



## INFORMATION TECHNOLOGIES

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## DEVELOPMENT OF PROTOTYPE FOR USER INTERFACE OF INFORMATION SYSTEM

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For intellectual activity in the time of information explosion, it is necessary to explore a lot of documents obtained from open sources of the Internet. The object of research is the interface and structure of the information system. This system allows to reduce the processed information flow by filtering documents. The filtration is based on the documents set clustering. This method is seldom used due to the complexity of the user interface.

To solve this problem, it is proposed to use the mind map view for visualizing the clustering results. The cluster hierarchy automatically creates the initial graph of the map nodes. The binary graph of the clustering results will automatically transform to the n-ary graph tree. The n is no more than the Yngve-Miller's number and should be determined by the user. The user also controls the mapping of clusters to the mind map, using SQL-queries.

The structure of the information system is determined. This system uses free software solutions as its integral parts. Neural network subsystem is required to adapt to the specific user needs.

A prototype of the mind map user interface is developed. It is made in JavaScript and is represented as a web page. A list of the main use cases for implementation in the MVP (the minimum viable product) is given.

**Keywords:** hierarchical clustering, mind map, information overload, user interface.

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## DEVELOPING OF THE E-GOVERNMENT SYSTEM BASED ON JAVA FOR ONLINE VOTING

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The current article is focused on proposing a new electronic voting system that will assist the government in conducting the online voting for the elections. The system will be secure with

the end to end encryption to ensure that no data theft occurs during the transfer. The key demerit of the system is the security from the end of the government. It has to be ensured that all the external threats are kept at bay when using the online voting system. The secondary research approach is considered to mine the information required to conduct the study and develop the system. Overall, it can be stated that the new system will allow the government and public to have improved voting experience if implemented successfully.

**Keyword:** Java-based E-government system, online voting, privacy theft.

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#### APPLICATION OF THE HOMEOSTATIC APPROACH TO THE FORMATION OF THE PORTFOLIO OF REGIONAL DEVELOPMENT PROJECTS

page 13–19

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The transition to the knowledge economy requires a change in approach to the management of the development of both: individual regions and entire countries. The definition of competitiveness has become one of the key definitions in the formation of the regional development strategy. For management of the development of the region is recommended to use a project-based approach. At this, the important processes are the processes of formation of a portfolio of projects and determination of their priorities.

The peculiarity of regional development projects is that they are aimed at satisfying a large number of different stakeholder groups. Each stakeholder group has its own view of the results of development projects. Providing homeostasis between the stakeholders of regional development projects is a hard job. Because projects demand are formed based on quality indicators. Constantly changing list of quantitative indicators is used to describe the quality indicators. In addition, the indicators themselves change their planned value and their importance in the framework of a quality indicator.

Considering limited budget of regional development it is necessary to form a portfolio of projects that will ensure maximum stakeholder requirements. In this regard, the tools of formation and prioritize of regional development projects are proposed to build on the basis of a homeostatic approach. This approach allows to build a complex management system aimed at the survival of the object of manage in an aggressive environment. Realizing the selected projects on the proposed approach, the regional authorities will be able to improve the competitiveness of the region significantly.

**Keywords:** project management, project portfolio management, homeostatic approach, regional development projects.

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#### DEVELOPMENT OF THE METHOD FOR TERRITORIAL COMMUNITY FORMATION BASED ON MULTI-CRITERIA SWARM ALGORITHM APPROACH

page 20–27

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The object of research is the formation of territorial communities based on swarm intelligence. In the process of research, a problem is identified that arises in the formation of territorial communities in Ukraine, namely the unstable political situation due to the introduction of many reforms.

In order to solve this problem, the aim is creation of an automated approach to the formation of territorial communities according to certain evaluation criteria.

The proposed method is used on the example of Zastavniivsky district of the Chernivtsi region (Ukraine) on such criteria as: the availability of hospitals, fire departments, police departments, kindergartens, and social institutions. With the help of swarm algorithms, 5 administrative centers and 19 settlements are created, satisfying the conditions of the task. The gray wolf and the bats algorithms formed a community and the center is determined, and the method of multi-criteria optimization optimizes the parameters of administrative units.

Geo-information technologies, statistical data of settlements of the Zastavniivskyi district of the Chernivtsi region, gray wolf and bats algorithms and the method of multi-criteria optimization make it possible to obtain the result of the process of formation of territorial communities of the proposed method. Due to these aspects, an automated process of forming territorial communities is obtained.

**Keywords:** bats algorithm, gray wolf algorithm, formation of territorial communities, evaluation criteria.

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# SYSTEMS AND CONTROL PROCESSES

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## ANALYSIS OF THE TECHNICAL POSSIBILITY OF SUBMARINE CAMOUFLAGE FROM DIRECTION FINDING MEANS

page 28–33

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The submarines studied in this work have an indisputable advantage, consisting in increased concealment, which allows them to concentrate in strategically important areas of the water area with attack means containing a combat unit of various composition and power. Concealment of the submarines significantly increases the danger of hitting critical infrastructures of states of medium and small area, even without their own water area.

Submarines, in addition to the marked advantage, have obvious disadvantages, which include «blindness» and «noisiness». Therefore, when solving tactical and strategic tasks of defense significance, it is necessary to take into account the need to eliminate these disadvantages.

One of the variants of the technical solution is presented for providing the submarine camouflage from the direction finding equipment with the help of hydroacoustic stations – underkeel, drop, towed. An analytical model of the technical effect is constructed to achieve limited visibility of the submarine outside the zone of geometric resonance. The effectiveness degree of submarine camouflage is analyzed in the case of the onset of a resonant situation in the enclosing module - wave coincidence. The pre-conditions for the onset of resonance are formulated under the condition that a large wave size of the outer shell of the enclosing module is provided. The content of aberration phenomenon irradiated by the outer shell of sound waves into the fluid of the inter-shell space is revealed.

Semi-detailed laboratory studies of the submarine model allow using ultrasonic technologies to ensure the concealment of the submarine in the absence of its own propulsion by means of a two-shell module separated by a liquid and artificially irradiated with ultrasound. At the same time, the theoretical prerequisites for increasing the effectiveness of submarine camouflage using resonant appearance in the form of wave coincidence in a laboratory unit confirms the correctness of the initial technical solutions. This allows to evaluate step-by-step the requirements of high camouflage efficiency:

- large wave size of the shell module;
- creation of caustic zones in the inter-shell space, which acts as an enclosing surface from the direction finding equipment;
- ensuring of the geometric resonance of the outer shell to form its «acoustic transparency»;

– creation of a zone of increased energy in the form of turbulence of the inter-shell liquid.

**Keywords:** aberration, wave coincidence, caustic surface, circumferential waves, bending waves of the shell.

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**DEVELOPMENT OF METHODS AND MODELS OF COMPLEX OF SECURITY TECHNOLOGIES FOR PRINTING PRODUCTS**

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The object of research is the process of selecting elements that make up a complex of security printing technologies to counter the fabrication of printing product. The problem is caused by the development of reproductive and digital technology, which makes it possible to easily reproduce an unsecured original packaging or label.

The analysis of existing technologies for describing the security level of a printing product against falsification with subsequent identification of its shortcomings is carried out. The application of the method of integral indicators for evaluating the security of a printing product against falsification is proposed. The peculiarity of the technique consists in determining the weigh coefficients taking into account 15 technological series to exclude the use of the same type of protective elements. The significance of each element in the integral evaluation is determined by the analysis of 500 labels (printed products). A further study is in refining of the proposed weight coefficients and development of an information support decision-making system for designers of secured printing products. Research results are recommendations for optimizing the choice of security complex.

**Keywords:** security of a printed product against falsification, technological series, security complex, security element.

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**DEVELOPMENT OF A MODEL FOR DETERMINING THE TIME PARAMETERS FOR THE INTERACTION OF PASSENGER TRANSPORT IN A SUBURBAN TRANSPORT AND TRANSFER TERMINAL**

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Servicing of passengers in the conditions of suburban communication is represented through a description of the connection between the components of the process of functioning of the route network and the totality of technological operations performed within the suburban transport and transfer terminal. The object of research is the process of functioning of a suburban transport and transfer terminal. It is suggested to consider the interaction of routes from the point of view of ensuring a reduction in the time of passenger transfer, which is realized by introducing a time combination of the location of vehicles of various types of services in a suburban transport and transfer terminal. The existing general structure and formalized components of the model of technological interaction of passenger transport in a suburban transport and transfer terminal. Based on the assessment of the total time of passenger transfer, the characteristic conditions and areas of acceptable values of the rational duration of the overlapped vehicle location in the suburban transport and transfer terminal are highlighted. The use of such form of interaction representation of passenger transport makes it possible to realize the procedure for finding rational time parameters for the simultaneous finding of vehicles of various types of services in suburban transport and transfer terminal. This search procedure ensures the minimization of the time spent by passengers for transfer in accordance with the existing opportunities of the resource channels of the subjects of passenger transport.

**Keywords:** suburban transport and transfer terminal, passenger transport, time of passenger transfer, time of overlapped idle.

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## MATHEMATICAL MODELING

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### FORECASTING OF PRODUCTION COST AND OTHER INDICES OF ACTIVITY OF INDUSTRIAL ENTERPRISE

page 47–52

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The forecasting of the cost of sales, the income of enterprises of the dairy and construction industries of Ukraine on the basis of statistical data of several enterprises is the object of research. It is necessary building economic-mathematical models for forecasting of the production cost and other economic indices of enterprise activity.

The factors that have the greatest impact on the cost of sales are determined. It is obtained that the first, third and fourth factor signs could be included in the regression model for the researching enterprise of dairy industry.

Correlation-regression analysis is used to analyze and forecast the indices of enterprise activity. Economic-mathematical models are constructed in the form of a linear multiple regression equation. These models describe the relationship between the production cost and the factors which affect on its result for the dairy industry, as well as between the net income of the enterprise of the construction industry of Ukraine and the cost of sales. Multiple correlation  $R$  and determination  $R^2$  coefficients (0.9566841 and 0.91524451) for the first and (0.972 and 0.945) for the second models are found. These coefficients show that the constructed models are adequate to experimental data and can be used for analysis and forecast of indices of enterprise activity.

The values of  $F$ -statistics and  $T$ -criterion show the significance of the model of the cost of sales and the correlation coefficient. The economic-mathematical model is obtained, which allows estimate the dependence of the change of the cost of sales from the change of the expenses of the dairy industry enterprise of Ukraine with a sufficiently high accuracy (95 %).

The obtained models can be used for analysis, forecasting and management of indices of enterprise activity in the system of effective using of enterprise resources, which will lead to rational using of production resources, increase profitability of enterprises.

**Keywords:** economic-mathematical models, multiple regression equation, multiple coefficients of correlation and determination.

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**INVESTIGATION OF THE ALGORITHM FOR CONSTRUCTING SMOOTH SPATIAL CURVES WITH THE ABILITY TO SPECIFY THE CURVATURE AND TORSION AT THE NODAL POINTS**

page 53–57

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In the existing methods for describing spline vector-parametric surfaces, a rich arsenal of algorithms has been accumulated. Often the development of hardware equipment outperforms the software. In addition, the state of the art often throws new «challenges» to the developer, for example, the need to obtain a channel surface with special properties, with predefined curvature and torsion, with a certain order of smoothness. This is important in the design of product pipelines, exhaust manifolds of internal combustion engines, etc. Therefore, it makes sense to investigate previously unexplored types of control over the future properties of spline curves, and surfaces based on them. Special polynomial splines of higher degrees (seventh degree) and mathematical apparatus (linear algebra, Cramer method, vector-parametric description of curves) are used in the work.

The formula for calculation of the vector-parametric segment of the seventh degree (on two end points, two first, second and third derivatives in them) is derived. The formula allows more flexible control over the shape of the desired spline, arbitrarily setting the initial data.

The algorithm given in the work allows to answer the «call», giving the designer complete freedom in controlling the geomet-

ric properties of the object even at the development stage. The algorithm allows to create better samples of modern technology thanks to the control of curvature and torsion.

**Keywords:** segment defined by two points and two first, second and third derivatives, smoothness of the corresponding degree.

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