation und Entwicklung des menschlichen Lebens interpretiert, dargestellt in den Produkten materieller und geistiger Arbeit, im System sozialer Normen und Institutionen, in geistigen Werten, in der Gesamtheit der Beziehungen der Menschen zur Natur, zueinander und zu sich selbst.

Keyword: economics, pedagogy, psychology, culture, philosophy, technology, educational process, literature.

Stichwort: Ökonomie, Pädagogik, Psychologie, Kultur, Philosophie, Technik, Bildungsprozess, Literatur.

Die grundlegende Position Usbekistans ist - ohne alles Nützliche, das durch die Welterfahrung angesammelt wurde, abzulehnen - die Wahl seines eigenen Weges der sozioökonomischen Entwicklung.

Eine Analyse des Standes des Problems der Herausbildung der Wirtschaftskultur von Kindern und Jugendlichen ermöglichte es, eine Reihe von Mängeln zu identifizieren. Dies liegt daran, dass die Wirtschaftskultur der Schüler im Prozess

außerschulische Arbeit wurde von der Wissenschaft nicht untersucht. Eine Reihe von Fragen bleibt offen und noch nicht vollständig entwickelt. Beispielsweise werden die Interaktion von Lehrer und Eltern bei der Bildung der Wirtschaftskultur von Schülern und die Möglichkeit einer zusätzlichen Ausbildung von Kindern im Bereich Wirtschaft nicht berücksichtigt.

Es bestehen also Widersprüche zwischen:

- gestiegene Anforderungen der Gesellschaft an

Wirtschaftskultur der Schüler, und unzureichende theoretische und

praktische Entwicklung von Formen und Mitteln

diese Art von Kultur;

– eine zunehmende Zahl methodischer Weiterentwicklungen auf

wirtschaftliche Bildung der jüngeren Generation und unzureichend

ihre wissenschaftliche und methodische Begründung.

Die Frage ist, welche Wege und Methoden sowie auf der Grundlage von

welche Inhalte die Wirtschaftskultur von Schulkindern zu bilden

der Prozess der außerschulischen Arbeit bleibt offen.

Der Problemstellung entsprechend wurden folgende Aufgaben festgelegt: 1. Den Begriff „Wirtschaftskultur eines Schulkindes“ in der psychologischen und pädagogischen Forschung zu berücksichtigen. 2. Untersuchung der psychologischen Aspekte und Merkmale der Bildung der Wirtschaftskultur bei Schulkindern in außerschulischen Aktivitäten. 3. Entwickeln und testen Sie ein zusätzliches Bildungsprogramm, das in außerschulischen Aktivitäten implementiert wird.

Kultur (lat. cultura) bedeutet wörtlich „Anbau“, „Verarbeitung“. Es wurde erstmals von dem antiken Philosophen Cicero in die wissenschaftliche Zirkulation eingeführt und implizierte den gezielten Einfluss des Menschen auf die Natur sowie die Erziehung und Bildung des Menschen selbst.

Derzeit gibt es mehr als 250 Definitionen von Kultur [2], was von der realen Komplexität dieses Phänomens und seiner Einbettung in zahlreiche gesellschaftliche Kontexte und damit letztlich von seiner Universalität zeugt.

Der Begriff „Kultur“ im philosophischen Lexikon wird als spezifische Art der Organisation und Entwicklung des menschlichen Lebens interpretiert, dargestellt in den Produkten materieller und geistiger Arbeit, im System sozialer Normen und Institutionen, in geistigen Werten, in der Gesamtheit der Beziehungen der Menschen zur Natur, zueinander und zu sich selbst[3].

Aus bildungskulturwissenschaftlicher Sicht ist Kultur die Summe der geistigen Errungenschaften der Menschheit, das Ergebnis und der Prozess der Kreativität, der schöpferische Selbstausdruck des Menschen, das Gedächtnis der Menschheit, die Gesamtheit der Zeichensysteme, die Gesamtheit materieller und geistiger Werte, der inneren Errungenschaften des Einzelnen, die an die Summe der Errungenschaften der Gesellschaft anknüpft. Unser Forschungsgebiet ist die Wirtschaftskultur jüngerer Schülerinnen und Schüler. Um sein Wesen zu bestimmen, ist es notwendig, den Inhalt des Begriffs "Wirtschaftskultur" zu klären.

Eine Analyse der philosophischen, soziologischen und pädagogischen Literatur zum Problem der Entstehung der Wirtschaftskultur zeigte unterschiedliche Ansätze zur Definition des Wesens des Begriffs "Wirtschaftskultur" in Bezug auf seine Merkmale, die unterschiedliche Richtungen in der theoretischen Entwicklung widerspiegeln Forschung auf dem Gebiet der allgemeinen Kultur.

Für die Anhänger des „persönlichen“ Ansatzes ist Kultur der persönliche Aspekt der menschlichen Existenz, der Prozess der schöpferischen Tätigkeit, die Erschaffung der menschlichen Welt durch den Menschen. Ausgehend von der Interpretation der Kultur als einem bestimmten Maß für die Bildung, Entwicklung und Verwirklichung der wesentlichen Kräfte eines Menschen in seiner sozialen Aktivität wird auch seine Rolle in der Entwicklung des Individuums offenbart. Kultur wirkt nach diesem Ansatz als Mittel zur Bildung von Fähigkeiten, Bedürfnissen, Gefühlen, also den sozialen Kräften einer Person. Dieser Ansatz Sysoeva A.A. betrachtet Wirtschaftskultur als „eine Reihe von intellektuellen, praktischen und emotional wertvollen Komponenten, die es dem Individuum ermöglichen, sich in wirtschaftlichem Handeln und Verhalten selbst zu verwirklichen, sich anzupassen und sich in bestehende und vorhergesagte sozioökonomische Bedingungen zu integrieren, unter Berücksichtigung der moralischen und moralischen Einstellungen der Gesellschaft." [11]L. N. Ponomarev betont, dass die Wirtschaftskultur das wichtigste Mittel der Selbstentfaltung ist, da ein Mensch mit einer wohlgeformten Wirtschaftskultur nicht nur kulturelle Werte schafft, bereichert und konsumiert, sondern im Prozess seiner Entwicklung auch zu einem höheren Maß an Freiheit aufsteigt [1].

Der „technologische“ Ansatz betrachtet Kultur im Gegensatz zum persönlichen als Weg (Technologie) und als Ergebnis von Aktivität. Diese Position spiegelt sich in der Bezeichnung der Wirtschaftskultur als organisch wider (Wissen, Überzeugung und schöpferische praktische Tätigkeit, sowie die Ergebnisse dieser Tätigkeit, die von Menschen im Zuge der gesellschaftlichen Entwicklung geschaffen werden. Einige Forscher in der Definition der Wirtschaftskultur betonen, dass sie eine der Arten der allgemeinen Kultur

ist und aufgrund spezifischer Unterschiede inhaltlich gemeinsame generische Merkmale aufweist: Wissen, die humanistische Ausrichtung der Assimilation und Entwicklung von Wissen, ihre Anwendung in der Praxis Aktivitäten. So versteht M. Vladyka Wirtschaftskultur als eine Reihe von Wegen, Formen und Ergebnissen der Tätigkeit eines Individuums im Bereich der Wirtschaft, die kulturelle wirtschaftliche Werte schafft und eine universelle Form der menschlichen sozialen Entwicklung darstellt. A. S. Kondykov, der die Bedeutung des wirtschaftlichen Denkens betont, definiert die Wirtschaftskultur als die Einheit von wirtschaftlichem Wissen, wirtschaftlichem Denken, Überzeugungen, Fähigkeiten und Fertigkeiten mit aktiver Arbeit[9].

Eine detaillierte Definition der Wirtschaftskultur findet sich in seinem Werk von T. N. Skiba. Ihrer Meinung nach „gehört die Wirtschaftskultur zu den Bereichen der Berufskultur, die einen historisch gewachsenen Bildungs-, Erziehungs- und Entwicklungsprozess darstellt, der auf von Menschen geschaffenen wirtschaftlichen Normen, Regeln, Anforderungen und Methoden beruht, die mit Tätigkeiten zur Erzeugung von Leben verbunden sind (Ernährung), verankert im ökonomischen Bewusstsein (theoretisches Wissen, praktische Fertigkeiten und Fähigkeiten – die das „Fundament“ der ökonomischen Bildung darstellen), sowie in direktem Zusammenhang mit der Umsetzung dieses Wissens im sozioökonomischen Bereich.

Diese Herangehensweise an die Definition von Wirtschaftskultur halten wir für nicht gerechtfertigt, da es unserer Meinung nach nicht hinnehmbar ist, Wirtschaftskultur auf ein Subsystem der Berufskultur zu reduzieren.

Im Lichte moderner Trends sind neue Ansätze zur Definition von Wirtschaftskultur entstanden. Wissenschaftler L.Sh. Losowski, B.A. Raizberg, E.B. Starodubtseva interpretiert Wirtschaftskultur als ein System von Werten und Anreizen für wirtschaftliche Aktivitäten, Respekt vor jeder Form von Eigentum und kommerziellem Erfolg als große soziale Errungenschaft, Schaffung und Entwicklung eines sozialen Umfelds für Unternehmertum [1].

Diese Definition der Wirtschaftskultur wird unserer Meinung nach unter Berücksichtigung moderner sozioökonomischer Bedingungen interpretiert und spiegelt die marktwirtschaftliche Seite der gesellschaftlichen Beziehungen wider.

Unter Berücksichtigung des Vorstehenden halten wir es daher für möglich, die Wirtschaftskultur als qualitatives Merkmal einer Person zu definieren, das den Grad der Bildung wirtschaftlicher Kenntnisse, Fähigkeiten und Fertigkeiten der praktischen Wirtschaftstätigkeit, die Entwicklung des wirtschaftlichen Denkens und Bewusstseins, die zeigt Grad der Verwirklichung wirtschaftlich bedeutsamer Eigenschaften einer Person im Bereich der gesellschaftlichen Produktion, Verteilung, Tausch und Konsumtion[7].

Eine detaillierte Beschreibung der Altersmerkmale jüngerer Schulkinder ist in den Arbeiten der prominenten Psychologen L.I. Bozhovich, V.V. Davydova, A.N. Leontjew, V.A. Krutetsky, N.S. Leitis, A.A. Lublinskaja und andere. Es ist bekannt, dass sich mit zunehmendem Alter nicht nur die körperlichen Merkmale von Kindern qualitativ verändern, sondern auch ihre Psyche, Merkmale der Wahrnehmung, des Denkens, des Gedächtnisses, der Lernaktivitäten, der Beziehungen zu anderen und schließlich das Niveau und die Tiefe des eigenen Wissens und Verständnis der umgebenden Realität.

Betrachten wir den Einfluss und die Bedeutung der Altersmerkmale jüngerer Schulkinder auf die Bildung der Grundlagen der Wirtschaftskultur, wobei wir uns bewusst machen, dass das Wirtschaftsleben ihre natürliche und alltägliche Umgebung ist. Darauf aufbauend sollte die ökonomische Bildung und Erziehung darauf ausgerichtet sein, neben der Vertrautmachung mit ökonomischen Begriffen und Kategorien die von ihnen im Alltag erworbenen eigenen Lebenserfahrungen zu systematisieren, zu vertiefen und nachzuvollziehen, um eine in sich adäquate Wirtschaftskultur zu formen den psychologischen Fähigkeiten eines jüngeren Schülers entsprechen.

Der Bildungsprozess an einer allgemeinbildenden Schule sollte daher eine individuelle Ansprache und Differenzierung der Schülerinnen und Schüler nach Altersgruppen unter Berücksichtigung der Komplexität der zu lösenden Aufgaben vorsehen. Die Notwendigkeit, diese Merkmale bei der wirtschaftlichen Bildung zu berücksichtigen, bedeutet die Verwendung solcher Organisationsformen, Methoden und Mittel, die den Bedürfnissen und Fähigkeiten eines bestimmten Alters entsprechen [8].

Als Ergebnis der gemeinsamen Aktivitäten von Familie, vorschulischen Einrichtungen und zusätzlichen Strukturen der vorschulischen Erziehung haben Kinder zu Beginn der Schulzeit ein aktives Interesse an den Phänomenen der sozioökonomischen Realität. Sie sind in der Lage, wirtschaftliches Denken zu zeigen, ein gesundes Interesse an Geld, sie sind bereit, das Verhältnis "Arbeit - Geld", die Unmöglichkeit, alle Bedürfnisse zu befriedigen, zu erkennen, sie erkennen die Fakten des Kaufens und Verkaufens, sie bekommen erste Vorstellungen über einige Berufe im Zusammenhang mit dem Wirtschaftsleben der Gesellschaft (Kassierer, Verkäufer, Manager, Buchhalter usw.).

Eine wichtige Voraussetzung für den Erfolg der Umsetzung der wirtschaftlichen Bildung sowie jeder anderen Richtung des pädagogischen Prozesses ist die Aktualität der Umsetzung des pädagogischen Einflusses, die Einbeziehung des Kindes in Aktivitäten zur Erreichung bestimmter pädagogischer Ziele. "Man kann kein Fach zu früh unterrichten, ... man kann kein Fach zu spät unterrichten, es gibt immer das beste Alter zum Lernen.

Moderne Psychologen und Pädagogen sind einhellig zu dem Schluss gekommen, dass das Interesse und die Neigung zu ökonomischen Kenntnissen und Fähigkeiten stark vom Alter der Kinder abhängen (im Alter von 13-14 Jahren nimmt das Interesse an systematischer Arbeit ab, während mit 7- 9 Jahre ist das Kind voller Arbeitsbegeisterung), ist es sinnvoll,

jüngere Schulkinder aktiver in die Arbeitsbeziehungen einzubeziehen und dabei ihren wirtschaftlichen Aspekt bewusst zu berücksichtigen. Das können Elternarbeit rund ums Haus, im Garten, auf der Post, in der Bücherei, Besorgungen im Laden, andere gemeinsame Arbeiten sein, ergänzt durch Gespräche, Gespräche über Wirtschaftsthemen, Erklärungen von Wirtschaftsbegriffen etc[13,14].

Es bilden sich auch elementare persönliche Manifestationen: Zum Zeitpunkt des Schuleintritts haben Kinder bereits eine gewisse Ausdauer, können sich entferntere Ziele setzen und diese erreichen (obwohl sie die Aufgabe oft nicht erfüllen), die ersten Versuche unternehmen, Handlungen von der zu bewerten Sie sind von ihrer gesellschaftlichen Bedeutung her durch erste Äußerungen eines Pflichtgefühls, einer Verantwortung gekennzeichnet. Es besteht ein großer Wunsch nach nützlichen Aktivitäten, seine sozioökonomischen Motive entwickeln sich.

Die eigene Erfahrung mit der Beobachtung des objektiven realen Lebens ist ebenfalls ausreichend und beinhaltet sicherlich die Vertrautheit mit einer beträchtlichen Anzahl wirtschaftlicher Konzepte und Phänomene. Die Möglichkeiten der Kinder bis zum Schuleintritt sind daher groß genug, um mit einer systematischen wirtschaftlichen Bildung und Erziehung zu beginnen.

Es ist bekannt, dass die Wahrnehmung von Schülern zu Beginn des Grundschulalters erstens dramatisch ansteigt, unterstützt durch die praktischen Aktivitäten des Kindes, und zweitens Emotionalität der wichtigste Katalysator für Wahrnehmung ist.

Daher ist es notwendig, in der wirtschaftlichen Vorbereitung von Kindern visuelle, anschauliche, lebendige Informationen zu verwenden, die besser, deutlicher, emotionaler wahrgenommen werden als beispielsweise symbolische Schemata und Bilder, es ist notwendig, praktische Methoden anzuwenden, die das aktivieren Aktivitäten des Kindes, verschiedene Spielformen, nicht-traditionelle Aufgaben, die es Ihnen ermöglichen, die Aufmerksamkeit des Kindes auf die studierten Wirtschaftskonzepte zu konzentrieren. Verweise auf die eigene wirtschaftliche Erfahrung des Kindes sollten als sehr ergiebig angesehen werden.

Das Hauptmerkmal der Aufmerksamkeit ist die Schwäche der freiwilligen Aufmerksamkeit. Ein jüngerer Schüler kann sich nur dann zu konzentriertem Arbeiten zwingen, wenn eine gute Motivation vorhanden ist (Aussicht auf eine Eins, Lob des Lehrers, Bestes zu tun usw.). Die unwillkürliche Aufmerksamkeit ist in diesem Alter viel besser entwickelt .

Daher ist die wichtigste Bedingung für die Organisation von Aufmerksamkeit im Prozess der ökonomischen Bildung die Sichtbarkeit des Lernens, die Verwendung neuer, heller, auffälliger visueller Hilfsmittel. Die Bekanntschaft mit solchen abstrakten Konzepten wie "Budget", "Plan", "Gewinn" und anderen erfordert die umfassende Verwendung von Illustrationen, Zeichnungen und Plakaten. Wir müssen uns jedoch daran erinnern, dass jüngere Schüler sehr beeinflussbar sind. Sehr lebhafte visuelle Eindrücke können mitunter einen derartigen Erregungsherd in der Großhirnrinde erzeugen, dass dadurch jede Möglichkeit des Verständnisses der Erklärung gehemmt wird.

Ein weiteres wichtiges altersbedingtes Aufmerksamkeitsmerkmal ist seine relativ geringe Stabilität. Daher müssen mündliche Erklärungen komplexer und abstrakter wirtschaftlicher Konzepte mit praktischer Arbeit, Wettbewerben, Problemlösungen usw. abgewechselt werden. Eine abwechslungsreiche Arbeit weckt die Aufmerksamkeit der Schüler und steigert das Interesse an wirtschaftswissenschaftlichen Kenntnissen.

Dadurch, dass sich das Gedächtnis im Grundschulalter unter dem Einfluss des Lernens in zwei Richtungen entwickelt: Die Rolle und das spezifische Gewicht des verbal-logischen, semantischen Gedächtnisses (im Vergleich zum visuell-figurativen Gedächtnis) wird verstärkt, das Kind ergreift die Fähigkeit, seine bewusst zu steuern Gedächtnis und Regulierung seiner Manifestationen (Memorieren, Reproduzieren, Erinnern) zwingt den Lehrer, die Einführung abstrakter Konzepte und konkretes Material vernünftig und ausgewogen zu korrelieren, mündliche Erklärungen und visuelle Hilfsmittel zu verwenden.

Die Neigung jüngerer Schüler zum mechanischen Auswendiglernen, durch einfaches Wiederholen, ohne die semantischen Zusammenhänge innerhalb des auswendig gelernten Materials zu verstehen, erfordert eine konsequente und vernünftige und vor allem logische Einführung neuer ökonomischer Konzepte, die Bildung von ökonomischem Wissen bei den jüngeren Schülern ein System.

Schließlich ist die wichtigste Voraussetzung und Bedingung für die ökonomische Bildung, dass im Grundschulalter eine intensive Denkentwicklung stattfindet. Die Entwicklung des Denkens führt zu einer qualitativen Umstrukturierung von Wahrnehmung und Gedächtnis, zu ihrer Umwandlung in willkürliche, geregelte Prozesse. Ein Kind im Alter von 7-8 Jahren denkt normalerweise in bestimmten Kategorien, während es sich auf die visuellen Eigenschaften und Qualitäten bestimmter Objekte und Phänomene verlässt, was es ihm letztendlich ermöglicht, ein ernsthaftes und konsequentes Studium wirtschaftlicher Phänomene zu beginnen, die für ein Kind schwierig sind. Dieser Umstand zwingt auch dazu, eigene und konkrete Erfahrungen und Spiele im Prozess der ökonomischen Bildung einzusetzen.

So kann die Bildung der Grundlagen der Wirtschaftskultur als qualitatives Merkmal einer Person, die den Grad der Bildung wirtschaftlicher Kenntnisse, Fähigkeiten und Fertigkeiten praktischer wirtschaftlicher Tätigkeit, die Entwicklung des wirtschaftlichen Denkens und Bewusstseins zeigt, durchaus in der Grundschule umgesetzt werden Schulalter, da es alle notwendigen psychologischen und pädagogischen Parameter dieses Alters erfüllt.

In sozialer Hinsicht ist die persönliche Konsumkultur ein integraler Bestandteil der allgemeinen und wirtschaftlichen Kultur. Als besonderes kulturelles Phänomen integriert es die

soziale und individuelle Qualität eines Menschen, die seine Einstellung zur umgebenden wirtschaftlichen Realität widerspiegelt und sich in der individuellen Teilnahme an praktischen Aktivitäten manifestiert, um zu lernen, zu meistern, die Erfahrung seines Verhaltens im Prozess zu transformieren sozialadäquate Anwendung ökonomischen Wissens.

Sozialpädagogisch gesehen ist die Herausbildung einer persönlichen Konsumkultur ein sozialpsychologischer Prozess, der sowohl unter dem Einfluss objektiver Einflussfaktoren des sozialen Umfelds als auch subjektiver Bedingungen für die zielgerichtete Gestaltung des Miteinanders und des geistig-praktischen Handelns abläuft das Individuum selbst im Bereich des sozioökonomischen Verhaltens[6].

Die besondere (gezielte) Einbeziehung des Bildungssystems in die Lösung des Problems der Erziehung einer persönlichen Konsumkultur bei jüngeren Schulkindern ist auf das gesellschaftliche Bedürfnis zurückzuführen, von Kindheit an Fähigkeiten und ein emotional angemessenes und rationales Konsumverhalten zu vermitteln, um eine Werteposition zu bilden, a verantwortungsvolle Einstellung des Einzelnen zur Arbeit und ihren Ergebnissen.

Die pädagogische Gestaltung eines Systems der zielgerichteten Erziehung einer persönlichen Konsumkultur sieht eine klare Definition spezifischer Aufgaben für die Entwicklung eines kulturell gebildeten Verbrauchers vor, einschließlich der Entwicklung seines persönlichen Bewertungsbewusstseins (Positionen und Beziehungen) und des Erlebens von Vernünftigem Verhalten, in der Einheit von Inhalten, Formen und Methoden, um einer Person die Methoden angemessener (ökonomisch gebildeter) Handlungen und Interaktionen mit der Objektwelt beizubringen. Eine solche Erziehung kann von einem jüngeren Schüler sowohl in der Arbeitswelt als auch in der Welt des rationellen Konsums von Arbeitsprodukten, in der Einheit dieser beiden Welten in sozial und wirtschaftlich orientierten Aktivitäten, sinnvoller Kommunikation und Selbsterkenntnis erfolgen Bildungsraum.

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PHILOLOGICAL SCIENCES

THE USAGE OF ELISION IN ENGLISH LEXICOLOGY

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ИСПОЛЬЗОВАНИЕ СЛОВА ЭЛИЗИЙ В АНГЛИЙСКОЙ ЛЕКСИКОЛОГИИ

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Abstract

The article elaborates elision which is characterized by the omission of vowels and consonants, even syllables from the word. It has been noted that there is a subtle difference between elision and contraction. Though both of them are observed with apostrophe, contraction may sometimes not be used with apostrophe. There is usually an apostrophe instead of the missing letter in an elision. The article underlies that contraction usually serves to form one word from two successive words while elision does not have such a function. The goal of both elision and contraction is the same- shortening of the words or phrases. The phenomenon of elision may happen in some styles of speaking including rapid speech, spontaneous speech, allegro speech, casual speech. Therefore, lyrics of rap hits and hip-hop songs are abundant with elisions. Besides, it should be noted that elision may emerge by omission of initial, middle and final letters or syllables of words or phrases.

Аннотация

В статье разрабатывается элизия, которая характеризуется пропуском гласных и согласных, даже слогов в слове. Было отмечено, что существует тонкая разница между элизией и сокращением. Хотя оба они наблюдаются с апострофом, сокращение иногда может не использоваться с апострофом. Обычно вместо пропущенной буквы в элизии ставится апостроф. В статье подчеркивается, что сокращение обычно служит для образования одного слова из двух следующих друг за другом слов, в то время как элизия не имеет такой функции. Цель как исключения, так и сокращения одна и та же — сокращение слов или фраз. Явление элизии может возникать в некоторых стилях речи, включая быструю речь, спонтанную речь, аллегро, случайную речь. Поэтому тексты рэп-хитов и хип-хоп песен изобилуют оговорками. Кроме того, следует отметить, что элизия может возникнуть путем пропуска начальных, средних и последних букв или слогов слов или словосочетаний.

Keywords: elision, contraction, omission, consonant, vowel, syllable, apostrophe
Ключевые слова: элизия , сокращение, опущение, согласный, гласный, слог, апостроф.

Before starting to focus on the subject matter of the topic to be researched in the article, we had better identify the definition of "elision". An elision or deletion is broadly defined as the omission of one or more sounds such as a vowel, a consonant, or a whole syllable in a word or phrase [2] Analyzing the definition of elision, we revealed that an elision is the omission of unstressed vowels, consonants from a word or phrase in order to decrease the number of letters or syllables while mixing the words together. There is usually an apostrophe instead of the missing letter. In general, the initial or the final letter or the middle letter is omitted or two words are merged together and an apostrophe is put between the remaining letters. Shokey claims in his book: "Elision is not an all-or-nothing process: Elision is more likely to occur in some styles of speaking and less likely in others" [7, p.14].

In fact, elision is often found in rapid speech, spontaneous speech, allegro speech, casual speech [1]. This is one of the reasons why the lyrics of rap hits and hip-hop songs are rich in elisions.

Sometimes contraction may be confused with elision. At the first glance, they are both the same though there is a noticeable distinction among contraction and elision. Contraction serves to combine two successive words to form a shorter word. For example, "aren't" is the contracted form of "are not". In other words, it is possible to guess this as "are + not = aren't".

Unlike contraction, an elision is a more specific term which is observed with the elimination of letters or sounds and substitution of them with an apostrophe. For instance, "o'er" is the elided form of the word "over". The same rule may be imposed to the word "ne'er" which is the elided form of "never". As obvious, the letter "v" has been eliminated from the word and replaced with the apostrophe.

In fact, the purpose of both contraction and elision is to shorten the words. If we explain the difference between the contraction and elision, it is possible to claim that two independent words generate one word in contraction while the shortening process occurs within one or two combined words in an elision. E.g. "wanna" in American English is the contracted form of the word "want to". Likewise, "gonna" is the shortened form of " going to". Unfortunately, "gonna" is mistreated as a contraction in some "reliable" sources. Apostrophe may not be used in a contraction. As we see, there is not any apostrophe in the formation of the word "gonna" or "wanna" while elision is characteristic with apostrophe. However, we can sometimes encounter elisions formed from the combination of two words as well. Such elisions are usually used in song lyrics and in poems in literature.

Except colloquial language, it is possible to take a myriad of examples for elisions both in poetry and prose in literature. Therefore, some words in the poem "The Rime of ancient mariner" by Samuel Taylor Coleridge" are characterized with the phenomenon "elision. For instance,

And now the STORM-BLAST came, and he
Was tyrannous and strong:
He struck with his o'ertaking wings,
And clashed us south along [6].

In the third line of the poem, the word "o'ertaking" is the elided form of "overtaking".

In the sonnet 141, William Shakespeare used an elision which can be seen in modern song lyrics as well. For instance,

In faith, I do not love thee with mine eyes,
For they in thee a thousand errors note;
But 'tis my heart loves what they despise,
Who, in despite of view, is pleased to dote; [3].

As can be seen from the third line, the word 'tis is the elision of "it is". This elided word is often used in current song lyrics,too.

Elision is not seen only in literary language. The examples for elision can also be taken for song lyrics, especially, the lyrics of the popular rap hits which are rich in elisions. A song named "Runnin' (Lose it all) " by Beyonce contains elisions. For example, [5]

I have been callin' you
I have been missin' you
Where else can I go?
Chasin' you, chasin' you

As seen from the above-mentioned lyrics of the song, the letter "g" has been omitted from the end of the word. Even the name of the song "Runnin' (Lose it all)" has been elided.

Another song lyrics by name "Don't cha" by the Pussy Cat Dolls host elision as follows; [4]

Shortly all on me 'cause it's hard to resist the kid
I got an idea that's dope for y'all.

In the first line of the lyrics of the song shown above, there is an elided word 'cause in the middle of the sentence. As known, the first two letters "be" have been eliminated from the word. Hence the word "because" has been shortened and formed an elision. In the second line "y'all" is an elided word derived from "you all"

In conclusion, it is possible set forth an idea that the most omitted letter is "v" often from the middle of a word or a phrase. But other consonants and vowels, as well as syllables can also be omitted and form an elision.

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PHYSICAL SCIENCES

PRINCIPLES OF CONSTRUCTION AND DESIGN OF DEVICES FOR CONVERSION OF SPECTRA AND IMAGE SCALE

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Abstract
The article discusses the principles of construction of electron-optical converters of spectra and scales of images, the description of their structures and methods of theoretical research. It is noted that electron-optical converters are used to visualize images from the infrared or ultraviolet regions of the light spectrum invisible to ordinary vision, and electron microscopes are used to transfer images from invisible micron or submicron sizes to the area of sizes convenient for visual studies. The paper also notes possible ways to improve these devices.

Keywords: electron-optical converter, scale, image, photocathode, electric field, spectrum, device.

Electron-optical conversion of spectra and image scales is currently widely used to solve various scientific and technological problems. For example, to visualize images from the infrared or ultraviolet regions of the light spectrum that are invisible to ordinary vision, electron-optical converters (EOCs) are used [1, 2]. Electron microscopes are used to transfer images from invisible micron or submicron sizes to the size convenient for visual studies [3]. The solution of problems in the technology of production of nano- and microelectronic products is carried out using the processes of ion lithography, ion implantation, etc., in which the processes of focusing charged particle beams or converting their energy are also widely used [4]. Examples can be continued, see, for example, [5-11]. Further in the paper, the principles of operation of some of these devices and note possible ways to improve them will be considered.

As noted above, an EOC is an electrovacuum device for converting an image invisible to the eye (in the vicinity, infrared, ultraviolet or X-ray range) into a visible one or to enhance the brightness of the image. An EOC contains: a photocathode, an electric field and a luminescent screen on which an intensified image is reproduced.

By means of a photocathode in EOC, there is a double image conversion: an optical image or an X-ray image will be converted into an electronic one, which on a luminescent screen will be further converted into a visible or brighter image. The electrons emitted by the cathode are accelerated by the electric field and receive energy sufficient to excite the screen section. Thus, there is an increase in the brightness of the image. The scheme of a flat electron-optical converter is shown in Figure 1 [1].

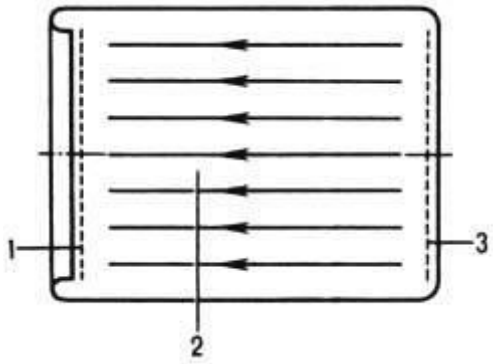

Figure 1 - Scheme of a flat electron-optical converter: 1-photocathode; 2-electric field; 3-luminescent screen.

The spectral features of the sensitivity of the photocathode and the brightness of the glow of the luminescent screen can have maxima in different wavelength ranges, therefore, there is a transfer of image transmission from one area to another.

If the electrons that are released by a separate small element of the photocathode are transferred by an electric field to the corresponding small element of the luminescent screen, then an image is created on the screen, consisting of a number of bright elements, geometrically similar to the image.

Since the current from each element of the photocathode is proportional to the light flux incident on it, and the brightness of the glow of the screen elements

(at a moderate current density) is linearly related to the size of the current coming into it, the distribution of the brightness of the glow on the screen rather accurately reproduces the distribution of illumination on the photocathode. Then the image on the screen, both in form and in brightness, reproduces the image projected onto the photocathode.

With the method of transmitting an electronic image from a photocathode on a luminescent screen, an EOC can be divided into three types: an EOC with parallel image translation by a uniform electrostatic field, an EOC with electrostatic concentration, and an EOC with magnetic concentration.

An elementary EOC with a plane-parallel photocathode and a screen and image transmission by a uniform electrostatic field was not widely used due to many shortcomings: a rather small conversion coefficient, insufficient resolution, and low picture contrast. The increase in h_Φ and the increase in R of the accelerating (anode) intensity are limited by the possibility of electrical breakdown and the appearance of field emission from the cathode. The decrease in contrast is explained by optical feedback: the radiation from the screen illuminates the photocathode, and the contrast-reducing electrons excite the scattered cross section of the screen.

The largest distribution was obtained by EOC with electrostatic focusing, in which the image is transferred by an inhomogeneous electrostatic field, i.e. field of the electronic lens. In these EOC, the field of the immersion (cathode) lens is formed between the photocathode and the anode, which is usually made in the form of a truncated cone with its smaller base facing the cathode; the potential of the anode is equal to the potential of the screen located directly behind the anode. The lens collects the electrons that are released by each point of the photocathode in narrow bundles, which on the screen create a bright image, geometrically similar to the image projected onto the cathode.

An EOC with focusing systems produce fairly good images with a resolution of several tens of line pairs/mm. The lens transmits the image with a reduction several times, which increases the brightness of the screen by 10 times; the existence of an anode electrode with a small hole from the cathode significantly reduces the optical feedback, protecting the cathode from being exposed to radiation from the screen.

The resolution of an EOC with electrostatic focusing and a flat cathode and screen is limited by the deviations of the electronic lenses: two geometric ones - astigmatism and curvature of the image surface - and a chromatic one, caused by the speeds and angles of emission of electrons emitted by the photocathode.

Reduction of deviations, diaphragming in the EOC is impossible, starting with the transmission of the image, which is made by a wide electron beam emerging from the cathode surface and perceived by the entire screen surface. Deviations reduce the resolution limit on the peripheral part of the screen; when removed from the axis, the resolution decreases by 10-15 times.

EOCs have been greatly improved with the use of flat-concave fiberglass plates. The image projected on the flat side of the input fiber optic plate without distortion passes to its concave side, on which the photocathode is created. A scheme of EOC with electrostatic focusing is shown in Figure 2.

On the concave side of the output FOP, the image is transferred to the screen by means of an electronic lens and will be observed relative to its flat side. The concave shape of the cathode and the screen allows to transmit an image with minimal distortion. A single EOC with an FOP at the input and output is referred to as a modular EOC and is widely used in night vision devices.

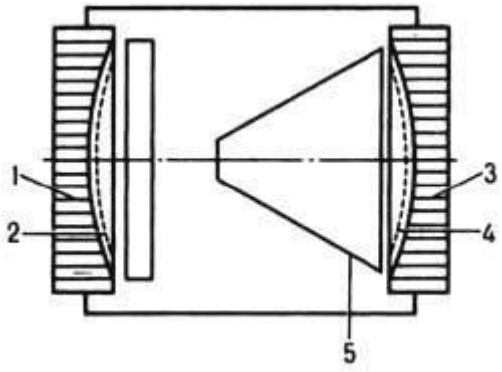

Figure 2 - Scheme of an EOC with electrostatic focusing:
1-input fiber-optic plate (FOP); 2- photocathode; 3 - output FOP; 4-screen; 5 - anode.

X-ray EOCs are significantly different from optical ones. They have a triple image transformation: the optical image received on the main luminescent screen due to the X-ray, which passed through the studied object, excites the photoelectron emission of the photocathode; the electronic image is transferred by an electric field to the output luminescent screen, exciting its glow.

The main luminescent screen is formed on a thin transparent film, on which a photocathode is created on the reverse side, which provides image transmission from the main screen to the photocathode with minimal distortion. The electronic image from the photocathode is transmitted to the screen with a tenfold reduction. The overall enhancement in the X-ray EOC reaches several thousand $cd/m^2 \cdot lx$.

It should be noted that the principle of operation of the image intensifier tube and other electron-optical and ion-beam devices and instruments is based on the

properties of electric and magnetic fields to exert a focusing effect on the flows of charged particles.

In the general case, the motion of charged particles can be described by equations that allow one to describe the coordinates of the motion of an arbitrary particle by the radius vector $\vec{R}(t)$. The Lagrange equation for an arbitrary particle has the form

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \vec{V}}\right)-\frac{\partial L}{\partial \vec{R}}=0, \qquad (1)$$

where t – time, $\vec{V}=\frac{d\vec{R}}{dt}$, L - Lagrangian.

For a charged particle with charge e and mass m_0 in an electric field with a distribution of electric potential φ and vector potential $\vec{A}$, the Langrangian has the form

$$L=-m_0c^2\sqrt{1-\frac{v^2}{c^2}}+e\left(\vec{A}\vec{V}-\varphi\right). \qquad (2)$$

In the last expression: c is a value equal to the speed of light, v is the modulus of the velocity of a charged particle.

In the Cartesian coordinate system x, y and z, the z axis of which coincides with the main optical axis of the studied electron lens or electron-optical (ion-optical) unit, without taking into account the relativistic effect, the following equations can be obtained from the above Lagrange equations

$$\ddot{x}=-\frac{e}{m}\frac{\partial\varphi}{\partial x},\ \ddot{y}=-\frac{e}{m}\frac{\partial\varphi}{\partial y}, \qquad (3)$$

$$\dot{x}^2+\dot{y}^2+\dot{z}^2=-\frac{2e}{m}(\varphi+\varepsilon). \qquad (4)$$

Here, e and m are the charge and mass of the particle, $\varphi = \varphi(x, y, z)$ is the distribution of the electrostatic potential, the dots denote time differentiation, and ε is the value of the initial energy of the charged particle.

In the case of an EOC, the initial conditions of equations (3) and (4) must take into account that the beginning of the movement of charged particles is the moment of their emission from the photocathode. Thus, the initial conditions for a cathode lens have the form

$$x(t)|_{t=0}=x_K,\ y(t)|_{t=0}=y_K,\ z(t)|_{t=0}=z_K, \qquad (5)$$

$$\dot{x}(t)|_{t=0}=\sqrt{-\frac{2e}{m}\varepsilon_X}=\sqrt{-\frac{2e}{m}\varepsilon}\sin\theta\cos\alpha, \qquad (6)$$

$$\dot{y}(t)|_{t=0}=\sqrt{-\frac{2e}{m}\varepsilon_Y}=\sqrt{-\frac{2e}{m}\varepsilon}\sin\theta\sin\alpha, \qquad (7)$$

$$\dot{z}(t)|_{t=0}=\sqrt{-\frac{2e}{m}\varepsilon_Z}=\sqrt{-\frac{2e}{m}\varepsilon}\cos\theta, \qquad (8)$$

where θ - the angle between the direction of emission of the particle emitted by the cathode and the main optical axis, α - the angle between the projection of the initial velocity vector of the particle emitted by the cathode onto the xy plane and the x axis; the index "k" denotes the value of the quantity at t=*0*, i.e. on the cathode.

In the first approximation, we find solutions to linear homogeneous equations, therefore, we take the right parts of these equations equal to zero, then they will take the form:

$$2\Phi x_1''+\Phi' x_1'+\left(\frac{\Phi''}{2}-2\varphi_2\right)x_1=0, \qquad (9)$$

$$2\Phi y_1''+\Phi' y_1'+\left(\frac{\Phi''}{2}+2\varphi_2\right)y_1=0, \qquad (10)$$

$$2\Phi D_{Z1}'-\Phi' D_{Z1}=0. \qquad (11)$$

Index "1" means that the values of quantities are determined in the first approximation, φ_2 is a function characterizing the quadrupole component of the field, primes denote differentiation with respect to the z coordinate.

Taking into account condition (8), the solution to equation (11) will be

$$D_{Z1}=\frac{2}{\Phi_K'}\sqrt{\Phi}\sqrt{\varepsilon_z}. \qquad (12)$$

It can be seen from (12) that D_{z1} is a quantity of the first order of smallness. General solutions of linear homogeneous differential equations of the second order (9) and (10) have the form

$$x_1=a_xU_x+b_xV_x,\ y_1=a_yU_y+b_yV_y, \qquad (13)$$

where a_x, b_x, a_y and b_y are arbitrary constants determined from the initial conditions; U_x, V_x, U_y, and V_y are particular linearly independent solutions of equations (9) and (10).

Further taking into account not only the paraxial components of the focusing field and setting the conditions corresponding to the design problems to particular linearly independent solutions of equations (9) and (10), it is possible to determine the main parameters of the EOC or other designed electron or ion beam devices.

The use of the approaches noted above and taking into account the peculiarities of the distribution of fields makes it possible to further improve the instrumental and technological base of the electronic, radio engineering and a number of other high-tech industries of the modern economy.

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ANALYSIS OF ABERRATION FOCUSING PARAMETERS OF IMMERSION LENSES WITH TWO PLANES OF SYMMETRY

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Abstract

The article discusses the results of numerical studies of new electron-optical elements that provide small aberrations, at least in one direction. A comparative analysis of the corpuscular-optical parameters of electrostatic 4-electrode and 6-electrode immersion lenses with two planes of symmetry, which consist, respectively, of four and six pairs of plate electrodes, located in planes equidistant from the middle plane and parallel to it, was carried out. The studied electron lenses can be used to upgrade analytical electron-optical instruments.

Key words: electron-optical device, electrode, aberration, electronic lens, electric field, symmetry, focusing.

The technical and operational characteristics of electron-optical and ion-beam devices and devices, as is known, depend on the focusing parameters of the electronic lenses included in their composition [1-7]. Therefore, the study of new electron-optical elements with small aberrations, at least in one direction, is an important task in the design of particle-beam technology [8-11].

In this work, we studied the corpuscular-optical parameters of an electrostatic 4-electrode immersion lens with two planes of symmetry, which consists of four pairs of plate electrodes located in planes equidistant from the middle plane and parallel to it. The lens electrodes are separated from each other by slots along the circles, the centers of curvature of which lie on the main optical axis and are located on different sides from the middle electrodes.

The projection of the electrodes of the 4-electrode immersion electron lens onto the *xz* plane of the Cartesian coordinate system *x, y, z* is shown in Figure 1.

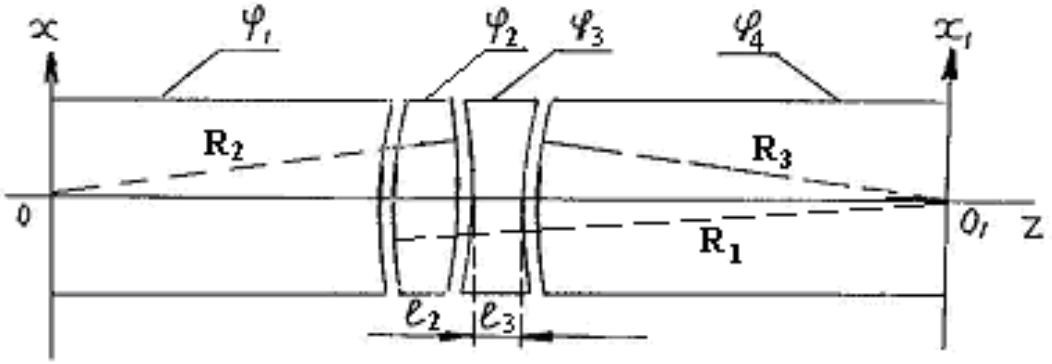

Figure 1 - Projections of the electrodes of a 4-electrode immersion lens

The distribution of the electrostatic potential along the main optical axis *Φ(z)* is determined by the formula

$$\Phi(z) = \beta_I(z) + \beta_{II}(R_1 + l_2 + z) + \beta_{III}(R_1 + l_2 + l_3 + z) + \varphi_2 - \varphi_3 + \varphi_4 \ . \quad (1)$$

Here

$$\beta_I(z) = (\varphi_1 - \varphi_2)R_1 \int_0^\infty \frac{J_1(\lambda R_1)}{ch\left(\frac{\lambda d}{2}\right)} J_0(\lambda z) d\lambda \ , \quad (2)$$

$$\beta_{II}(z) = (\varphi_3 - \varphi_2)R_2 \int_0^\infty \frac{J_1(\lambda R_2)}{ch\left(\frac{\lambda d}{2}\right)} J_0\left(\lambda\left(R_1 + l_2 + z\right)\right) d\lambda \ , \quad (3)$$

$$\beta_{III}(z) = (\varphi_3 - \varphi_4)R_3 \int_0^\infty \frac{J_1(\lambda R_3)}{ch\left(\frac{\lambda d}{2}\right)} J_0\left(\lambda\left(R_1 + l_2 + l_3 + z\right)\right) d\lambda \ , \quad (4)$$

R_1, R_2, R_3 - radii of curvature of the circles along which the electrodes are separated by slots; l_2, l_3 - dimensions of the width of the second and third (middle) electrodes along the line of its intersection with the *yz* plane; *d* - the distance between the planes on which the lens electrodes are located; φ_2, φ_3 - the potential values of the middle electrodes; φ_1, φ_4 - the values of the potentials applied to the extreme electrodes of the lens.

The total aberrations of the calculated lenses in the vertical and horizontal directions have the form

$$\Delta y^{(3)} = y_0^3 C_{y1} + y_0^2 y_0' C_{y2} + y_0 y_0'^2 C_{y3} + y_0'^3 C_{y4} + y_0 x_0^2 C_{y5} + y_0 x_0 x_0' C_{y6} + \\ + y_0 x_0'^2 C_{y7} + y_0' x_0^2 C_{y8} + y_0' x_0 x_0' C_{y9} + y_0' x_0'^2 C_{y10} + y_0 \varepsilon_z C_{y11} + y_0' \varepsilon_z C_{y12}, \quad (5)$$

$$\Delta x^{(3)} = x_0^3 C_{x1} + x_0^2 x_0' C_{x2} + x_0 x_0'^2 C_{x3} + x_0'^3 C_{x4} + x_0 y_0^2 C_{x5} + x_0 y_0 y_0' C_{x6} + \\ + x_0 y_0'^2 C_{x7} + x_0' y_0^2 C_{x8} + x_0' y_0 y_0' C_{x9} + x_0' y_0'^2 C_{x10} + x_0 \varepsilon_z C_{x11} + x_0' \varepsilon_z C_{x12}. \quad (6)$$

Here, C_{y1}–C_{y12}, C_{x1}-C_{x12} - the aberration coefficients, and x_0, y_0, x_0', y_0' - the initial values of the displacement and inclination of charged particles.

The focusing parameters of the studied lenses were calculated using the results of [7, 10] for the mode of formation of a single focus at a point located on the main optical axis, i.e. at a point O_1 (Figure 1). To implement this condition, the necessary values of the ratios of the potentials φ_2 and φ_3 the second and third electrodes of the studied immersion lens were calculated. The results of calculations for the values of $R_1 = R_2 = 1,\ \varphi_1 = \varphi_4 = 1,\ l_2 = l_3 = l$ are shown in Figures 2–7 (line 1 for $l = 0.02$ and line 2 for $l = 0.025$).

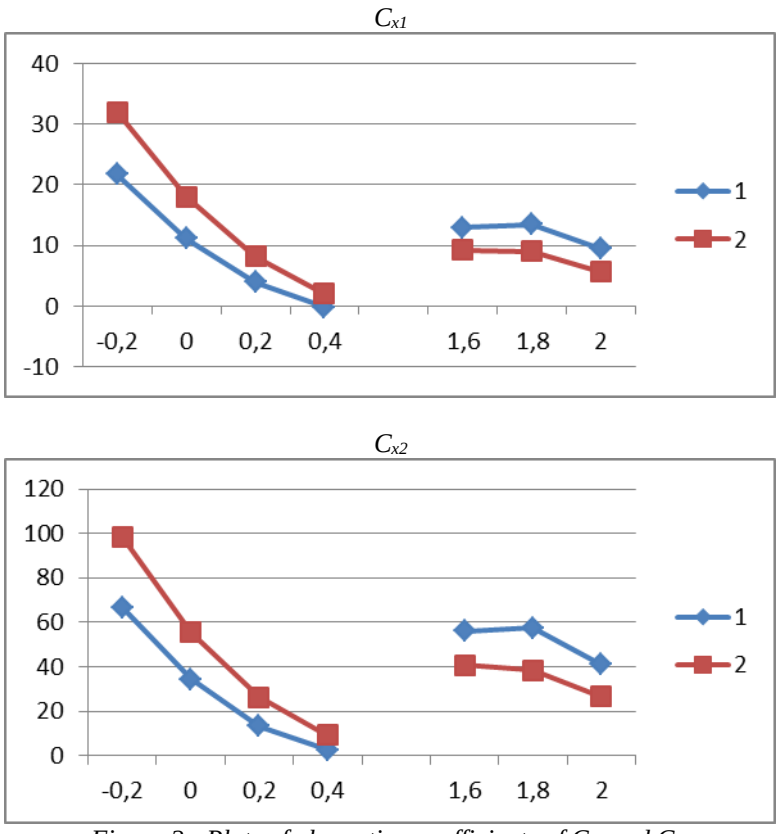

Figure 2 - Plots of aberration coefficients of C_{x1} and C_{x2}

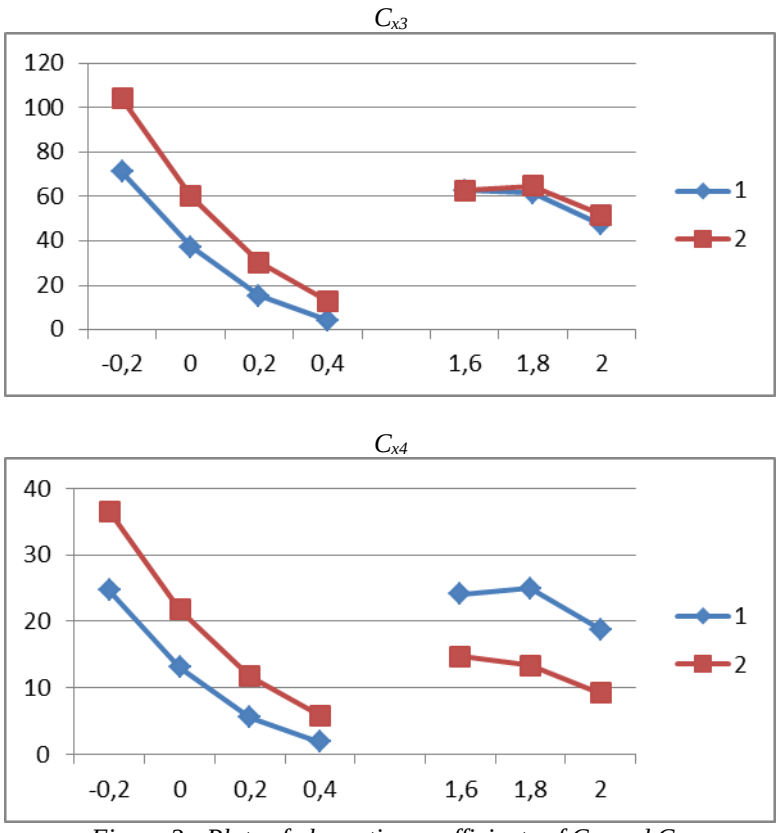

Figure 3 - Plots of aberration coefficients of C_{x3} and C_{x4}

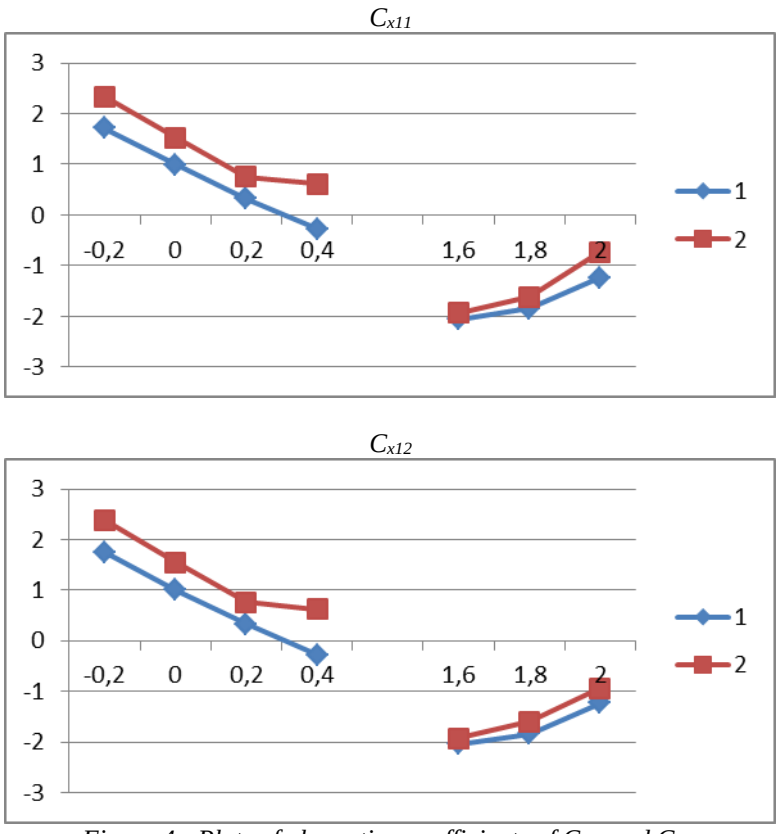

Figure 4 - Plots of aberration coefficients of C_{x11} and C_{x12}

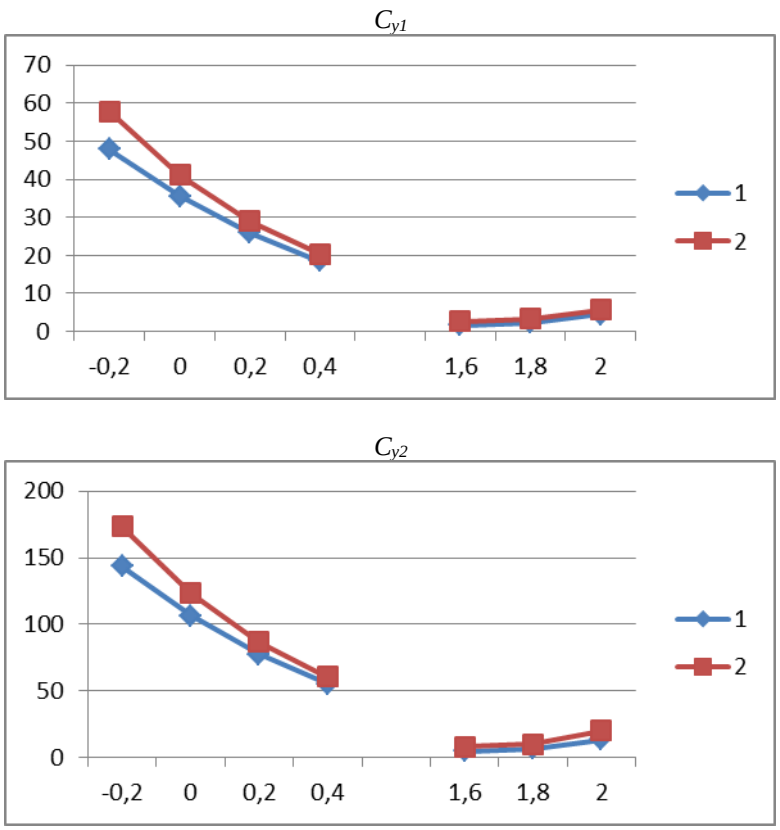

Figure 5 - Plots of aberration coefficients of C_{y1} and C_{y2}

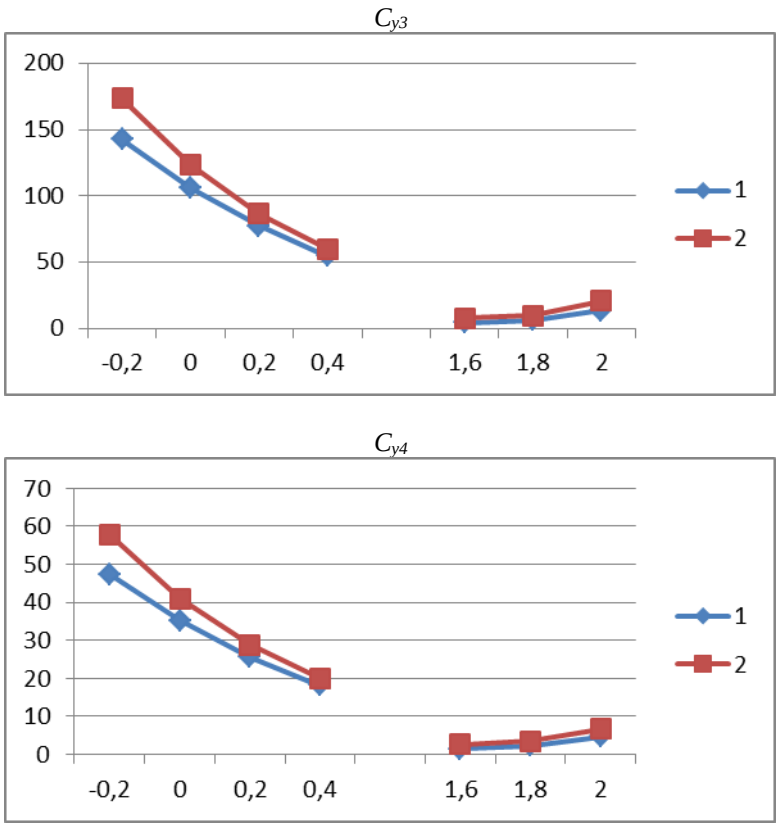

Figure 6 - Plots of aberration coefficients of C_{y3} and C_{y4}

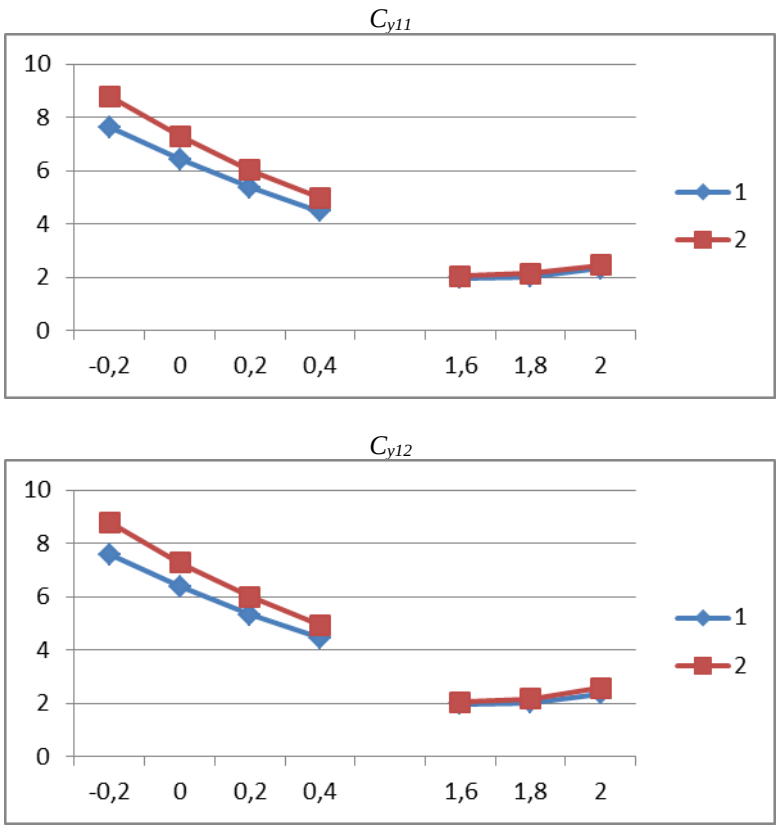

Figure 7 - Plots of aberration coefficients of C_{y11} and C_{y12}

For a comparative analysis of the focusing properties, the aberration coefficients of a 6-electrode lens with a similar configuration of electrodes were also calculated. In this case, it was assumed that $\varphi_1 = \varphi_6 = 1$, and the ratios of the potentials of the middle electrodes were determined from the condition for the formation of a single focus at a point specified on the main optical axis. Just as in a 4-electrode single lens with two planes of symmetry, in the studied lens the values of aberrations in the horizontal direction are noticeably smaller

than the aberrations in the vertical direction. Comparison of the calculation results for a 6-electrode lens with the results of calculation of the aberration characteristics of a 4-electrode doubly symmetric single lens allows us to conclude that an increase in the number of lens electrodes leads to an increase in the parameters of influence on the focusing properties and provides more opportunities for regulating and optimizing the focusing parameters of the corpuscular- optical devices.

The investigated electron lenses can be used to upgrade analytical electron-optical devices, as well as electronic and ion lithography installations, and to improve their resolution in the production of nano- and microelectronic products.

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MATERIAL STRUCTURE OF THE "ETHER" OF THE UNIVERSE

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МАТЕРИАЛЬНАЯ СТРУКТУРА «ЭФИРА» ВСЕЛЕННОЙ

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Abstract

The article analyzes the concept of "ether" - a medium consisting of material formations that have mass and fill the entire space of the Universe.

The article analyzes the concept of "ether" - an all-pervading medium, from ancient times to the present day. The materiality of the medium filling the space of the Universe is proved. On the basis of experimental data, the internal structure of formations that fill the interstellar and intergalactic spaces of the Universe is determined. It is

proved that these formations are non-nuclear. The masses of these formations are determined depending on their own wavelength (frequency). The process of transmission of impulses in the material medium that fills the space of the Universe is determined. The analysis of the background cosmic radiation spectrum is carried out and the causes of its inhomogeneity in the entire range of the background cosmic radiation spectrum are determined. The value of the cosmological constant is calculated. It is proved that the cosmological constant is constant, but only within certain areas of the space of the Universe.

Аннотация

В статье проведён анализ понятия «эфира» - среды, состоящей из материальных образований, имеющих массу и заполняющих всё пространство Вселенной.

На базе экспериментальных данных определена внутренняя структура образований, заполняющих межзвёздное и межгалактическое пространства Вселенной. Доказано, что эти образования являются безъядерными. Определены величины масс этих образований в зависимости от собственной длины волны (частоты). Определён процесс передачи импульсов в материальной среде, заполняющей пространство Вселенной. Проведён анализ спектра фонового космического излучения и определены причины его неоднородности во всём диапазоне спектра фонового космического излучения. Рассчитана величина космологической постоянной. Доказано, что космологическая постоянная является постоянной, но только в пределах определённых участков пространства Вселенной

Keywords: "Ether", solar wind, stars, galaxies, emission spectrum, background cosmic radiation, wavelength, frequency, cosmological constant.

Ключевые слова: «Эфир», солнечный ветер, звёзды, галактики, спектр излучения, фоновое космическое излучение, длина волны, частота, космологическая постоянная.

1. ЭКСКУРС В ИСТОРИЮ ПОНЯТИЯ ЭФИРА

Рассмотрим основные концепции эфира, существовавшие в естествознании, и проанализируем их положительные стороны и недостатки, [2].

Термин «эфир» употреблял ещё в античные времена Аристотель для обозначения материи, из которой состоит всё, в том числе «из чего состоит небо и что на небе». В те времена древние греки вкладывали в понятие эфира всепроникающую среду - самое тонкое первовещество, которое было недоступно чувственному наблюдению. Древние греки называли эфир «светоносным».

В более поздние времена физик, математик Р. Декарт в своём знаменитом произведении «Диоптрика» («La Dioptrique», 1637) излагает идеи эфира, как переносчика света. Х. Гюйгенс в своей работе «Трактат о свете» («Trait de la lumiere», 1690) описывает волновую теорию света, где высказывает идею: световые возбуждения являются упругими импульсами в эфире. И. Ньютон в своём труде «Математические начала натуральной философии» («Philosophiæ Naturalis Principia Mathematica», 1687) также упоминал об этих знаниях, [1]. Математик, механик, физик XVIII столетия Л. Эйлер в своих трудах писал о том, что все оптические, электрические, магнитные и другие явления объясняются взаимодействием «грубой» материи.

Декарт утверждал наличие у мирового эфира обычных механических свойств вещества. Понятие мирового эфира в интерпретации Декарта удерживалось в науке вплоть до начала XX века, [7].

В соответствии со своей натурфилософией, Декарт рассматривал всю Вселенную, как неопределённо протяжённую материю, принимающую различные формы под действием присущего ей движения.

Декарт считал, что всё пространство заполнено первоматерией или её производными. Эта материя способна к делению на части любой формы под действием приложенной силы. Каждая из её частей может обладать любым допустимым движением. Частицы материи сохраняют свою форму, пока у них имеется приобретённое движение.

В XVIII, XIX веках и даже в начале XX века эфир был одной из центральных тем обсуждения физиков, математиков, химиков и исследователей других дисциплин. Английский физик, математик Д. Максвелл, благодаря модельным представлениям об эфире, создал теорию электромагнитного поля [8]. В «Трактате об электричестве и магнетизме» («A Treatise on Electricity and Magnetism») он написал следующее: «В настоящее время мы не можем понять распространение во времени иначе чем-либо, как полёт материальной субстанции через пространство, либо как состояние движения или напряжения в среде, уже существующей в пространстве ... Действительно, как бы энергия не передавалась от одного тела к другому во времени, должна существовать среда или вещество, в которой находится энергия, после того как она покинула одно тело, но ещё не достигла другого... Следовательно, все эти теории ведут к понятию среды, в которой имеет место распространение, и если мы примем эту среду как гипотезу, я думаю, она должна занять выдающееся место в наших исследованиях, и следует попытаться построить мысленное представление её действия во всех подробностях; это и являлось моей постоянной целью в настоящем трактате».

Голландский физик-теоретик Х. Лоренц, а также французский математик, физик А. Пуанкаре, считали электромагнитные явления динамическими свойствами эфира.

На съезде 86-го Конгресса Союза немецких естествоиспытателей и врачей было объявлено, как факт, что такое понятие, как эфир, окончательно упразднено.

Физиков стали делить на тех, кто был сторонником новой теории и тех, кто стоял на позициях существования эфира.

Приводим отрывки из речи Эйнштейна. произнесенной 5 мая 1920 г. в Лейденском университете: “ … очевидно, с точки зрения специальной теории относительности гипотеза об эфире лишена содержания. … Электромагнитное поле является первичной, ни к чему не сводимой реальностью, и поэтому совершенно излишне постулировать еще и существование однородного изотропного эфира и представлять себе поле как состояние этого эфира», [9].

В настоящее время в науке существуют две точки зрения на взаимосвязь пространства и материи.

Субстанциальная концепция. В рамках этой концепции пространство и материя существуют независимо и рассматриваются как самостоятельные сущности. В этой концепции пространство и материя считаются существующими извечно. Отношение между пространством и материей представляется как отношение между самостоятельными, независимыми субстанциями.

Реляционная концепция. В рамках этой концепции утверждается зависимость существования пространства и материи. В рамках этой концепции пространство и материя рассматриваются как взаимозависимые сущности. В этой концепции построена системы отношений, в которой пространство и материя взаимно влияют друг на друга.

2. ПРОЦЕСС ПЕРЕДАЧИ ИЗЛУЧЕНИЙ ЗВЁЗД ГАЛАКТИКИ

2.1 ЧТО ИЗЛУЧАЕТ СОЛНЦЕ?

Излучение Солнца состоит из материальной составляющей и импульсной волновой составляющей с длинами волн в широком диапазоне.

Материальная составляющая, называемая «солнечный ветер» - это поток ионизированных частиц гелиево-водородной плазмы, истекающий из солнечной короны со скоростью 300—1200 км/с в окружающее космическое пространство. Это атомы гелия и водорода, электроны, протоны, нейтроны и комбинации этих частиц. Импульсно-волновая составляющая представляет собой спектр фотонов от гамма и рентгеновского излучения до радиоволнового излучения.

Рис.1 Излучение Солнцем материальной субстанции

Излучение Солнца в видимой части спектра составляет незначительную часть всего спектра излучения.

Импульсно-волновое излучение передаётся в межзвёздной среде со скоростью «света», равной 300000 км/с.

«Солнечный ветер» движется в среде, а импульсное излучение передаётся материальной субстанцией самой межзвёздной среды.

Исследуем структуру материальной субстанции межзвёздной среды и процесс передачи этой материальной субстанцией импульсного излучения Солнца.

При температуре нагрева фотосферы (поверхность Солнца) 6000 C^{O} все атомы находятся в возбуждённых состояниях.

При квантовых переходах между возбуждёнными состояниями происходит переход атома из одного энергетического состояния E_k в другое энергетическое состояние E_i. При энергетических переходах происходит излучение кванта (порция энергии) - фотона.

Энергия излучаемого фотона E_ν равна разности энергий ΔE энергетических уровней E_k и E_i:

$$E_\nu = E_k - E_i = \Delta E = h\nu \quad (1)$$

Величина импульса $\vec{P}_\nu$ излучаемого фотона, определяется выражением:

$$\vec{P}_\nu = \frac{\Delta E}{C} = \frac{h\nu}{C} = \frac{h}{C}\,\nu \quad (2)$$

Таким образом, импульсы в фотосфере Солнца образуются при квантовых переходах между возбуждёнными состояниями атомов.

При квантовых переходах в окружающую среду передаются импульсы с энергией равной разности энергий ΔE между возбуждёнными состояниями атомов.

Образуется спектр излучения Солнца.

Импульсное излучение, попадая в атмосферу Земли, вступает во взаимодействие с атомами атмосферы Земли. Импульсное излучение в атмосфере Земли возбуждает колебание электронных оболочек атомов атмосферы в широком диапазоне – от коротковолновой рентгеновской и гамма областей до длинноволнового радиодиапазона. **Вывод: Свет не излучается Солнцем, свет возбуждается в атмосфере Земли.**

На **Рис.2** показан спектр излучения Солнца при температуре около 6 тысяч градусов[14]. В настоящее время принята следующая градация спектра Солнца:

Диапазон длин волн ультрафиолетового спектра

$$\lambda = (3{,}8 \cdot 10^{-5} \div 3 \cdot 10^{-7})\ \text{см} \quad (3)$$

Диапазон длин волн видимого спектра

$$\lambda = (7{,}3 \cdot 10^{-5} \div 3{,}8 \cdot 10^{-5})\ \text{см} \quad (4)$$

Диапазон длин волн инфракрасного спектра

$$\lambda = (7{,}3 \cdot 10^{-5} \div 3 \cdot 10^{-2})\ \text{см} \quad (5)$$

Диапазон длин волн радиоизлучения

$$\lambda > 3 \cdot 10^{-2}\text{см} \quad (6)$$

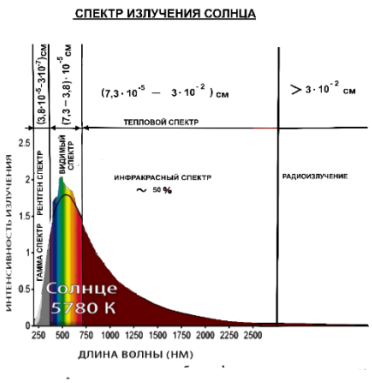

Рис. 2
Спектр излучения Солнца

Исследуем процесс образования спектра излучения и появление видимой части спектра при нагреве тела. На **Рис.3** показан спектр излучения спирали электрической лампы накаливания при нагреве до температуры 1500К.

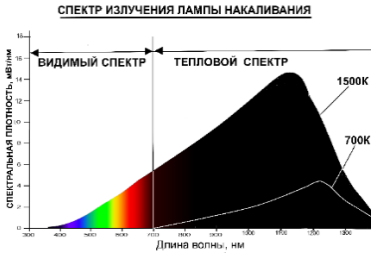

Рис.3
Распределение энергии в спектре лампы накаливания

По мере нагрева спирали появляется видимая часть спектра.

Обращаем особое внимание, что график на **Рис.3** демонстрирует процесс образования спектра излучения от 0К до 1500К, а не финальный спектр излучения Солнца при 6000К.

На рисунке мы видим: при нагреве спирали до температуры 700К излучается только тепловой спектр с длинами волн от 0нм до 700нм = $700 \cdot 10^{-7}$см = $7 \cdot 10^{-5}$см.

Видимого спектра излучения ещё нет.

При дальнейшем нагреве спирали до 1500К, появляется видимая часть спектра в интервале длин волн $(7 \cdot 10^{-5} \div 4 \cdot 10^{-5})$ см.

Сравним спектр излучения нагреваемой спирали со спектром излучения Солнца:

- видим, что длина волны $7 \cdot 10^{-5}$см теплового излучения спирали тела совпадает с конечной границей длин волн $7{,}3 \cdot 10^{-5}$см теплового излучения Солнца. Эта длина волны является началом границы видимого спектра Солнца $7{,}3 \cdot 10^{-5}$см.

- видим, что длина волны $4 \cdot 10^{-5}$см излучения нагретой спирали совпадает с конечной границей длин волн $3{,}8 \cdot 10^{-5}$см видимого спектра излучения Солнца.

Этот эксперимент показал, что видимая часть спектра излучения появляется при нагреве тела выше 700К и исчезает при нагреве до 1500К.

Спектр видимого света находится в очень узком диапазоне длин волн.

В природе нет видимого света. Появление видимого спектра излучения в этом диапазоне длин волн связано только с восприятием глазом человека этого интервала излучения.

За пределами этого диапазона длин волн человек не видит спектра излучения **Рис.4.**

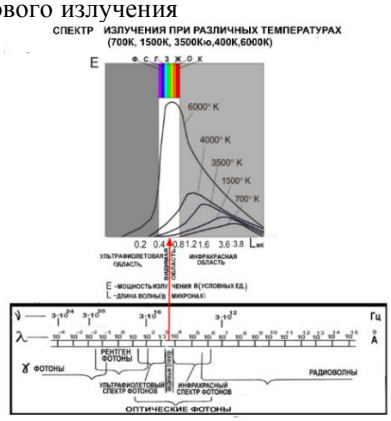

Рис.4 Спектр излучения нагреваемого тела при различных температурах

Свет становится видимым только в результате восприятия глазом и анализа мозгом определённой части спектра излучения. Определённым частотам (длинам волн) спектра излучения человек присвоил понятие цвета.

Видимый диапазон частот (длин волн) присутствует в спектре излучения Солнца, [14].

Именно этот диапазон излучения Солнца определил формирование органа зрения человека в процессе приспособления к окружающей среде.

Природа с помощью глаза и мозга как бы «подсветила» частоту колебаний в узкой области длин волн излучаемого спектра Солнцем для ориентации человека в природе **Рис.4**.

Исследуем процесс передачи импульсов в среде с помощью эксперимента с биллиардными шарами **Рис.5**.

Расположим биллиардные шары вплотную друг к другу (положение I) . Приложим импульс к первому шару (положение II).

Шары останутся на месте, но импульс будет передан от первого шара к последнему шару. Последний шар переместится. Перемещение шара доказывает перемещение импульса в среде шаров.

Аналогично происходит взаимодействие между электронами электронных оболочек атомов вещества среды (атмосфера Земли).

Импульс, приложенный к электронной оболочке атома, создаёт объёмное колебание этой оболочки с частотой **ν** (сферический осциллятор) (положение III).

Колебания электронной оболочки с частотой **ν** передаются окружающим электронным оболочкам атомов, которые передают колебания в окружающее пространство (положение IV).

Исследуем передачу импульсов в среде.

Запишем формулу энергии Планка:

$$E = h\nu \quad (7)$$

h – постоянная Планка

ν – частота

Выразим импульс $\vec{P}$ через энергию E, частоту ν и длину волны λ, (8).

$$\vec{P} = \frac{E}{C} = \frac{h\nu}{C} = \frac{h}{C}\,\nu = \frac{h}{\lambda} \quad (8)$$

Запишем формулу энергии Эйнштейна.

$$E = m\,C^2 \quad (9)$$

Определим импульс $\vec{P}$ (10).

$$\vec{P} = \frac{E}{C} = \frac{m\,C^2}{C} = mC \quad (10)$$

m –масса микрочастиц среды (плотность среды), передающая импульс фотона

C – скорость света

$\vec{P}$ – импульс микрочастицы

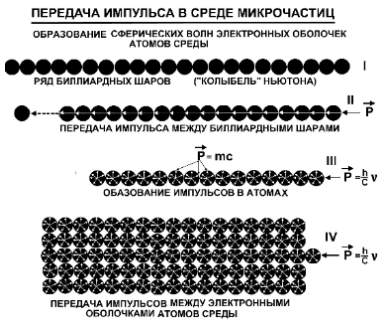

Рис.5
Передача импульсов в среде

Запишем формулу энергии в виде:

$$E = m\,C^2 = mC \cdot C = \vec{P} \cdot C \quad (11)$$

Из формулы (11) следует: энергия E - есть скорость C передачи импульса $\vec{P}$ в среде.

Запишем формулу импульса (12):

$$\vec{P} = mC \quad (12)$$

Сравнивая формулы (8) и (12) импульса $\vec{P}$ запишем равенство:

$$\vec{P} = \frac{h}{C}\,\nu = mC \quad (13)$$

Импульсы $\vec{P}$ фотонов создаются квантовыми переходами между возбуждёнными состояниями атомов в широком диапазоне спектральных частот ν.

Из формулы (13) следует что импульсы $\vec{P}$ передаются электронами электронных оболочек атомов среды и, следовательно, определяются частотными параметрами ν и λ электронов атомов в возбуждённых состояниях.

Из формулы (13) следует: так как h и C являются константами, следовательно, масса m электронов электронных оболочек атомов среды, в которой создаются и передаются импульсы $\vec{P}$, пропорциональна частоте импульсов ν.

Таким образом, спектр импульсов, передаваемых атомами среды определяется массой электронов электроносфер атомов, передающих эти импульсы.

Масса m, входящая в формулу (13), это масса электронов электронных оболочек атомов среды, передающих импульсы.

Вывод: фотон - это не микрочастица. Фотон – это процесс передачи импульса между электронами массой m электронных оболочек атомов среды.

Для передачи импульсов, излучаемых Солнцем в окружающее межзвёздное пространство, нужна среда. Для передачи импульсов в атмосферу

Земли на расстояние 150 миллионов километров от Солнца нужна среда.

Современная наука не понимает процесса передачи световых импульсов в среде. Наука предполагает передачу импульсов в виде движения в пространстве безмассовых частиц – фотонов.

Ранее эту предполагаемую среду, в которой распространяются фотоны, называли эфиром. В настоящее время среду, в которой распространяются фотоны, называют полем. При этом внутренняя структура и эфира и поля не определена и носит гипотетический характер.

Из проведенного анализа следует, что именно среда и является проводником импульсов. Наличие среды является необходимым условием для распространения импульса.

2.2 ОБНАРУЖЕНИЕ МЕЖЗВЁЗДНОГО ИЗЛУЧЕНИЯ

Впервые космическое радиоизлучение обнаружил в 1932 г. на волне 14,6 м американский инженер К. Янский. Янский установил, что радиоизлучение приходит из космоса - от Млечного Пути, причём наибольшая интенсивность его наблюдается в направлении центра нашей Галактики. В 1939 г. другой американский радиоинженер, Г. Ребер, зарегистрировал радиоизлучение Млечного Пути на волне 1,87 м.

В середине XX века официальная астрофизика считала, что космическое пространство заполнено нейтральным атомарным водородом. В 1945 году Хюлст, а в 1948 году И. С. Шкловский рассчитали ожидаемую длину волны излучения атомами межзвёздного вещества равную 21,1 см (частота 1420,40575 МГц), [2].

В 1951 году излучение с такой длиной волны было обнаружено Г. Юэном, К. Мюллером и Я. Оортом.

В 1964 году физик А. Пензиас и радиоастроном Р. Уилсон обнаружили фоновое космическое излучение, которое позже назвали «реликтовым» излучением. На основании экспериментов по изучению фонового космического излучения была построена карта реликтового излучения **Рис.7,** [12].

Реликтовое излучение - это космическое фоновое излучение, равномерно заполняющее Вселенную, [3], [4].

Оно обладает высокой степенью изотропности и спектром, характерным для абсолютно чёрного тела с температурой 2,726К.

Величина разности температуры для всего наблюдаемого пространства составляет менее 0,0001%.

В экспериментах Пензиаса и Вильсона измерения проводились только на одной частоте.

В последующие годы дальнейшие измерения проводились на других частотах. В работе [14] было подтверждено, что это излучение является излучением чёрного тела и имеет типичную колоколообразную кривую интенсивности, которая показана на **Рис.6,** [11].

Поскольку возможности наземных наблюдений в микроволновом диапазоне ограничены из-за атмосферного поглощения, была запущена спутниковая миссия COBE.

График интенсивности реликтового излучения **Рис.6** представляет собой компиляцию результатов исследования, полученных из различных экспериментов.

Источники экспериментальных данных указаны на рисунке **Рис.6** [11] и в тексте настоящей статьи. Наиболее подробная карта реликтового излучения была построена в результате работы аппарата «Реликт1», космического аппарата «WMAP» и экспериментов, проведенных на спутнике «Планк». WMAP (Wilkinson Microwave Anisotropy Probe) — космический аппарат НАСА, предназначенный для изучения реликтового излучения. WMAP продолжил и завершил космическую миссию COBE.

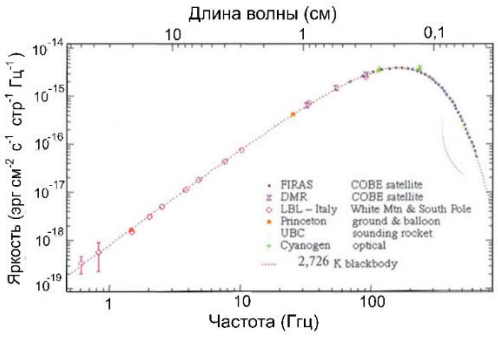

Рис.6

Измерение спектра реликтового излучения

WMAP с октября 2001 по 2009 год передавал на Землю результаты сканирования небесной сферы.

На основе данных была составлена радиокарта неба на нескольких длинах волн: от 1,4 см до 3 мм.

После девяти лет работы WMAP был отключен в 2010 году после запуска более совершенной космической обсерватории «Планк», по инициативе Европейского космического агентства в 2009 году.

В результате работы были получены распределения интенсивности реликтового излучения с высоким разрешением **Рис.7,** [12].

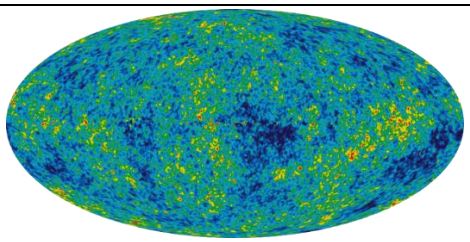

Рис.7
Карта реликтового излучения по данным спутника WMAP

*На **Рис.8** показан спектр космического реликтового излучения, полученного как наземными радиотелескопами, так и данными со спутников, [13].*

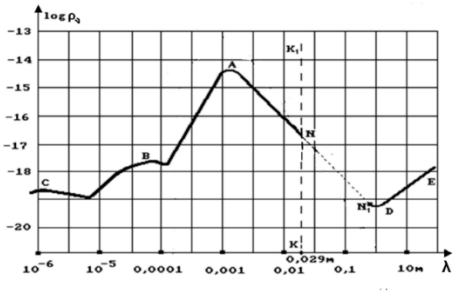

Рис.8
Зависимость плотности реликтового излучения Вселенной от длины волны.

Этот график так же является компиляцией данных из различных источников.

Максимум излучения приходится на частоту 160,4 ГГц. Это соответствует длине волны 1,9мм.

Ни звёзды, ни радиогалактики, ни межгалактический газ, ни переизлучение на межзвёздной пыли не могут дать излучения, приближающегося по свойствам к микроволновому фоновому излучению. Суммарная энергия этого излучения слишком велика по сравнению с другими видами излучений.

Спектр реликтового излучения не похож ни на спектр звёзд, ни на спектр радиоисточников. Этим, а так же высокой степенью изотропии, доказывается космологическое происхождение микроволнового фонового излучения.

2.3 АНАЛИЗ СТРУКТУРЫ И ЭЛЕМЕНТОВ СРЕДЫ, ЗАПОЛНЯЮЩЕЙ ПРОСТРАНСТВО КОСМОСА

Согласно официальной точке зрения астрофизики считается, что межзвёздное пространство заполнено нейтральным одноатомным водородом, [5], [6].

Материальная субстанция, заполняющая межзвёздное пространство, передаёт импульсы называемые фотонами, которые создают микрочастицы, излучаемые звёздами. Эти импульсы передаются в среде со скоростью света, в том числе в атмосфере Земли.

Переходим к определению структуры среды, заполняющей космическое пространство и передающее эти импульсы.

Для атома водорода в основном состоянии длина волны электрона в земных условиях, равна $\lambda = 2.4 \cdot 10^{-10}$ см (комптоновская длина волны).

Устойчивые состояния ядер атомов определяются энергией связи нуклонов (протонов и нейтронов) в ядре атомов.

Для ядра водорода удельная энергия связи равна 1,1 МэВ/нуклон.

Определим величину энергии связи исходя из частоты ν=1429МГц и длине волны излучения λ =21,1 см **Рис.6.** Определим так же величину энергии связи, исходя из частоты ν=160,4ГГц и длины волне излучения λ=1,9 мм **Рис.8.**

Энергия определяется формулой Планка

$$E=h\nu \quad (14)$$

h= $6{,}58 \cdot 10^{-16}$эВ·с - постоянная Планка

ν =$1{,}42 \cdot 10^{9}$1/с

Посчитаем энергию связи для водородоподобного образования с частотой ν =$1{,}42 \cdot 10^{9}$1/с и длиной волны λ =21,1см.

$$E= 6{,}58 \cdot 10^{-16} \cdot \underline{1{,}42} \cdot 10^{9}\ [эВ \cdot с \cdot 1/с] = 9{,}34 \cdot 10^{-7} эВ. \quad (15)$$

Определим, во сколько раз энергия связи (E=$9{,}34 \cdot 10^{-7}$эВ) водородоподобного образования с длиной волны λ =21,1 см меньше энергии связи атома водорода в земных условиях, равной E=1,1 МэВ/нуклон.

$$\frac{9{,}34 \cdot 10^{-7}}{1{,}1 \cdot 10^{6}} \sim 10^{-12} \quad (16)$$

Расчёты показывают, что энергия связи водородоподобного образования с длиной волны λ=21,1 см в 10^{12} раз меньше, чем в атоме водорода в земных условиях.

Посчитаем энергию связи для водородоподобного образования с частотой ν=160,4ГГц и длиной волны λ=1,9 мм.

$$E= 6{,}58 \cdot 10^{-16} \cdot 1{,}6 \cdot 10^{11}\ [эВ \cdot с \cdot 1/с] = 10{,}79 \cdot 10^{-5}\ эВ. \quad (17)$$

Определим, во сколько раз энергия связи (E=$10{,}79 \cdot 10^{-5}$эВ) водородоподобного образования с длиной волны λ=1,9 мм меньше энергии связи атома водорода в земных условиях равной E=1,1 МэВ/нуклон.

$$\frac{10{,}79\cdot10^{-5}}{1{,}1\cdot10^{6}} \sim 10^{-10} \quad (18)$$

Расчёты показали, что энергия связи водородоподобного образования с длиной волны λ=1,9 мм в 10^{10} раз меньше, чем в атоме водорода с длиной волны $\lambda = 2.4\cdot10^{-10}$ см в земных условиях.

Сформулируем условие устойчивого состояния динамической системы.

Устойчивость динамической системы – это способность динамической системы находиться в исходном установившемся состоянии при постоянстве и неизменности внешних воздействий.

Для существования устойчивой системы, в том числе атома, условием динамического равновесия является равенство энергий ядра и электронной оболочки.

Из расчётов следует, что в водородоподобном реликтовом образовании вещества, энергия электронной оболочки не может обеспечить динамическое устойчивое состояние нейтрального атома водорода, так как энергия связи в водородоподобном образовании в (10^{10} - 10^{12}) раз меньше, чем в атоме водорода.

.

Таким образом, в водородоподобном образовании не может быть ядра.

Из расчётов следует, что это образование представляет собой электрон, движущейся в объёме сферы.

Безъядерное образование состоит из одного электрона и является материальной субстанцией.

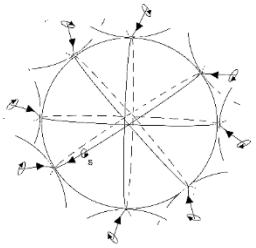

Рис.9

Безъядерное электронное образование

Назовём эту материальную структуру «безъядерным электронным образованием».

Безъядерное электронное образование показано на **Рис.9.**

Размеры и плотность этих безъядерных электронных образований определяются их местоположением в обозримой Вселенной.

Любая Галактика имеет ограниченные размеры, определяемые взаимодействием галактик между собой.

Поэтому безъядерные электронные образования, заполняющие галактическое и межгалактическое пространство, имеют наибольшую плотность в пространстве галактики **Рис.6** и **Рис.8**.

Так как измерения проводились в нашей галактике «Млечный путь», можно сделать вывод, что длина волны 1,9мм **Рис.6** и **Рис.8** соответствует безъядерным электронным образованиям нашей галактики.

В межгалактическом пространстве, занимающем больший объём, безъядерные водородоподобные образования, заполняющие межгалактическое пространство, имеют меньшую плотность, то есть большие размеры.

Именно поэтому фиксируются излучения в реликтовом фоновом излучении с различными длинами волн, в том числе с длинами волн λ=21,1 см, λ=32 см и другие **Рис.8**.

Пространство, заполненное безъядерными электронными образованиями, передающими импульсы в межзвёздной среде, является той «светоносной средой», которую в различные исторические периоды называли «эфиром» или «полем».

Среда, заполняющая пространство Вселенной, является материальной средой, получающей и передающей импульсы в пространстве 4π стерадиан **Рис.10**.

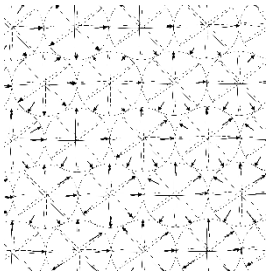

Рис.10

Материальная среда, заполняющая пространство Вселенной

Радиус наблюдаемой в настоящее время части Вселенной составляет 46 миллиардов световых лет.

Информация в пространстве в интервале 46 миллиардов световых лет передаётся со скоростью «света» 300000км/с безъядерными электронными образованиями, заполняющими это пространство.

2. КОСМОЛОГИЧЕСКАЯ ПОСТОЯННАЯ

Космологическая постоянная - это величина, характеризующая плотность материальной субстанции в различных областях наблюдаемого пространства Вселенной.

В пространстве Вселенной расположены галактики, группы галактик, и сверхскопления галактик.

В 1990 – е годы астрофизики выяснили, что на масштабах порядка 300 мегапарсек Вселенная практически однородна.

Объем пространства между звёздами в галактиках, объем пространства между галактиками в скоплениях галактик и объем пространства между скоплениями галактик гораздо больше объема пространства, занимаемого звёздами, галактиками и скоплениями галактик.

Межзвёздное пространство галактик, межгалактическое пространство и пространство между скоплениями галактик Вселенной заполнено материальной субстанцией, состоящей из безъядерных электронных образований.

Размеры безъядерных электронных образований, заполняющих эти пространства, являются переменными в различных частях Вселенной.

В природе нет пространства без материи, как и нет материи без пространства.

Определим плотность среды, заполняющей пространство Вселенной, в зависимости от плотности фонового излучения, представленного на графике **Рис.8**.

На графике **Рис.8** приведён спектр длин волн и интенсивность фонового космического излучения. Наибольшая интенсивность излучения приходится на длину волны λ = 1,9мм (частота ν = 160,4ГГц).

Максимальная плотность безъядерных водородоподобных (электронных) образований регистрируется в галактике. Результаты исследования, приведенные на графике **Рис.8**, проводились в нашей галактике.

Следовательно, плотность излучения с длиной волны λ = 1,9мм характеризует плотность межзвёздной среды нашей галактики «Млечный путь».

Из проведенного анализа следует, что безъядерные водородоподобные (электронные) образования передают весь спектр фонового космического излучения, приведенного на графике **Рис.8**.

Особо обратим внимание, что среда, состоящая из безъядерных электронных образований, является передатчиком всего спектра фонового космического излучения.

Длина волны λ = 1,9мм соответствует плотности среды безъядерных электронных образований внутри пространства нашей галактики.

Посчитаем массу безъядерного водородоподобного (электронного) образования с определённой частоте ν, заполняющего пространство нашей галактики.

Воспользуемся уравнением, приведенными в статье:

$$E = m C^2 = h \nu \qquad (19)$$

Из этого уравнения определим массу безъядерного электронного образования, заполняющего пространство нашей галактики.

$$m = \frac{h}{C^2} \nu \qquad (20)$$

Посчитаем массу безъядерного электронного образования с длиной волны λ =1,9 мм (частота ν = 160,4ГГц).

$$m = \frac{h}{C^2} \nu = \frac{6{,}626\,070\,15 \times 10^{-27}\text{эрг·с}}{(3 \cdot 10^{10}\text{см/с})^2} 160{,}4 \cdot 10^{9}\text{Гц}$$

$$(1/\text{с}) = \frac{6{,}6 \cdot 1{,}6}{9} \frac{10^{-27} \cdot 10^{2} \cdot 10^{9}}{10^{20}} \approx 10^{-36}\text{г} \qquad (21)$$

Посчитаем массу безъядерного электронного образования с длиной волны λ =21,1 см (частота ν = 1420,40575 МГц).

$$m = \frac{h}{C^2} \nu = \frac{6{,}626\,070\,15 \times 10^{-27}\text{эрг·с}}{(3 \cdot 10^{10}\text{см/с})^2} 1420{,}40575 \cdot 10^{6}\text{Гц}$$

$$(1/\text{с}) = \frac{6{,}6 \cdot 1{,}4}{9} \frac{10^{-27} \cdot 10^{3} \cdot 10^{6}}{10^{20}} \approx 10^{-38}\text{г} \qquad (22)$$

Из анализа спектра приведенного на графике **Рис.8** и формул (21) и (22) можно сделать вывод, что плотность материальной субстанции безъядерного электронного образования, заполняющего пространство наблюдаемой Вселенной, является переменной, неоднородной.

Космологическая постоянная является постоянной только в пределах пространства солнечных систем, галактик, и в скоплениях галактик в наблюдаемой части Вселенной.

Доказательством переменной плотности вещества Вселенной, образованного безъядерными электронными образованиями, являются результаты исследования, полученные с помощью спутников «Вояджер-1» и «Вояджер-2».

Согласно полученным экспериментальным данным, средняя плотность микрочастиц солнечного ветра (электроны, протоны и нейтроны) на расстоянии 150 млн км от Солнца в пределах орбиты Земли составляет 8, 8 частиц на кубический сантиметр.

Плотность микрочастиц на границе гелиопаузы (19 млрд км от Солнца) полученная детекторами микрочастиц, установленными на спутниках «Вояджер-1» и «Вояджер-2», составила 0, 002 частицы на кубический сантиметр.

Детекторами были обнаружены только протоны. Электроны и нейтроны в районе гелиопаузы не были зарегистрированы.

В природе ничего не исчезает и не возникает. Вещество в природе переходит из одного состояния в другое.

Электроны, излучаемые Солнцем, трансформируются в безъядерные электронные образования, заполняя пространство межзвёздной среды нашей галактики.

Поскольку единственными источниками микрочастиц в галактиках являются звёзды, следовательно, звёзды являются источниками электронов, образующих безъядерные электронные образования межзвёздной среды галактик и межгалактического пространства.

Суммарное излучение звёзд галактики образует межгалактическую среду, заполняемую безъядерными электронными образованиями.

Плотность материальной субстанции, состоящей из безъядерных электронных образований, является переменной величиной в наблюдаемом пространстве Вселенной.

Наблюдаемое пространство Вселенной на расстоянии 46 млрд световых лет в пространстве 4π стерадиан заполнено материальной субстанцией, состоящей из безъядерных водородоподобных (электронных) образований.

Импульсы, передаваемые этой средой, позволяют наблюдать Вселенную на таких расстояниях.

На основании приведённых расчётов массы и структуры безъядерных водородоподобных (электронных) образований можно утверждать, что эти образования заполняют межзвёздное пространство, межгалактическое пространство то есть пространство Вселенной.

Именно безъядерные водородоподобные (электронные) образования, заполняющие пространство, передают импульсы и представляют собой то, что называют «эфиром» или «полем».

Выводы

1. Доказана материальность среды, заполняющей пространство Вселенной
2. На базе экспериментальных данных определена внутренняя структура образований, заполняющих межзвёздное и межгалактическое пространства Вселенной и доказано, что эти образования являются безъядерными.
3. Определены величины массы этих образований в зависимости от длины волны (частоты).
4. Определён процесс передачи импульсов в материальной среде, заполняющей пространство Вселенной.
5. Проведён анализ спектра фонового космического излучения и определены причины его неоднородности во всём диапазоне спектра фонового космического излучения.
6. Рассчитана величина космологической постоянной. Доказано, что космологическая постоянная является постоянной, но только в пределах определённых пространств Вселенной.

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TECHNICAL SCIENCES

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PARAMETERS OF THE GENERALIZED ANALYTICAL MODEL OF THE FREIGHT MARKET FOR MANAGEMENT DECISION-MAKING (ON THE EXAMPLE OF THE SHIPPING COMPANY GN GROUP LTD (TURKEY))

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ПАРАМЕТРЫ ОБОБЩЕННОЙ АНАЛИТИЧЕСКОЙ МОДЕЛИ ФРАХТОВОГО РЫНКА ДЛЯ ПРИНЯТИЯ УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ (НА ПРИМЕРЕ СУДОХОДНОЙ КОМПАНИЯ GN GROUP LTD (ТУРЦИЯ))

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Abstract

The article discusses some of the possible parameters of the freight market that influence management decisions when choosing options for using the fleet of a shipping company. Based on the analysis of parameters, a generalized scheme is proposed for the development of an analytical model of managerial decision-making.

Аннотация

В статье рассматриваются одни из возможных параметров фрахтового рынка, влияющих на принятие управленческих решений при выборе вариантов использования флота судоходной компании. На основе анализа параметров предложена обобщенная схема для разработки аналитической модели принятия управленческих решений.

Keyword: freight market, demand, supply, analytical model, shipping company

Ключевые слова: фрахтовый рынок, спрос, предложение, аналитическая модель, судоходная компания

Введение. Эффективность использования судов флота международной судоходной компания GN Group LTD (Турция) [1] зависит от качества принимаемых руководством компании управленческих решений, основанных на результате анализа изменения конъюнктуры международного фрахтового рынка, а так же учета соотношения между спросом и предложением услуг на трамповый тоннаж, определяющих колебание фрахтовых ставок вокруг цены производства [2]. Изменения уровня фрахтовой конъюнктуры на рынке обусловлено общим состоянием мирового производства, однако существует ряд специфических обстоятельств, которые необходимо учитывать при принятии управленческих решений. Как правило, принимаемые решения базируются на обобщенной аналитической модели получения прибыли при использовании материальных активов, которая принята в компании и позволяет учитывать набор критически важных параметров (количественных и качественных).

Основная часть.

В соответствии с рисунком 1 при анализе особенностей фрахтового рынка необходимо учитывать тип рынка и географический секция работы судов флота. Это связано с тем, что географические секции мирового фрахтового рынка и виды перевозок тесно взаимосвязаны. Благодаря мобильности и универсальности судов судоходная компания (СК) может быстро реагировать на изменения конъюнктуры в одной какой-либо географической секции, что приводит к постепенному перераспределению тоннажа до тех пор, пока не будет достигнуто относительное выравнивание среднего уровня рентабельности работы флота по всей транспортной системе, поделенной на географические секции мирового фрахтового рынка.

Помимо географического секции, судоходная компания должна учитывать влияние на свою работу особенностей открытого или закрытого фрахтового рынков, а так же их влияние друг на друга. Закрытый рынок, как правило, обслуживает грузопотоки, находящиеся под контролем государства, регулярные перевозки крупных промышленных компаний и линейное судоходство. Открытый рынок включает международные морские грузопотоки, где участие в перевозках не лимитируется какими-либо ограничениями и осуществляется в условиях относительно свободной конкуренции.

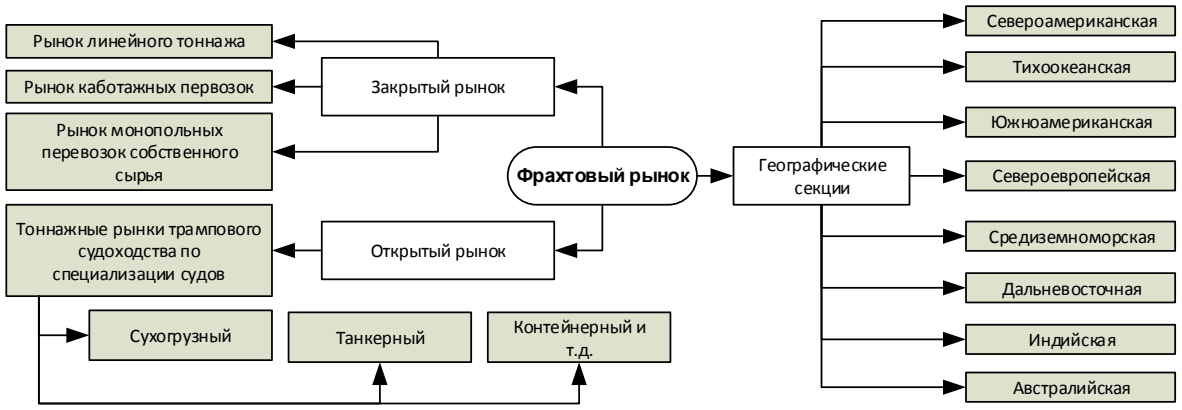

Рис. 1. Общая структура фрахтового рынка [4]

Открытый и закрытый рынки тесно взаимодействуют друг с другом. Так, в период низкого спроса на тоннаж многие трамповые судовладельцы принимают участие в линейных перевозках: в качестве аутсайдеров либо сдавая свой флот в таймчартер членам конференции. В случае, если ситуация изменяется, например, в период бума спроса линейный тоннаж широко используется для перевозок массовых грузов, особенно в малозагруженных направлениях. Перераспределение судов флота между географическими сегментами и типом рынка происходит по роду перевозимого груза, что в зависимости от сложившейся конъюнктуры фрахтового рынка оказывает влияние на эффективную загрузку судов. Например, балкеры могут использоваться на перевозках угля, руды, зерна или удобрений, а нефтебалкеры и нефтерудовозы - на перевозках наливных или навалочных грузов. Современные лесовозы - пакетовозы - на перевозках леса, навалочных грузов или контейнеров.

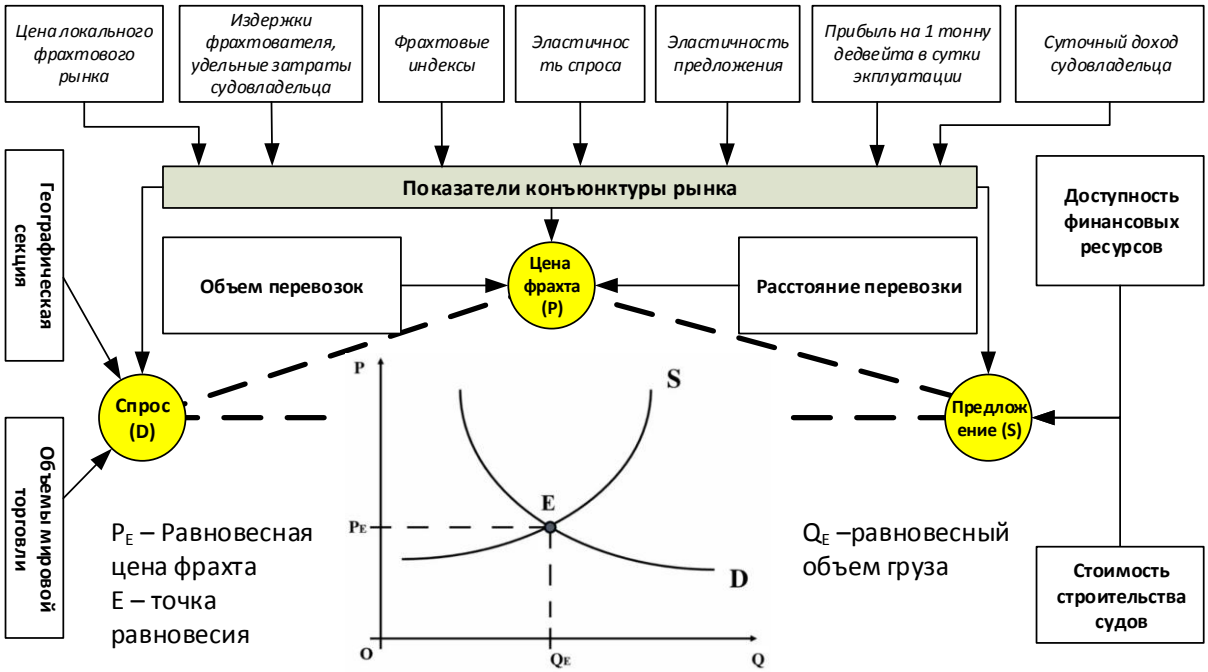

Рис. 2. Основные показатели обобщенной аналитической модели для анализа конъюнктуры фрахтового рынка

Судоходной компания GN Group LTD (Турция) является участником открытого фрахтового рынка, который составляет 15-20% от общего объема международных морских перевозок, что в абсолютном выражении составляет около 500 млн.т/год, или десятки тысяч фрахтовых сделок в год [3]. В соответствии с рисунком 2 к основным показателям открытого фрахтового рынка можно отнести: спрос (D), цена (P) и предложение (S). Значение этих показателей отражают конъюнктуру международного фрахтового рынка, которая рассматривается как соотношение между спросом и предложением услуг на трамповый тоннаж, которое определяется колебанием фрахтовых ставок вокруг цены производства [2].

В обобщенном виде, на значения показателей оказывает влияние ряд параметров (например, например цена локального фрахтового рынка), которые отражают особенности производства транспортных услуг на глобальном международном фрахтовом рынке. Транспортная продукция не может производиться в запас и храниться на складах до повышения на нее спроса. В случае кризиса судовладелец вынужден продолжать эксплуатировать свой флот до тех пор, пока связанные с этим убытки

ниже, чем расходы по содержанию судна на приколе. Поэтому в период избытка тоннажа ставки фрахта падают иногда ниже себестоимости перевозок, что является причиной смены географической секции работы судов флота.

Выводы. Использование обобщенной аналитической модели для анализа конъюнктуры фрахтового рынка позволяет определить точку равновесия между тремя показателями в зависимости от объемов перевозимого груза: S(Q), P(Q), D(Q). В соответствии с рисунком 2, точкой равновесия считает $P_E(Q)$, которая отражает способность судов флота перевести определенное количество груза за максимальную цену в сложившихся рыночных условиях. Анализ показателей и параметров, определяющих конъюнктуру фрахтового рынка, позволяет установить тенденцию развития спроса и предложения тоннажа, а также оценить ситуацию на фрахтовом рынке в среднесрочной перспективе. Это позволяет сформировать необходимую базу для принятия обоснованных решений по таким вопросам, как сдача (фрахтование) судов в таймчартер, заключение долгосрочных контрактов, продажа или покупка судов, бывших в эксплуатации. Тем не менее, при определении стратегии и программы строительства нового флота для судоходной компании, необходимо формировать долгосрочный прогнозы (на 5 лет и более). Для этого требуется учитывать возрастной состав флота по типам и тоннажным группам судов, портфель заказов на 3-5 лет, тенденции развития производства и экспорта данной группы товаров и изменения географии основных грузопотоков.

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IMPROVING THE ACCURACY OF OBJECT RECOGNITION BY REDUCING THE SCALING ERRORS OF PATTERN

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Abstract

In robotics, when recognizing objects by their images, errors arise associated with changing the image scale. This error is due to the minimum change in the distance between the reference object or recognizable image and the camera. The article outlines known methods for scaling images and describes their shortcomings. An algorithm for scaling object images is proposed. It is shown that the reliability of pattern recognition in this case increases by minimizing errors in estimating the measure of proximity between objects with equally accurate measurements. The article presents the results of computer simulation of the proposed algorithm in the form of tables and analyzes the additive, multiplicative and scale errors in measuring the parameters of objects. The simulation showed the advantage of using this algorithm over others.

Keywords: recognition, accuracy, proximity measure, scale errors, invariance

1. Introduction. Intelligent or adaptive robots can be used in nuclear power stations, rescue operations, chemistry, oil-gas and mining areas, counter-terrorism, when inspecting the area during the protection of objects and other extreme conditions, as well as space research. Under these conditions, people may not be within the object, or their presence within the object is dangerous for their life. Moreover, in conditions of high danger, a person begins to make mistakes, his working capacity and efficiency of work are reduced [1].

Remote control robots by operators cannot be controlled when they enter radio-shadows. That is why it is very important for them to work autonomously, at least for a short time. In addition, the management of robots requires constant attention, which is very tiring. In some environments (fog, smoke, night, etc.), operators often lose direction.

Unlike robots controlled by radio and television communication channels, intelligent and adaptive robots can work very effectively even during strong radio interference, in a wide area of radio shadows (high-rise buildings, mountains, mines, underwater area, shielded rooms), as well as at a distance from the control station.

The main reason that prevents the development of high-performance robots is the lack of an accurate concept of the construction, organization and operation of such systems. Modern robots are poorly adapted to changing real conditions because they are based on existing automatic control and regulation theory.

2. Problem Statement. There are two directions in the development of intelligent robots.

The first direction is to create completely independent systems to solve more complex problems in conditions of different levels of certainty. The complexity of the conditions is determined by the presence of priori information about the external environment.

This direction is used in the development of robots operating in a high-precision environment.

The second direction is an integrated human-machine system, in which the number of functions performed by the machine increases exponentially. Removing the operator from monotonous work and direct control significantly reduces the amount of information sent through the air, and the ability of the operator to intervene in complex situations expands the range of issues to be addressed. Thus, the intellectual capabilities of the robot depend on the intelligence and professional training of the operator, and during the performance of simple operations, the machine provides tirelessness, reliability and error-free performance. As this is more important for the military, a number of remote-controlled robots have been developed for military purposes.

One of the main organs of robots in both directions is technical vision systems. Technical vision systems perform the functions of adaptive robots, together with manipulators, when visual sensing organs are provided with devices that technically enliven and adapt individual human intellectual functions. However, there are currently a number of reasons that limit its widespread use. The most important of these is that it is not yet sufficiently effective. Therefore, increasing its effectiveness is one of the most important issues facing science and technology [2,3].

During the operation of technical vision systems, its effectiveness is mainly determined by 3 parameters: recognition accuracy, working speed and functional reliability. Therefore, in order to increase the effectiveness of technical vision systems, it is necessary to increase one of them, depending on the field of application, and at least keep the others unchanged.

There are real opportunities to increase the working speed of technical vision systems. Examples include the use of accelerating elements and blocks using the latest advances in electronics and microelectronics, the use of modern computer hardware and technology, the use of parallel-type matrices, artificial neurons and optical structural computing devices. Thus, there are theoretical methods and tools to increase the working speed of technical vision systems. This problem has been solved theoretically. The practical solution is delayed due to insufficient technical means and technologies.

The reliability of technical vision systems remains a very important issue in all areas of application. However, the issue of its increase depends on the development of electronic and microelectronic equipment, computer equipment and technology, and their reliability is currently at a very high level [4].

As for the recognition accuracy of technical vision systems, the problems have not been fully resolved. Because as technique and technology develop, the complexity of objects and processes increases, and the need for their automation becomes more rigorously. At the same time, the size of recognizable images is reduced and further complicated. In this case, the issue of increasing the accuracy of recognition becomes even more relevant.

The reliability of technical vision systems means correctly determining the compatibility of recognition and standard images with each other. When determining the proximity of these images, the proximity of the measured values of the parameters that characterize them is checked. Therefore, the closer the real values of these parameters are, the greater the demand for their measurement errors. Because in this case, the effect of measurement errors on the accuracy of recognition is stronger. If the true values of the parameters are significantly greater than the measurement error from each other, then an error in recognition is not allowed. It should be noted that, the latter case is more widespread in technical issues. That is, the parameters of recognition and standard images compare very little from each other. Therefore, minimization of measurement errors of parameters of images is a very actual issue [3,5].

3. Problem solving. One of the harmful factors that increase the measurement errors of the parameters of patterns is the scale change of recognized patterns. When recognizing patterns, the scale of the recognized pattern does not remain constant relative to the scale of the standard image and is constantly changing. The reason for this is the constant change in the distance between the object and the field of vision of the technical vision system. In this case, even the same objects will not be recognized correctly when using formulas to estimate the measure of proximity between existing patterns. Therefore, invariance of scale changes in the descriptions of recognizable objects must be ensured [6].

There are many formulas, methodologies, and approaches for estimating the measure of proximity (z) between recognition and standard images during pattern recognition: Euclidean distance, Chebyshev distance, Minkowski distance, standardized Euclidean distance, Hamming distance and more [1]. However, the listed formulas partially eliminate additive errors and multiplicative errors when estimating the measure of proximity between objects. Errors resulting from the change in the scale of the images are not eliminated in these formulas. The latest errors can be partially eliminated by the Canberra formula. Therefore, another method or algorithm should be used to eliminate the dependence of image recognition on scale changes.

The measure of proximity (z) between recognition and standard patterns can be measured using various formulas. The most common of these are the Manhattan (1) and Canberra (2) formulas [1,3,5]:

$$z = \sum_{i=1}^{n} \left| x_i - y_i \right| \tag{1}$$

$$z = \sum_{i=1}^{n} \frac{\left| x_i - y_i \right|}{\left| x_i + y_i \right|} \tag{2}$$

Where x_i and y_i are the current parameters of recognition and standard patterns, respectively.

As can be seen, the Manhattan formula is completely unsuitable for scale variations of recognizable images. The Canberra formula is partly suitable for scale changes of the recognizable images. However, experiences show that this is not enough for the effective operation of technical vision systems.

Various structural and algorithmic methods are used to create more effective invariance of technical vision systems to scale changes of recognition patterns. However, they do not completely solve the problem, as they complicate the structure and operation of the system. Therefore, the issue of ensuring the invariance of the scale changes of recognition patterns during image recognition remains a topical issue. In recent studies, it has been suggested to determine the measure of proximity between objects using the following formula to eliminate scale errors in patterns [7,8]:

$$z = \sum_{i=1}^{n} \left| \frac{x_i}{x_{average}} - \frac{y_i}{y_{average}} \right| \qquad (3)$$

where $x_{average}$ and $y_{average}$ are the mean values of the parameters of the recognition and standard images, respectively.

The dependence on the change in the size of proximity between objects during recognition depending on the scale of the image was checked by computer modeling. In computer modeling, this formula was compared with the known Canberra formula [1] and other formula proposed by the author [4].

However, studies have shown that there are some shortcomings of this formula. Disadvantages of this formula:

The number of image parameters should not depend on the scale. In general, the number of image points and recognition parameters changes when the scale of the image changes and the value of the scanned pixel is constant. Therefore, in this case, the characteristic points as parameters should be taken so that the number does not change. Because in this case, not the point of the image, but the point next to it can be taken by mistake.

When the value of a parameter changes, the multiplicative error also changes, which creates an additional error [9,10].

Therefore, 2 options should be considered to solve this issue.

1. The number of image parameters does not depend on the scale. In this case, the scaling coefficient of the image must be found. This coefficient should be found as the ratio of perimeters, pixels or areas of reference and recognition images. After that, from the $x_{i,measure} = k * x_{i,real}(1 + \delta x) + \Delta x$ formula x_i, the real value should be found. Here $x_{i,real}$, δx və Δx are the real value, multiplicative and additive errors of the image parameter, respectively. Multiplicative and additive errors of image parameters can be determined a priori.

Then the final formula is as follows:

$$Z = z_1 + z_2 + \cdots + z_n;\ \ Z_i = x_{i,real} - y_i$$

2. The number of parameters of the image depends on the scaling. In this case, 2 methods can be used:

a. Characteristic points should be taken as a parameter.

b. After the scaling coefficient is found, the scale of the image is artificially changed to equal the number of pixels in the reference image. After that, by taking $k = 1$ in the above formula, z should be found with that formula.

Taking into account the mentioned innovations, computer modeling was carried out.

The obtained results during the study are given in the tables.

Table 1

The dependence of the measure of proximity between objects on the change depending on the scale of the image

Multiplicative error of measurement of γ- x_i	Additive error of measurement of Δ- x_i	K- scale change of recognizable image	Δz_1 (for Manhattan formula)	$\Delta z_2 * 10^{-4}$ (for proposed formula)	$\Delta z_3 * 10^{-4}$ (for Canberra formula)
0.01	0.5	1	0	0	0
0.01	0.5	1.1	0.5	2	2.48
0.01	0.5	1.2	1.4	3.7	4.5
0.01	0.5	1.3	2.31	5.1	6.2
0.01	0.5	1.4	3.18	6.3	7.7
0.01	0.5	1.5	3.99	7.4	9.02
0.01	0.5	1.6	4.72	8.3	10
0.01	0.5	1.7	5.4	9.1	11
0.01	0.5	1.8	6.04	9.9	12
0.01	0.5	1.9	6.63	10.5	12.8
0.01	0.5	2.0	7.18	11	13.5
0.01	0.5	2.1	7.7	11.6	14.2
0.01	0.5	2.2	8.18	12.1	14.8
0.01	0.5	2.3	8.64	12.5	15.3
0.01	0.5	2.4	9.07	12.9	15.8
0.01	0.5	2.5	9.47	13.3	16.2
0.01	0.5	2.6	9.85	13.7	16.7
0.01	0.5	2.7	10.21	14	17
0.01	0.5	2.8	10.55	14.3	17.4
0.01	0.5	2.9	10.88	14.5	17.7

In Table 1 when estimating the measure of proximity between the images the multiplicative and additive errors are assumed to be constant, the proposed method appears to be more effective than the Canberra and Manhattan methods when the scale change of the recognizable image increases to 0.1.

Δz_1, $\Delta z_2$and Δz_3in the table are calculated as follows:

$$\Delta z_1 = \frac{z_{kn} - z_{k0}}{z_{k0}};\ \Delta z_2 = \frac{z_{2,n} - z_{2,0}}{z_{2,0}};$$

$$\Delta z_3 = \frac{z_{3,n} - z_{3,0}}{z_{3,0}}$$

Here, $Z_{1,n}, Z_{2,n}$ and $Z_{3,n}$– respectively, the obtained values by using (1), (2) and (3) formulas of the measure of proximity between the recognizable image and the standard image in n current scale change of recognizable images; $Z_{1,0}, Z_{2,0}$ and $Z_{3,0}$ – respectively, are the obtained values using formulas (1), (2), and (3) to measure of proximity between the standard image and recognizable image when the scale of the recognizable image is equal to the scale of the standard image. The dependence of the measure of the proximity between objects during recognition on the change of the multiplicative error in the measurement of the parameters of the recognizable image was checked by computer modeling. The obtained results are presented in Table 2.

Table 2

Dependence of the change in the measure of the proximity between objects depending on the multiplicative error

Multiplicative error of measurement of γ - x_i	Additive error of measurement of Δ- x_i	K- scale change of recognizable image	Δz_1 -(for Manhattan formula)	$\Delta z_2 * 10^{-6}$ (for proposed formula)	$\Delta z_3 * 10^{-6}$ (for Canberra formula)
0.01	0.5	1	0	0	0
0.011	0.5	1	3.97	2.59	2.37
0.012	0.5	1	7.94	4.48	4.82
0.013	0.5	1	11.9	6.64	7.73
0.014	0.5	1	15.8	8.72	10.3
0.015	0.5	1	19.8	11.1	12.9
0.016	0.5	1	23.7	13.5	15.5
0.017	0.5	1	27.7	15.1	18.1
0.018	0.5	1	31.6	17.6	21.08
0.019	0.5	1	35.5	19.6	23.66
0.020	0.5	1	39.5	21.8	26.1
0.021	0.5	1	43.4	24.0	28.7
0.022	0.5	1	47.3	26.2	31.2
0.023	0.5	1	51.3	27.8	33.9
0.024	0.5	1	55	30.4	36.6
0.025	0.5	1	59.1	33.1	39.1
0.026	0.5	1	63	35.1	41.6
0.027	0.5	1	66.9	37.1	44.1
0.028	0.5	1	70.8	39.1	47.1
0.029	0.5	1	74.7	40.8	49.57

In Table 2, when estimating the measure of proximity between the images the additive error and the scale change of the recognizable image made are taken to be constant, the method proposed at increasing values of the multiplicative error appears to be more effective than the Canberra and Manhattan methods.

The dependence of the measure of the proximity between objects during recognition on the change of the additive error in the measurement of the parameters of the recognizable image was checked by computer modeling. The obtained results are presented in Table 3.

Table 3

Dependence of the change in the measure of the proximity between objects depending on the additive error

Multiplicative error of measurement of γ - x_i	Additive error of measurement of Δ- x_i	K- scale change of recognizable image	$\Delta z_1 * 10^{-4}$ (for Manhattan formula)	$\Delta z_2 * 10^{-4}$ (for proposed formula)	$\Delta z_3 * 10^{-4}$ (for Canberra formula)
0.01	0.5	1	0	0	0
0.01	0.55	1	18.5	2.2	2.7
0.01	0.6	1	37.1	4.4	5.4
0.01	0.65	1	55.7	6.6	8.1
0.01	0.7	1	74.3	8.86	10.7
0.01	0.75	1	92.8	11.06	13.4
0.01	0.8	1	111.0	13.2	16.1
0.01	0.85	1	129.0	15.4	18.8
0.01	0.9	1	148.0	17.6	21.5
0.01	0.95	1	167.0	19.8	24.2
0.01	1.0	1	185.0	22.0	26.8
0.01	1.05	1	204.0	24.2	29.5
0.01	1.1	1	222.0	26.4	32.2
0.01	1.15	1	240.0	28.6	34.9
0.01	1.2	1	259.0	30.8	37.5
0.01	1.25	1	277.0	33.0	40.2
0.01	1.3	1	296.0	35.2	42.8
0.01	1.35	1	314.0	37.4	43.5
0.01	1.4	1	333.0	39.5	48.1
0.01	1.45	1	351.0	41.7	50.8

In Table 2, when estimating the measure of proximity between the images the multiplicative error and the scale change of the recognizable image made are taken to be constant, the method proposed at increasing values of the additive error appears to be more effective than the Canberra and Manhattan methods.

The analysis of the values obtained as a result of modeling is shown in the following results.

4. Conclusion

1. The proposed algorithm gives less error than the Canberra formula, which is the best of the existing formulas for determining the invariant to scale changes of recognizable image when estimating the measure of the proximity between objects.
2. The proposed algorithm gives less error than the Canberra formula, for the multiplicative error of measuring the parameters of the recognizable image

when estimating the measure of the proximity between objects.

3. The proposed algorithm gives less error than the Canberra formula, for the additive error of measuring the parameters of the recognizable image when estimating the measure of the proximity between objects.

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METHOD OF MODELING AND RESEARCHING MULTIDIMENSIONAL PROCESSES

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Abstract

The article analyzes the problems of construction and determination of the basic properties of three-dimensional numbers, as well as exploring opportunities to use them, along with quaternions, in modeling physical processes and digital processing of three-dimensional signals and images. It is noted that the algebras of quaternions, octaves and other hypercomplex numbers are actively used in various branches of science and technology for mathematical and computer modelling of complex physical processes and designing high-tech technical devices and systems.

The main part considers the peculiarities of using modified multidimensional numbers for modelling processes and designing high-tech devices. The main attention is given to the possibility of using hypercomplex numbers in modelling multidimensional signals. It is suggested to use three-dimensional variables represented as hypercomplex numbers for the processing of three-dimensional signals.

On the basis of the analysis of features of algebraic bases for multidimensional and three-dimensional numbers offered in the paper it is shown that they form, in general case, noncommutative on multiplication algebra with division over the field of real numbers. Moreover, the functions of the considered hypercomplex variables satisfy the Laplace equation. This means that the functions of hypercomplex variables are harmonic functions.

It is concluded from the mentioned results that the development of the theory of functions of hypercomplex variables will considerably enlarge the instrumental base of applied mathematical research.

Since in practice one has to solve problems in three-dimensional space most often, more detailed consideration of the properties of three-dimensional hypercomplex numbers will follow.

In conclusion, it is pointed out that the algebraic properties of hypercomplex numbers, including the proposed three-dimensional numbers in this paper, allow using them for mathematical and computer simulation of complex physical processes and designing of high-tech technical devices, as well as effectively conduct research in the processing of multidimensional signals, the dimensionality of which coincides with the dimensionality of hypercomplex numbers.

Keywords: hypercomplex number, quaternion, transformation, multidimensional signal, harmonic function.

At present, vector algebra, algebras of quaternions, octaves and other hypercomplex numbers are actively used in various fields of science and technology for mathematical and computer simulation of complex physical processes and design of science-intensive technical devices and systems [1-5]. For example, in the design of modern control systems of moving objects, communication and information transmission systems much attention is paid to the problems of digital processing of multidimensional signals and images [6,7]. When solving particular problems of multidimensional signal transformation, different authors use the most suitable sections of mathematics in their opinion. The method of using hypercomplex numbers [8] can also be considered as one of the effective methods of processing complex structured signals. It should be noted that in recent years, a number of scientific papers also propose new modifications of hypercomplex numbers, which expand the theoretical possibilities of research works.

In this paper we will consider some basic properties of three-dimensional numbers and their use, along with quaternions, in modelling and digital processing of three-dimensional signals and images.

As it is known, Fourier transforms, Laplace transforms and Z-transforms are most commonly used in the processing of one-dimensional signals. With increasing spatial dimension of signals the above mentioned transforms are considered depending on relevant number of variables. For example, when studying two-dimensional signals, extended Fourier transform of two variables is used and considered. The use of hypercomplex numbers gives a good toolkit for research and processing of complex multidimensional signals and images.

Recall that the most developed systems of hypercomplex numbers are obtained by first doubling the complex numbers, which are usually written in the form

$$z = x + iy \ , \qquad (1)$$

and then obtained four-dimensional and other doubled further hypercomplex numbers. Note also, the author of this paper has shown the possibility of constructing an algebra of three-dimensional numbers [9].

In [9] it was pointed out that the best known extension of complex numbers forming a noncommutative algebra with division are quaternions, which have the form

$$x = x_0 + ix_1 + jx_2 + kx_3 , \quad (2)$$

where x_0, x_1, x_2, x_3 – real numbers, *i, j* и *k* – imaginary units satisfying the following rules

$$i^2 = j^2 = k^2 = -1,\ ij = -ji = k,$$
$$jk = -kj = i, \qquad ki = -ik = j.$$

In the same paper it was noted that in the general case, the hypercomplex number *q* can have the following form

$$q = \sum_{n=o}^{N} i_n x_n , \quad (3)$$

where x_n – real number, i_n – unit guiding factor.

For a complex number, if it is treated as a special case of a hypercomplex number, in formula (3) the conditions for the unit guide coefficients must be fulfilled

$$i_0 \equiv i_0^a \equiv 1 , \ i_0 i_1 = i_1 \quad (4)$$
$$i_1^2 = -1 , \quad (5)$$

where a - random real number.

For multidimensional hypercomplex numbers, the unit guide coefficients can satisfy the conditions

$$i_0 \equiv i_0^a \equiv 1 , \ i_0 i_n = i_n \quad (6)$$
$$i_j i_k = \sigma_{jk} . \quad (7)$$

Values σ_{jk} define the properties of hypercomplex numbers. Formulas (4) and (6) mean that i_0 is the unit coefficient of the real number axis and $i_0 x_0 \equiv x_0$ is a real component of a hypercomplex number.

In order for the hypercomplex numbers to form a division algebra, accept unit guiding coefficients i_n mutually orthogonal and establishing an orderly relationship of direction to either of x_n с x_0, т.е. with points on the real number axis, as follows

$$i_n = \frac{\partial x_0}{\partial x_n} . \quad (8)$$

It follows from (8) that i_n are unit vectors. Therefore, given the properties of the vector product and using (8) without transformations, we have

$$i_j i_k = -i_k i_j = -1 , \ i_n^2 = -1 . \quad (9)$$

Any hypercomplex number $q = x_0 + \sum_{n=1}^{N} i_n x_n$, can be geometrically represented as point *A* in space with coordinates $x_0, x_1, x_2, \ldots, x_N$. In this case, the coordinate x_0 characterizes the scalar component of the hypercomplex number, and the set of other coordinates describe its vector component. A hypercomplex number can also be represented as a vector with the starting point at the origin and the end at point A. When representing a hypercomplex number in this way, the scalar component and the total vector component can be seen as scalar and vector projections of the hypercomplex number, respectively.

The basic principle of limit theory for hypercomplex numbers is based on and proceeds from the assumption that there exists a single point belonging to all spaces of a given sequence. The concept of a limit point for hypercomplex numbers is similar to the concept of a limit point for complex numbers.

$P = f(q)$ is a single-valued function defined by the area *G* hypercomplex variable spaces *q*. Derivative of a function *f(q)* at the point *q* (mark $f'(q) = \frac{df}{dq}$) is defined as follows

$$f'(q) = \lim_{\Delta q \to 0} \frac{\Delta P}{\Delta q} = \lim_{\Delta q \to 0} \frac{f(q+\Delta q) - f(q)}{\Delta q} \quad (10)$$

Equation (10) can be represented as

$$\lim_{\Delta q \to 0} \frac{\Delta P}{\Delta q} = \lim_{\substack{\Delta q_s \to 0 \\ \Delta q_v \to 0}} \frac{\Delta P_s + \Delta P_v}{\Delta q_s + \Delta q_v} = f'(q), \quad (11)$$

where $\Delta q_s = \Delta x_0$, $\Delta q_v = \Delta \sum_{n=1}^{N} i_n x_n$,

$\Delta P_s = \Delta f_0$, $\Delta P = \Delta \sum_{n=1}^{N} i_n f_n$.

As of $\Delta q \to 0$, as in the case of a separate $\Delta q_s \to 0$, and when the condition is separately fulfilled $\Delta q_v \to 0$,

$$\lim_{\Delta x_0 \to 0} = \frac{\Delta P_s + \Delta P_v}{\Delta x_0} = \lim_{\Delta x_0 \to 0} \frac{\Delta f_0 + \sum_{n=1}^{N} i_n \Delta f_n}{\Delta x_0} = f'(q), \quad (12)$$

$$\lim_{\Delta q_v \to 0} \frac{\Delta f_0 + \sum_{n=1}^{N} i_n \Delta f_n}{\sum_{n=1}^{N} i_n \Delta x_n} = f'(q) \quad .(13)$$

From (12) and (13) it follows that the Cauchy-Riemann conditions for hypercomplex numbers are

$$\frac{\partial f_0}{\partial x_0} = \frac{\partial f_1}{\partial x_1} + \frac{\partial f_2}{\partial x_2} + \ldots\ldots + \frac{\partial f_n}{\partial x_n} = \sum_{n=1}^{N} \frac{\partial f_n}{\partial x_n} , \quad (14)$$

$$\frac{\partial f_j}{\partial x_0} = -\frac{\partial f_0}{\partial x_j}, \ \frac{\partial f_k}{\partial x_0} = -\frac{\partial f_0}{\partial x_k},$$

at n=1,2,…,j,..,k,…,N, (15)

$$\frac{\partial f_j}{\partial x_k} = \frac{\partial f_k}{\partial x_j} . \quad (16)$$

Equation (16) follows from (15). Equation (14) takes expression (16) into account.

By differentiating (14) with respect to x_0 taking into account (15) we get

$$\frac{\partial^2 f_0}{\partial x_0^2} + \sum_{n=1}^{N} \frac{\partial^2 f_0}{\partial x_n^2} = 0. \quad (17)$$

Equation (17), as we see, is the Laplace equation. This means that the function f_0 is a harmonic function.

From equations (14) - (16) we also obtain

$$\frac{\partial^2 f_n}{\partial x_0^2} + \sum_{n=1}^{N} \frac{\partial^2 f_n}{\partial x_n} = 0. \quad (18)$$

From the last equation it follows that the functions f_n are also harmonic functions.

To summarize the first and main points above.

1. Hypercomplex numbers of the form (3) satisfying conditions (6) and (9) form in general a noncommutative multiplicative algebra with division over the field of real numbers.

2. Functions of the hypercomplex variables considered satisfy the Laplace equation. This means that the functions of hypercomplex variables are harmonic functions.

It can be concluded from the mentioned results that the development of the theory of functions of hypercomplex variables will make it possible to considerably extend the instrumental base of applied mathematical research.

In view of the fact that we have to solve problems in the three-dimensional space most often in practice, let us dwell on the study of the functions of three-dimensional hypercomplex numbers.

Restricting expression (3) to the first three terms of the expansion, let us write the three-dimensional hypercomplex number in the form

$$q = x + iy + jz \quad , \quad (19)$$

where $x = x_0, y = x_1, z = x_2, i = i_1, j = i_2$.

Thus, condition (9) for three-dimensional hypercomplex numbers in these notations will take the form

$$i^2 = j^2 = -1, \; ij = -ji = -1. \quad (20)$$

In this equation z and q are three-dimensional variables of the form

$$q = s + ix + jy. \quad (26)$$

At the value of $s = 0$ and condition $ij = 0$ from (25) one can obtain an analogue of the two-dimensional Fourier transform, which has been investigated in sufficient detail and is widely used in practice. A more detailed analysis is not given here due to space limitations of the paper.

Summing up, we note that the algebraic properties of hypercomplex numbers, including the three-dimensional numbers proposed in this paper, allow using them for mathematical and computer simulation of complex physical processes and design of science-intensive technical devices, as well as effectively conducting research in the processing of multidimensional signals whose dimensionality coincides with the dimensionality of hypercomplex numbers.

The value of the radius vector of a three-dimensional variable is determined by the expression

$$R = |q| = \sqrt{q\bar{q}} = \sqrt{x^2 + y^2 + z^2}. \quad (21)$$

In expression (21), R is a module of a three-dimensional hypercomplex number.

Note that these three-dimensional numbers do not form a normalized algebra similar to the algebra of quaternions, but can be used to solve a number of applied scientific and technical problems.

Angle between the radius vector and the axis *x* mark θ, and the angle between the projection of the radius-vector on the *yz* plane and the y-axis denote φ, then

$$x = R\cos\theta,$$
$$y = R\sin\theta\cos\varphi,$$
$$z = R\sin\theta\sin\varphi.$$

A hypercomplex three-dimensional number in a coordinate system R, θ, φ takes the form

$$q = R\left[\cos\theta + \left(i\cos\varphi + j\sin\varphi\right)\sin\theta\right]. \quad (22)$$

B (22) R – module, θ and φ – arguments of a three-dimensional hypercomplex number.

In addition to the representation in the form (19), a hypercomplex three-dimensional number can also have the following form

$$q = R\left[\cos\theta_x + i\cos\theta_y + j\cos\theta_z\right]. \quad (23)$$

where θ_x - angle between the radius vector and the axis x, θ_y - angle between the radius vector and the axis y, θ_z - angle between the radius vector and the axis z.

Using the representation of a three-dimensional number in the form (19) one can construct a three-dimensional version of the Laplace transform as well.

The Laplace integral, as it is known, has the form

$$F(p) = \int f(z)\exp(-pz)\,dz. \quad (24)$$

Here integration is performed on some given contour in the plane of the complex variable z, which puts the function *f(z)* defined on L in agreement with the analytic function *F(p)* of the complex variable $p = x + iy$.

In case of use a three-dimensional variable instead of a complex variable in (24), you can get

$$F(q) = \int f(z)\exp(-qz)\,dz = \int f(z)\exp\left[-(s + ix + jy)z\right]dz. \quad (25)$$

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REDUCING RANDOM ERRORS IN ESTIMATING THE PROXIMITY MEASURE BETWEEN OBJECTS WHEN RECOGNIZING IMAGE GEOMETRICS ON SMALL SAMPLES

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Abstract

In practice, some cases are available, when due to a small sample, measuring the accuracy of proximity measure values estimation between recognizable and reference objects is low because of the increased random error. In order to reduce random errors, it is necessary to carry out repeated measurements of the parameters. However, this reduces the performance of the pattern recognition system, which is undesirable in many cases. Therefore, methods are needed not to have little effect on the performance of the system by reducing the values of random errors in the measurement of parameters. The article considers an algorithm for increasing the reduction of random errors in estimating the measure of proximity between objects by using the minimum number of repeated measurements and a priori information on the distribution of random errors. The algorithm is based on the use of computer resources and fuzzy set theory.

Keywords: geometrics, measurement, small sample, object recognition, random errors, fuzzy set theory, membership function.

1. Introduction. When recognizing close images, proximity measure values between objects turn out to be in the same order as the value of the errors in its assessment. Therefore, the recognition reliability of close images is low, and in order to improve it, great efforts are required to improve the accuracy of estimating the proximity measure values between objects [1,p.198], [2].

Increasing the recognition reliability of close images provides for a number of measures to minimize errors in estimating the proximity measure values between objects. However, the existing measures are designed to minimize systematic errors in estimating the measure of proximity between objects. The situation is different with the minimization of random errors. The only effective way to minimize random measurement errors is the statistical processing of measurement results. However, this requires a large number of measurements, which significantly degrades the operation speed of the system. Therefore, the development of new methods for minimizing random errors in estimating the proximity measure values between objects that do not significantly degrade the operation speed of the system is relevant [3,p.325-330], [4,p.223].

2. Problem statement. The used method suggests the use of fuzzy set theory. The theory of fuzzy sets is based on the concept of a fuzzy set, which is characterized by a membership function [3,p.215-219], [4,p.150-153].

The basis of the method for obtaining the membership function is the estimation of the probability density *f(z)* of proximity measure values between objects *z* from small sample size. There is often a sharp reduction in the amount of information, which is the reason for the search for ways to make better use of limited information. This leads, first of all, to the need to create effective statistical methods for analyzing limited data. In limited conditions information is usually operated with a small sample, which is realized as a small number of observations over proximity measure values between objects that describes the phenomenon under study. The insignificant efficiency of traditional methods of statistical analysis with a limited amount of data leads to the need to search for new methods of data processing.

The main tasks of statistical analysis of a small sample are: estimation of the distribution law; estimation of the moments of proximity measure values between objects; testing statistical hypotheses.

3. Problem solving. The definition of a small sample can be approached from information positions. Since a random sample carries information about the image under study, statistical processing is nothing more than extracting information from the sample. If we apply the term "small sample" to the method of estimating the proximity measure values between objects between fuzzy sets, then we get the following definition. A small sample is recognized as a set {*z1,…zn*} of experimental values of z_i obtained during appropriate tests, and *n* is so small that it is impossible to use classical methods for determining the distribution law *Z*. For small $n = \overline{3,8}$, in order to obtain an estimate for $\tilde{f}(z)$, it is possible to use the method of rectangular contributions. This method is aimed at constructing an estimate for the distribution density $\tilde{f}(z)$. It is based: in addition to the sample itself {*z1,…zn*} on the use of additional a priori information about the value of the proximity measure values between objects *z*; on an individual approach to each individual implementation of the sample; on a uniform "smearing" of information obtained from a separate implementation of the sample; on a finite interval *d* [6,p.130] .

As additional a priori information, the knowledge of the interval [z_{min}, z_{max}] of the change in the value of the proximity measure between objects *z* is assumed. In this case, it is assumed that the estimated distribution function *f(z)* being continuous, does not have very steep leaps in a given interval, and

$$f(z) \geq 0, z \in [z_{\min}, z_{\max}]; \quad (1)$$

$$f(z) \equiv 0, z \notin [z_{\min}, z_{\max}]. \quad (2)$$

The presence of such a priori information, even in the absence of implementations of *z*, makes it possible to construct an estimate for the density $\tilde{f}(z)$. At the current level of the knowledge, none of the possible implementations within the interval [z_{min}, z_{max}] can be given preference. Such a feature has a uniform distribution on [[z_{min}, z_{max}]. Therefore, in the absence of a small sample, the density estimate is presented as:

$$\tilde{f}(z) = f_0(z) \quad (3)$$

The function *f0(z)* is called a priori distribution density.

The rectangular contribution is the result of 'smearing' each z_i value over some *2d* interval from z_i-*d to* z_i+ *d*. The width of the contribution *2d* can be selected subjectively [7,p.191-201].

If only the limit values of z_{min},and z_{max} are known, and none of the possible values of *z* within these limits can be given preference in terms of probability, then the initial approximation of the probability density is assumed to be as follows:

$$\tilde{f}_0(z) = \begin{cases} \dfrac{1}{z_{\max} - z_{\min}}, z \in [z_{\min}, z_{\max}]; \\ 0, z \notin [z_{\min}, z_{\max}]. \end{cases} \quad (4)$$

The presence of the experimental value of z_i makes it possible to specify the estimate by adding a rectangular contribution

$$\varphi_i(z) = \begin{cases} \dfrac{1}{2d}, z \in [z_i - d, z_i + d]; \\ 0, z \notin [z_i - d, z_i + d]. \end{cases} \quad (5)$$

The rectangular contribution is set symmetrically about the point $x=x_i$ on a finite interval of length *d*, which is a "smearing" the information about the proximity measure values between objects obtained from this implementation.

Linear summation with equal weights of a priori density (4) and contributions (5) for all *n* sample elements {$z_{1,}…z_n$} eventually leads to the desired density estimate [4,p.186].:

$$\tilde{f}(z) = a\left(f_0(z) + \sum_{i=1}^{n} \varphi_i(z) \right), \quad (6)$$

where $a = (n+1)^{-1}$ is weight coefficient.

In equation (6), through the weight coefficient *a*, the density estimate $\tilde{f}(z)$ is normalized. When constructing a density estimate by the method of rectangular contributions according to equation (6), for contributions that go beyond one of the interval boundaries [z_{min}, z_{max}], it is recommended to discard the parts that go beyond these boundaries. Above the remaining part of the contribution, which lies inside the interval [z_{min}, z_{max}], as above the base, a rectangle should be evenly built up, the area of which is equal to the discarded one.

On condition

$$z_{\min} \langle z_1 \langle z_2 \langle \ldots \langle z_n \langle z_{\max} \quad (7)$$

It is possible to accept

$$d = \max(z_i - z_{\min}, z_i - z_{i-1}, z_{\max} - z_n). \quad (8)$$

For the extreme contributions $\varphi_1(z)$ and $\varphi_n(z)$, going beyond one of the boundaries of the interval [z_{min},z_{max}], the following equations can be accepted:

$$\varphi_1(z) = \begin{cases} \dfrac{1}{d + z_1 - z_{\min}}, z \in [z_{\min}, z_1], \\ 0, z \notin [z_{\min}, z_1]; \end{cases} \quad (9)$$

$$\varphi_n(z) = \begin{cases} \dfrac{1}{d + z_{\max} - z_n}, z \in [z_n, z_{\max}], \\ 0, z \notin [z_n, z_{\max}]. \end{cases} \quad (10)$$

If the boundaries z_{min} and z_{max} are known, then instead of (6) the following equation of taken

$$\tilde{f}(z) = n^{-1} \sum_{i=1}^{n} \varphi_i(z), \quad (11)$$

where instead of (8) the following equation can be written

$$d = \max(z_i - z_{i-1}). \quad (12)$$

As a result of the analysis of a small sample any proximity measure values between objects can be represented by the relevant discrete fuzzy set. For this, firstly, a small sample should be obtained, i.e., several proximity measures value between objects z_i should be found. Secondly, it is necessary to obtain a subjective

estimate of the probability density $\tilde{f}(z)$ from the implementation values of Z, using the analysis of a small sample, i.e., continuous membership function $\mu_A(z_i)=\tilde{f}(z)$. The subjectivity of $\tilde{f}(z)$ is determined by the subjectivity of the selection of n and d. Thirdly, we need to discretize Z into z_{min}, z_{max} and move from $\tilde{f}(z)$ to the subjective probability function $p_A(z_i)$, i.e. to the trellis membership function $\mu_A\ (z_i) = p_A(z_i) = \mu_A$ [8,p.111-114].

Based on the above-mentioned, the procedure for obtaining the membership function $\mu_A(z_i)$ for a fuzzy set is as follows: a small sample $z_1,z_2,\ldots,z_n$ is experimentally determined; the width $2d$ and the height h of the rectangular contributions are selected; the contributions (4),(5) are determined; an estimate of the probability density (6), (8) is determined and its graph is constructed; discretization Z is carried out, the values of z_i and their subjective probabilities are determined; the trellis membership function and the fuzzy set are fixed.

4. Example. As a result of the research, several implementations (from 3-15) of the random variable of the recognized and reference objects parameters were obtained. It is required to obtain the relevant fuzzy set and the trellis membership function for the proximity measure values between objects. For this, it is necessary to perform the following algorithm [10,p.125]..

1. Let us be given some small sample: a) with the initial values of the recognized object $x_1=99;\ x_2=98;\ x_3=97$; b) with the reference values of the object $y_1=100;\ y_2=96;\ y_3=101$. According to the Manhattan formula

$$z=\sum_{i=1}^{n}|x_i-y_i| \tag{13}$$

the proximity measure between the recognized and reference objects is calculated. After the calculation, a new small sample is formed: $z_1=1;\ z_2=2;\ z_3=4$.

2. The followings are selected:

a) the width of the rectangular contribution $2d$, determined as the maximum of the subsequent values differences z_i from the previous ones z_{i-1}

$$2d=2\max\{z_i-z_{i-1}\}=2\max\{2-1;\ 4-2\}=2\max\{1;\ 2\}=2*2=4, \tag{14}$$

б) the height of the rectangular contribution h so that $2dh = 1(d=2)$:

$$h=\frac{1}{2d}=\frac{1}{4}=0{,}25 \tag{15}$$

3. According to formula (5), rectangular contributions are determined in the range from z_i-d до z_i+d:

$$\varphi_1(z)=\begin{cases}0{,}25;\ z\in[1-2,\ 1+2];\\ 0;\ z\notin[1-2,\ 1+2];\end{cases} \tag{16}$$

$$\varphi_2(z)=\begin{cases}0{,}25;\ z\in[2-2,\ 2+2];\\ 0;\ z\notin[2-2,\ 2+2];\end{cases} \tag{17}$$

$$\varphi_3(z)=\begin{cases}0{,}25;\ z\in[4-2,\ 4+2];\\ 0;\ z\notin[4-2,\ 4+2].\end{cases} \tag{18}$$

Simplifying formulas (16) - (18), the following equations are obtained:

$$\varphi_1(z)=\begin{cases}0{,}25;\ z\in[-1;\ 3];\\ 0;\ z\notin[-1;\ 3];\end{cases} \tag{19}$$

$$\varphi_2(z)=\begin{cases}0{,}25;\ z\in[0;\ 4];\\ 0;\ z\notin[0;\ 4];\end{cases} \tag{20}$$

$$\varphi_3(z)=\begin{cases}0{,}25;\ z\in[2;\ 6];\\ 0;\ z\notin[2;\ 6].\end{cases} \tag{21}$$

According to (3.11) $\tilde{f}(z)=\frac{1}{3}\sum_{1}^{3}\varphi_i(z)$ is found according to which the following is obtained

$$\int_{-1}^{6}\tilde{f}(z)dz=\frac{1}{3}(3*1*0{,}25+2*1*0{,}5+1*1*0{,}75)=0{,}83 \tag{22}$$

4. The range $[-1;6]$ of the continuous value of proximity measure between objects $\tilde{Z}$ is assigned in accordance with seven values z_i of the discrete value of the proximity measure between objects Z

z_i=-0,5; 0,5; 1,5; 2,5; 3,5; 4,5; 5,5

with subjective probabilities the following equations are obtained

$$P_z(z_1)=\frac{1*0{,}25}{3}=0{,}083=P_z(z_2)=P_z(z_7) \tag{23}$$

$$P_z(z_3)=\frac{1*0{,}5}{3}=0{,}167=P_z(z_5)=P_z(z_6) \tag{24}$$

$$P_z(z_4)=\frac{1*0{,}75}{3}=0{,}25 \tag{25}$$

Simulation of the program algorithm showed that with an increase in the number of repeated measurements NK, the proximity measure values between objects decreases to zero [11,p.30-33]..

where $\sum_{i=1}^{7}P_z(z_i)=1$.

6. We get the membership functions of the proximity measure values between objects z:

$$\mu_z(z_i)=\begin{cases}0{,}083,\ i=1{,}2{,}7;\\ 0{,}167,\ i=3{,}5{,}6;\\ 0{,}25,\ i=4\end{cases} \tag{26}$$

and a discrete fuzzy set of proximity measure values between objects

$$Z=0{,}083/1+0{,}083/2+0{,}167/3+0{,}25/4+0{,}167/5+0{,}167/6+0{,}083/7. \tag{27}$$

5. Conclusion. The analysis of the obtained results showed that the universal division of the range of random errors variation into intervals is achieved by selecting the interval width $b=\sigma/$. This is due to the characterization of random errors. Testing various input

data showed full compliance of theoretical research with experimental results. This means that the developed algorithm has sufficient reliability. Therefore, it can be used to improve the reliability of RO by reducing random errors in estimating the proximity measure between objects. The final results showed that the optimal selection of the interval width can more accurately estimate the proximity measure between objects.

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NUMERICAL STUDY OF FOCUSING PARAMETERS OF AN AXISYMMETRIC CATHODE LENS

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Abstract

This paper presents the results of numerical studies of a three-electrode cathode lens with axial field symmetry and analyses its paraxial parameters and spatial aberrations. The resultant calculations and analysis of the focusing properties of the lens show that the values of lens aberrations become greater the greater the negative modulo value of the applied potential of the focusing electrode. The results of this work can be used in the design of electron and ion-probe technology nodes for micro- and nanoelectronics and a wide range of analytical devices.

Keywords: cathode lens, beam, charged particle, focusing, parameter, aberration, crossover.

The cathode or emission lens is one of the main elements of electron- and ion-beam process units in micro- and nanoelectronics, charged particle accelerators and a range of analytical instruments and devices. The quality of focusing in a cathode lens directly determines the main technical characteristics of high technology devices and the resolution of analytical instruments [1-6].

In this paper, we numerically investigated and analysed the paraxial parameters and spatial aberrations of a three-electrode cathode lens consisting of a planar cathode and two cylindrical electrodes with equal diameters that are arranged in series and coaxially. Note that there has been much research on the focusing properties and aberration characteristics of various lens types, e.g., [7-11].

Introduce a cylindrical coordinate system r, z, ψ . The cathode in this coordinate system is perpendicular to the main optical axis z and the cathode surface is used as the reference for this coordinate. The formations of the cylindrical electrodes (bodies of rotation) are parallel to the axis z . For cathode potential, the value of potential of the first and second cylindrical electrodes is assumed to be zero., φ_1 и φ_2 .

Due to the rotational symmetry of the electrodes, the parameters of the lens in question are independent of the coordinate ψ .

The electrostatic potential distribution along the main optical axis of such a lens can be calculated with sufficient accuracy using the formula

$$\Phi(z)=\varphi_1 th\left(1.318\frac{z}{R}\right)+\frac{1}{2}(\varphi_2-\varphi_1)\left[th\left(1.318\frac{z+z_1}{R}\right)+th\left(1.318\frac{z-z_1}{R}\right)\right], \quad (1)$$

where z_1 - is the length (formative size) of the first cylindrical electrode (i.e. focusing electrode); R - is the radius value of the cylindrically shaped electrodes. The dimensions of the gaps between the electrodes are considered small and can be neglected.

In the paraxial approximation, the motion of charged particles in the lens in question satisfies the equation [2]

$$\Phi r''+\frac{1}{2}\Phi' r'+\frac{1}{4}\Phi'' r=0\ . \quad (2)$$

The general solution to equation (2) is

$$r(z)=r_k u(z)+\frac{2}{\Phi_k^{'}}\sqrt{\varepsilon_r}\,v(z)e^{i\beta}\ , \quad (3)$$

where r_k - coordinate of the point of departure of the charged particle from the cathode, $\Phi_k^{'}$ - value of electrostatic field strength at the cathode, ε_r - radial component of the initial energy of a particle escaping from the cathode, β - the angle between the planes, one of which passes through the axis z and the particle's point of departure, the other through the initial velocity vector and a line parallel to the axis z, starting at the point of departure of the particle, $u(z)$ и $v(z)$ - частные линейно-независимые решения уравнения (2).

The solution $u(z)$ satisfies equation (2) under initial conditions

$$u(0)=1\ ,\quad u'(0)=0\ . \quad (4)$$

Due to the resultant $z=0$ the singularity in equation (2) the second partial linear-independent solution $v(z)$ is defined from the expression

$$v(z)=\sqrt{\Phi(z)}w(z)\ , \quad (5)$$

where $w(z)$ is a solution to the equation

$$\Phi w''+\frac{3}{2}\Phi' w'+\frac{3}{4}\Phi'' w=0 \quad (6)$$

under initial conditions

$$w(0)=1\ ,\ w'(0)=0\ . \quad (7)$$

The cathode lens parameters were calculated assuming it formed a crossover, i.e. under the condition

$$u(z)\big|_{z=z_c}=0\ . \quad (8)$$

here z_c denotes the crossover coordinate of the charged particle beam generated by the lens in question.

As a result of numerical calculations carried out using computers, the ratios of the lens parameters (electrode sizes, electrode potentials) at which the condition (8) is fulfilled were determined. The results are presented as a graph (Figure 1). In carrying out the calculations it was assumed $R=1$. In the figures hereafter, line 1 corresponds to the value $z_c=5R$, line 2 - value $z_c=10R$, line 3 - value $z_c=15R$, line 4 - value $z_c=20R$.

The coordinate of an arbitrary particle with non-zero initial energy in the crossover plane can be determined by the formula

$$r(z_c)=\frac{2}{\Phi_k^{'}}\sqrt{\varepsilon_r}\,v(z_c)e^{i\beta}\ . \quad (9)$$

From expression (9) it can be seen that the beam crossover size in paraxial approximation for different values z_c depends on the values $\Phi_k^{'}$ and $v(z_c)$.

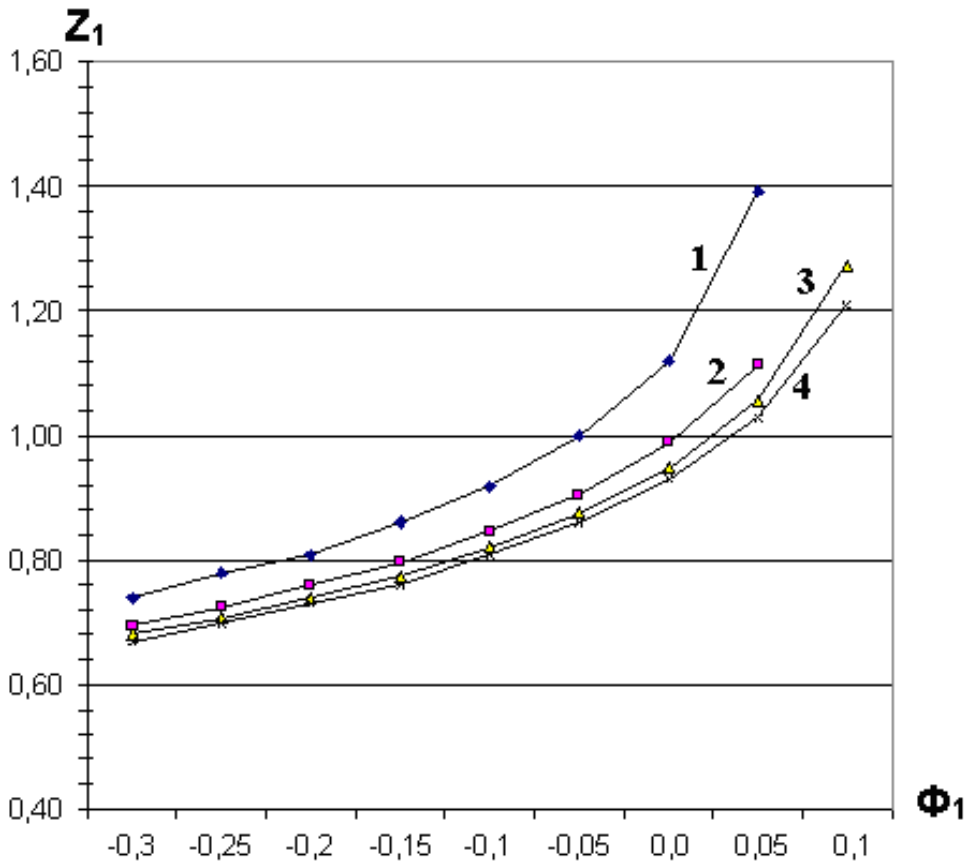

Figure 1 - Graph of crossover formation conditions.

The individual aberrations of the lens in question can be determined by analysing the charged-particle trajectory equation [2]

$$re^{i(\psi+\theta)} = r_k u(z) + b_1 v(z) + r_k\sqrt{\varepsilon_z}C_{21}(z) + b_1\sqrt{\varepsilon_z}C_{22}(z) + \\ + r_k^3 C_{31}(z) + r_k^2\bar{b}_1 C_{32}(z) + r_k^2 b_1 C_{33}(z) + \\ + r_k b_1^2 C_{34}(z) + r_k b_1\bar{b}_1 C_{35}(z) + b_1^2\bar{b}_1 C_{36}(z) + r_k\varepsilon_z C_{37}(z) + b_1\varepsilon_z C_{38}(z)\,. \quad (10)$$

Aberration coefficients C_{nj} $(n=2,3;\ j=1,2,\ldots,8)$ have the form

$$C_{21} = B_{21} - u'\zeta_1\ ,\ C_{22} = B_{22} - v'\zeta_1\ ,\ C_{31} = B_{31} - u'\zeta_{21}\ , \\ C_{32} = B_{32} - u'\zeta_{22}\ ,\ C_{33} = B_{33} - u'\zeta_{22} - v'\zeta_{21}\ , \\ C_{34} = B_{34} - v'\zeta_{22}\ ,\ C_{35} = B_{35} - u'\zeta_{23} - v'\zeta_{22}\ , \\ C_{36} = B_{36} - v'\zeta_{23}\ ,\ C_{37} = B_{37} - u'\zeta_{24}\ ,\ C_{38} = B_{38} - v'\zeta_{24}\ . \quad (11)$$

here

$$\mathrm{B}_{nj} = -\frac{2}{\Phi_k'}\left(u\int_0^{z_0}\frac{S_{nj}}{\sqrt{\Phi}}v\,dz_0 - v\int_0^{z_0}\frac{S_{nj}}{\sqrt{\Phi}}u\,dz_0\right)\ , \quad (12)$$

where

$$S_{21} = \frac{\sqrt{\Phi}}{2\Phi_k'}\Phi'''u\ , \quad (13)$$

$$S_{22} = \frac{\sqrt{\Phi}}{2\Phi_k'}\Phi'''v \quad (14)$$

$$S_{31} = \frac{\Phi^{IV}}{32} u^3 - \frac{\Phi'''}{4} u\zeta_{21}\,, \tag{15}$$

$$S_{32} = \frac{\Phi^{IV}}{32} u^2 v - \frac{\Phi'''}{4} \zeta_{22} u\,, \tag{16}$$

$$S_{33} = \frac{\Phi^{IV}}{16} u^2 v - \frac{\Phi'''}{4} \left[\zeta_{22} u + v\zeta_{21}\right], \tag{17}$$

$$S_{34} = \frac{\Phi^{IV}}{32} uv^2 - \frac{\Phi'''}{4} v\zeta_{22}\,, \tag{18}$$

$$S_{35} = \frac{\Phi^{IV}}{16} uv^2 - \frac{\Phi'''}{4} \left[u\zeta_{23} + v\zeta_{22}\right], \tag{19}$$

$$S_{36} = \frac{\Phi^{IV}}{32} v^3 - \frac{\Phi'''}{4} \zeta_{23} v\,, \tag{20}$$

$$S_{37} = -\frac{\Phi'''}{4} u\zeta_{24} - \frac{\Phi^{IV}\Phi u}{2\Phi_k{}'^2}\,, \tag{21}$$

$$S_{38} = -\frac{\Phi'''}{4} v\zeta_{24} - \frac{\Phi^{IV}\Phi v}{2\Phi_k{}'^2}\,. \tag{22}$$

Included in the latter expressions ζ_{21} - ζ_{24} are determined according to the following formulas

$$\zeta_{21} = \frac{1}{2R} - \frac{uu'}{2} + \sqrt{\Phi}\int_0^{z_0} \frac{uu''}{\sqrt{\Phi}} dz_0\,,$$

$$\zeta_{22} = \frac{\sqrt{\Phi}}{2}\int_0^{z_0} \left(u''v - u'v'\right) dz_0\,,$$

$$\zeta_{23} = \frac{\sqrt{\Phi}}{2}\int_0^{z_0} \frac{1}{\Phi\sqrt{\Phi}}\left(\frac{\Phi_k{}'^2}{4} - \Phi v'^2 - \frac{\Phi''}{4} v^2\right) dz_0\,,$$

$$\zeta_{24} = \frac{\sqrt{\Phi}}{2}\int_0^{z_0} \frac{1}{\Phi\sqrt{\Phi}}\left[1 + \frac{1}{\Phi_k{}'^2}\left(2\Phi\Phi'' - \Phi'^2\right)\right] dz_0\,.$$

The results of the calculations of a number of aberration coefficients are shown in the graphs below (fig.2 to fig.7).

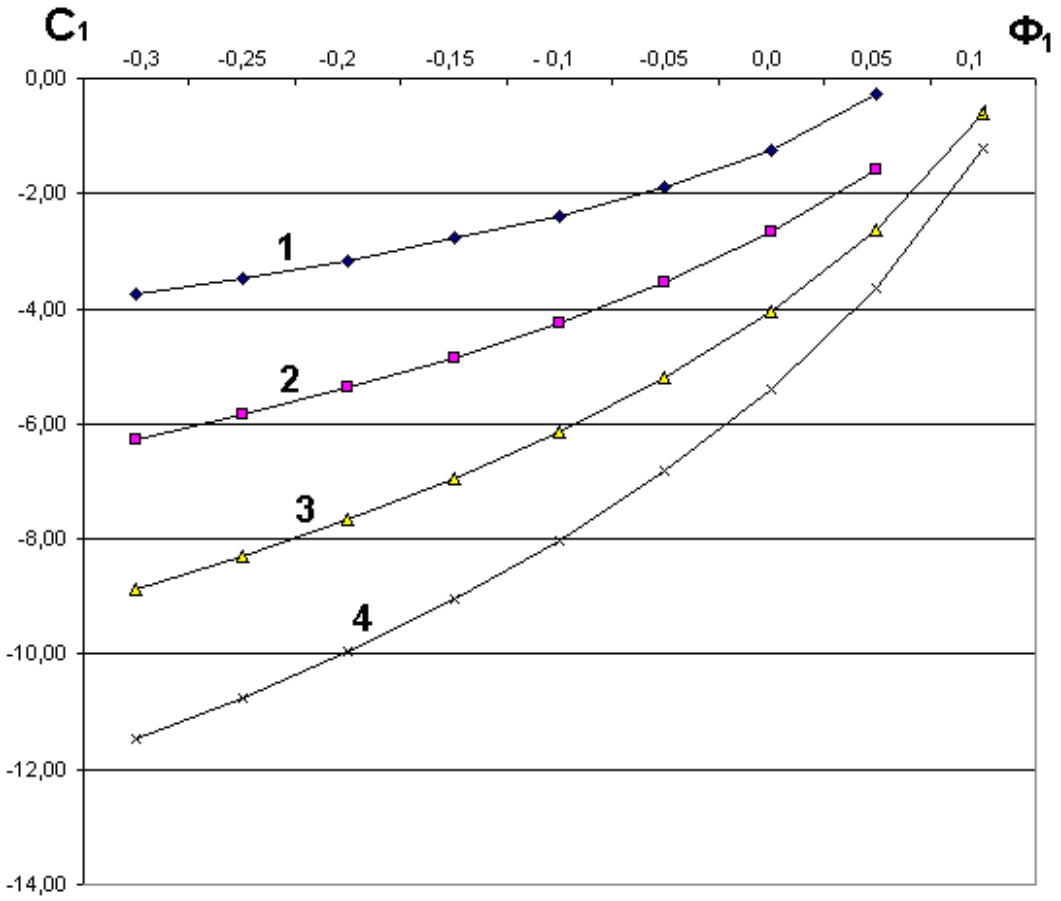

Figure 2 - Aberration coefficient graphs C_{31}

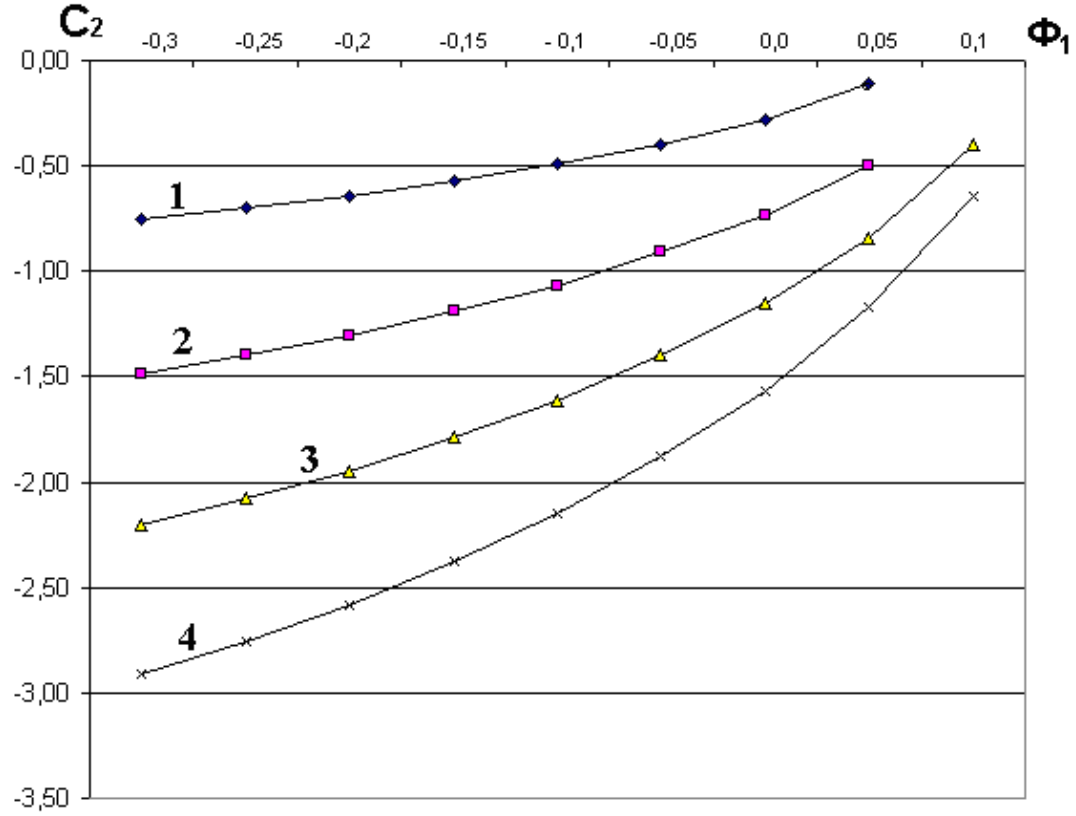

Figure 3 - Aberration coefficient graphs C_{32}

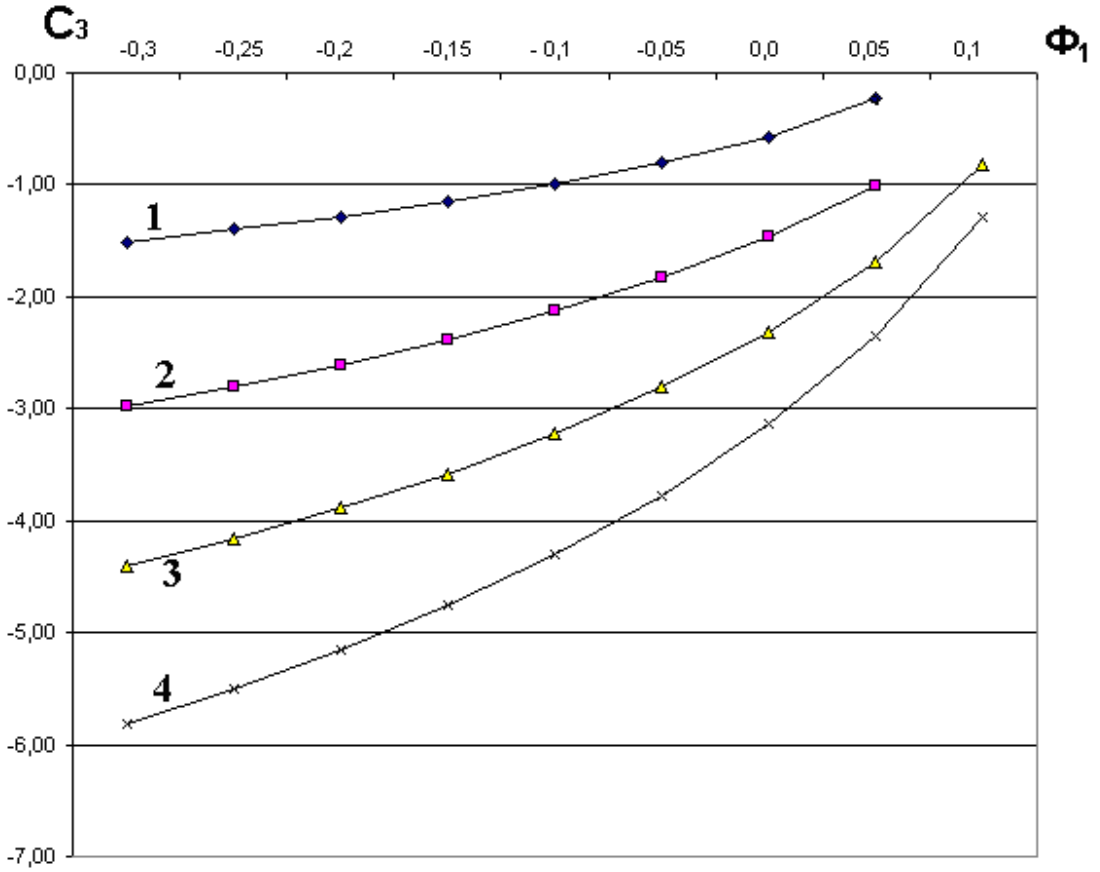

Figure 4 - Aberration coefficient graphs C_{33}

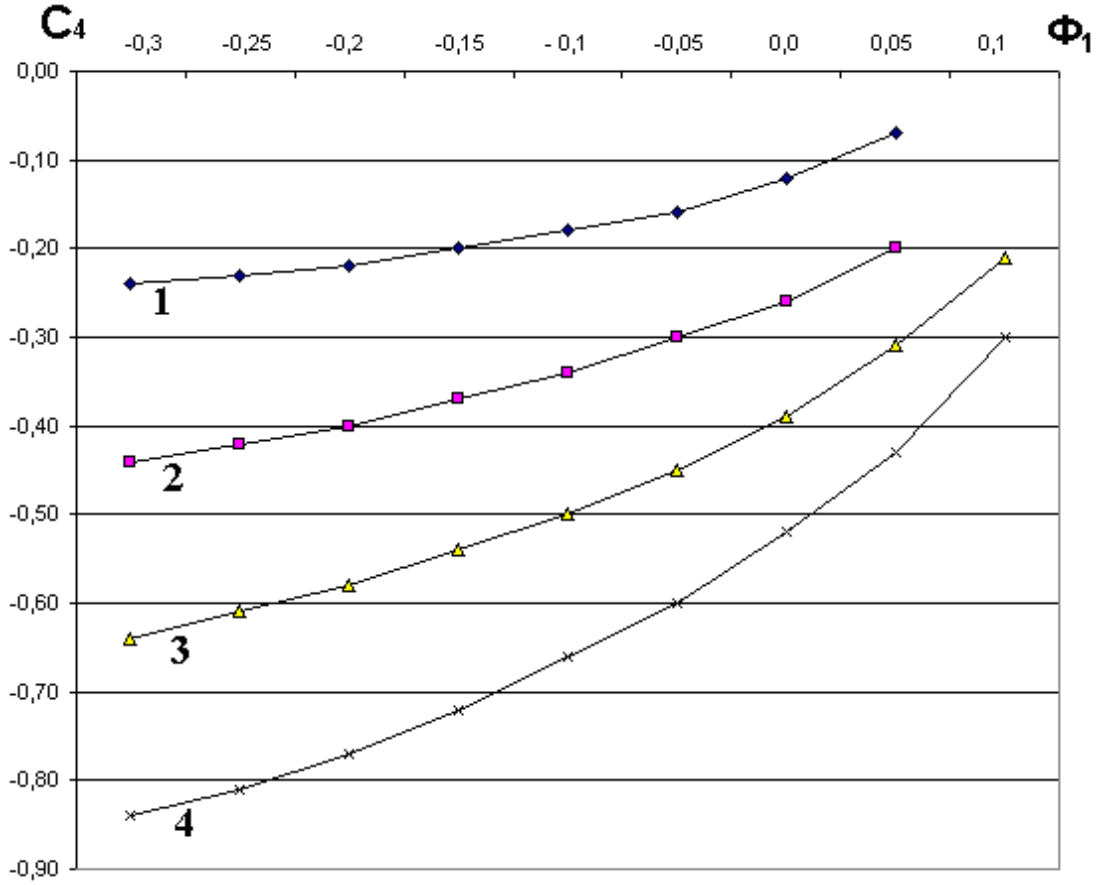

Figure 5 - Aberration coefficient graphs C_{34}

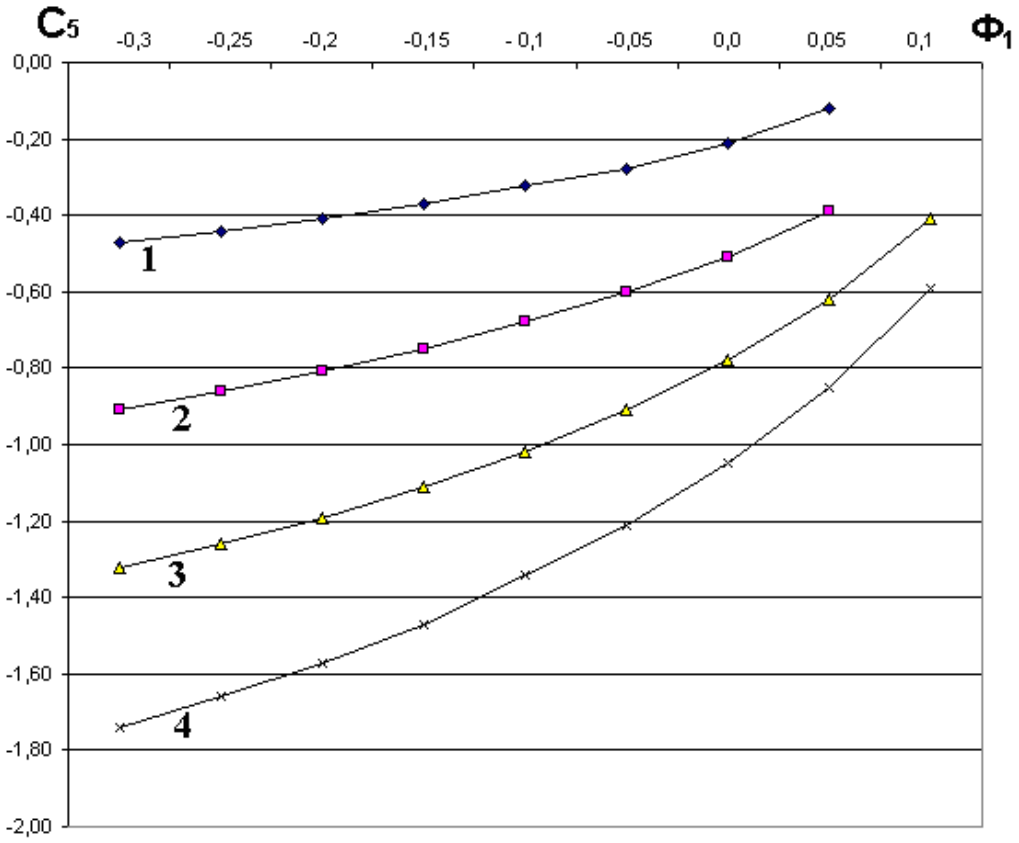

Figure 6 - Aberration coefficient graphs C_{35}

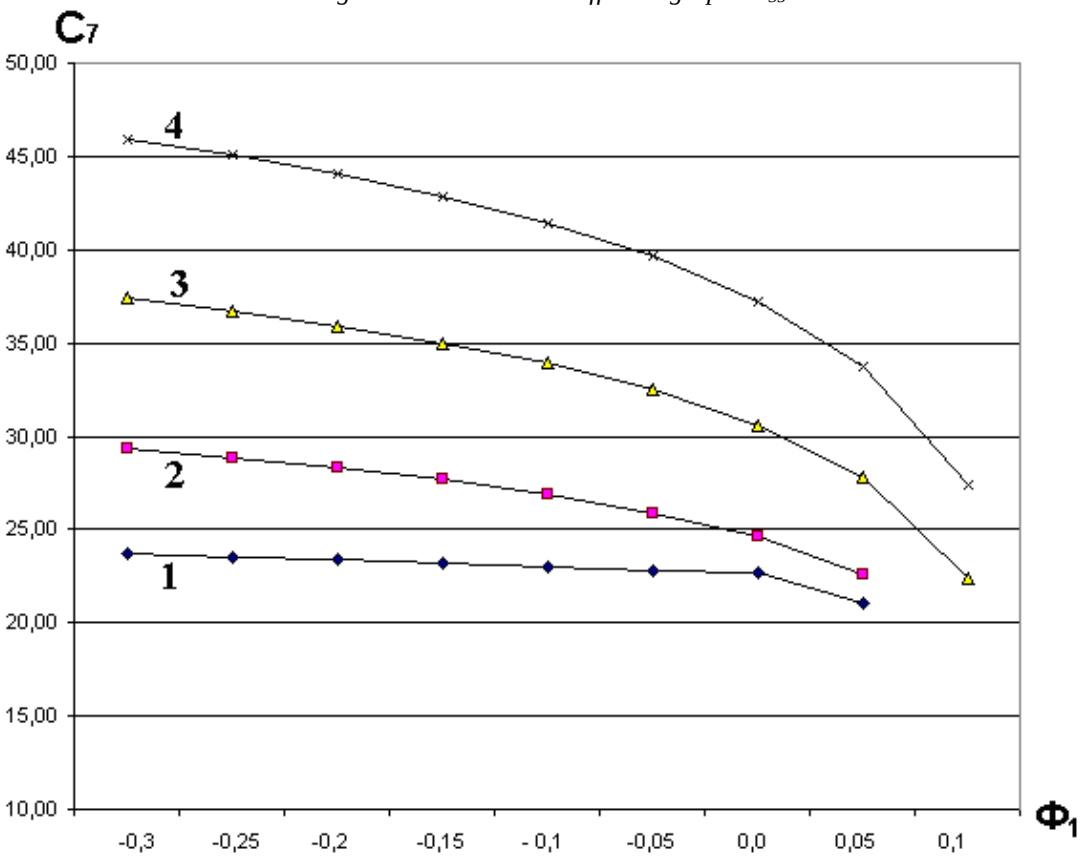

Figure 7 - Aberration coefficient graphs C_{37}

From the data obtained, it can be seen that the aberration values of the investigated lens become larger in cases where the focusing electrode has a larger modulo negative value of the applied potential. In this case, the lens field is more curved, impairing the ability to focus at high quality. The compensating effect of one or more additional focusing electrodes can be used to overcome this factor.

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F_β SCORE ADVANTAGES OVER MATTHEWS CORRELATION COEFFICIENT IN BINARY CLASSIFICATION MODEL EVALUATION

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Abstract

Widely used metrics to evaluate binary classification model include F_β score, which for unbalance datasets may give overoptimistic evaluation points. There are conducted research which recommends using Matthews Correlation Coefficient (MCC) for binary classification model's evaluation with unbalance datasets. However, a performance goal of model's evaluation may treat with different priorities the model's ability to be correct for all objects versus to be correct only for objects from "positive" class. In this case, MCC can measure only 1st aspect but F_β score - both aspects of model's performance.

Keywords: binary classification model, F_β score, Matthews Correlation Coefficient (MCC), confusion matrix.

A binary classification model for each object from dataset predicts it's class. The class of the binary classification model is always described by a set of two values, e.g., "+1" or "-1". Regardless of the class's name, one class is considered as "positive" and the other - "negative". For example, a model of binary classification in medicine must be able to determine the presence or absence of a disease then in the first case the object will be assigned to the "positive" class, in the second - to the "negative". Most classification algorithms are supervised learning, i.e., input dataset includes "real world" class for each object from the dataset. Once the model is built, it's predicted class is compared with available "real world" class and each object is assigned to one of 4 categories:

TP – includes object(s) which "real world" class is "+1" and model's predicted class is "+1";

FP - includes object(s) which "real world" class is "-1" and model's predicted class is "+1";

TN - includes object(s) which "real world" class is "-1" and model's predicted class is "-1";

FN - includes object(s) which "real world" class is "+1" and model's predicted class is "-1".

The number of objects per each category is included in model's confusion matrix $\mathrm{M} = \begin{pmatrix} TP & FN \\ FP & TN \end{pmatrix}$ and binary model's quality is evaluated by metrics calculated on matrix M. The most often used metrics are Accuracy, Recall, Precision, F_β score (1), Matthews Correlation Coefficient (MCC) (2), area under ROC and PR curves [1,2,3].

$$F_\beta = \frac{(1+\beta^2)\cdot \mathrm{TP}}{(1+\beta^2)\cdot \mathrm{TP}+\beta^2\cdot FN+FP} \quad (1)$$

$$MCC = \frac{TP\cdot TN - FP\cdot FN}{\sqrt{(TP+FP)\cdot(TP+FN)\cdot(TN+FP)\cdot(TN+FN)}} \quad (2)$$

In formula (1) the value of β determines whether Precision or Recall has more impact on over all F_β score. When $\beta \in [0,1)$ then the value of Precision has the bigger impact; when $\beta > 1$ - the value of Recall.

When $\beta = 1$ then both metrics are equally considered. The values of F_β score belong to interval [0,1]; when F_β is equal to 1 then binary model correct 100% of times and identifies correctly all of objects from positive class.

The values of MCC per formula (2) belong to interval $[-1,1]$; when MCC is equal to 1 then binary model has no misclassified objects.

Despite widely used metrics Accuracy and F_β metrics for measuring a binary classification model's quality in works [2,3] is recommended to use MCC metric instead, especially for unbalanced datasets, emphasizing that the F_β produces more optimistic quality score than actual model's ability to predict object's class. The examples in favour of MCC given in [2,3] include:

1. for a "positively" unbalanced dataset that includes 91 objects of class "+1" and 9 objects of class "-1", the model classifies 99 objects to class "+1" and 1 object from positive class is included to class "-1", i.e. the matrix M consists of values: TP = 90, FN = 1, TN = 0, FP = 9. According to formulas (1) - (2) is obtained: $F_{\beta=1}$ = 0.95, MCC = -0.03.

2. for a "positively" unbalanced dataset that includes 75 objects of class "+1" and 25 objects of class "-1", the model classifies 11 objects to class "+1" and 89 objects – to class "-1"", i.e. the matrix M consists of values: TP = 5, FN = 70, TN = 19, FP = 6. According to formulas (1) - (2) is obtained: $F_{\beta=1}$ = 0.12, MCC = -0.24.

3. for a "negatively" unbalanced dataset that includes 90 objects of class "-1" and 10 objects of class "+1", the model classifies 98 objects to class "+1" and 2 objects - to class "-1" i.e. the matrix M consists of values: TP = 9, FN = 1, TN = 1, FP = 89. According to formulas (1) -(2) is obtained: $F_{\beta=1}$ = 0.17, MCC = -0.19.

4. for a "negatively" unbalanced dataset that includes 89 objects of class "-1" and 11 objects of class "+1", the model classifies 3 objects to class "+1" and 97 objects to class "-1", i.e. the matrix M consisted of values: TP = 2, FN = 9, TN = 88, FP = 1. According to formulas (1) - (2) is obtained: $F_{\beta=1}$ = 0.29, MCC = 0.31.

The summary of model's evaluation from examples 1-4 is presented in rows "$F_{\beta=1}$" and "MCC" from Table 1. The value of MCC is lower than "$F_{\beta=1}$", however as it was specified at the beginning, MCC is measured by interval [-1,1] whereas F_β - by internal [0,1] so to have a correct comparison the received values of MCC must be normalized fist as specified by formula (3) and only after compared with F_β.

$$\mathrm{MCC}' = \frac{\mathrm{MCC}+1}{2} \quad (3)$$

The normalized MCC is presented in line MCC' from Table1. The comparison of MCC' vs F_β show:

Table 1

Binary classification models evaluated by $F_{\beta=1}$ and MCC'

	1	2	3	4
$F_{\beta=1}$	0.95	0.12	0.17	0.29
MCC	-0.03	-0.24	-0.19	0.31
MCC'	0.49	0.38	0.41	0.66

Example №1: for "positively" unbalanced dataset the model failed to classify correctly objects from class "-1" (TN=0) but $F_{\beta=1}$ is high (the higher than MCC') because the number of objects included in FP and FN is relatively small compare to the number of objects are included in TP (formula (1) doesn't take into consideration models' failure for TN but MCC formula (2) does).

Examples №2, №3, №4: MCC' is higher than $F_{\beta=1}$, because formula (1) has more penalty for big values in FN and FP compared to formula (2).

The results from Table1 demonstrate that for the unbalanced datasets (examples №2, №3, №4) the received MCC' is more optimistic than $F_{\beta=1}$ and may lead to incorrect conclusions regarding the model's performance and only for the unbalanced dataset (example №1) when ration $\frac{TP}{FP+FN} \geq 1$ MCC' metric is significantly low and $F_{\beta=1}$ looks overoptimistic.

Let's now measure models' correctness for all objects against models' correctness for only objects from positive class. For models from example 1-4 set β = 2 to estimate's model Recall and set β=0.0001 to estimate's model Precision. The new summary is presented in Table2. The received scores to be read as:

Example 1 – model is correct 97% of times and identifies correctly 91% of objects from positive class, so if the goal is model's correctness, then model from example 1 is quite good.

Example 2 – model is correct 8% of times and identifies correctly 45% of objects from positive class, so both model' precision and recall are low and model isn't good.

Example 3 – model is correct 9% of times and identifies correctly 33% of objects from positive class. so both model' precision and recall are low and model isn't good.

Example 4 – model is correct 67% of times and identifies correctly 21% of objects from positive class, so if the goal is model's correctness, then may be model can be considered as good.

Table2

Binary classification models evaluated by $F_{\beta=0.0001}$ and $F_{\beta=2}$

	1	2	3	4
$F_{\beta=1}$	0.95	0.12	0.17	0.29
$F_{\beta=0.0001}$	0.91	0.45	0.09	0.67
$F_{\beta=2}$	0.97	0.08	0.33	0.21
MCC'	0.49	0.38	0.41	0.66

The results from Table1 and Table2 allow to conclude the following: for unbalance dataset $F_{\beta=1}$ looks overoptimistic when ration $\frac{TP}{FP+FN} \geq 1$ so as recommended in [2,3] MCC' to be considered for model evaluation; when ration $\frac{TP}{FP+FN} < 1$ then $F_{\beta=1}$ score doesn't tend to be overoptimistic and can be used for model's evaluation. When binary model needs to be evaluated for is ability to correctly classify object from only "positive" class then metric F_β score to be utilized with corresponding value of β parameter.

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