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## 6. Conclusions

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The model of evaluation of the financial market state, based on the methods of change-point detection and probability density estimation using the spline functions, is proposed.

The model allows to calculate the probability function of the market trend reversal within the predetermined time interval in the future.

The knowledge of the exact value of the risk of the market trend reversal potentially allows to automate the choice of the take-profit value for the opened positions, based on

the expected profit that would be impossible when using the deterministic approaches; to formalize the decision-making about closing of the trade positions opened earlier by setting the threshold value of the acceptable risk. It is also possible to use the function value as the technical indicator, which has a high degree of visibility.

The prospects of further research in this direction: the determination of optimal sample size for the density estimation, selection of optimal density estimation parameters, depending on the time scale of the data, analysis of the effectiveness of the trade strategies based on the use of the obtained function.

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### ADAPTATION OF MATHEMATICAL MODEL OF METHANOL SYNTHESIS REACTOR (p. 4-6)

Djabran Abdalhamid, Marina Loriya, Alex Tselyshev, Peter Eliseyev, Ivan Zakharov

The development of the adaptation algorithm of the model of complex object on the example of methanol synthesis column is discussed in the paper.

The main objective of the paper is to develop experimental-statistical models. To create such models it is necessary to have the ability of careful research of the control object, as well as collect quite a large amount of experimental material. For complex control objects, it is sometimes difficult to determine the number of influencing factors and their mutual influence. It is not always possible to use active experiment on the working equipment of continuous and large-scale productions. However, this model has a very simple form. It is easy to use in solving the optimization problems. The paper proposes to use a control system with the combined model for managing multi-shelf gas reactor (e.g. methanol synthesis reactor)

**Keywords:** adaptation, mathematical model, methanol synthesis column, optimal process parameters

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### ANALYSIS OF SURVIVABILITY OF THE SYSTEM OF ORGANISATION OF TRAINS FLOW ON PERCOLATION THEORY (p. 7-10)

Andrii Prokhorchenko

This article deals with the study of the properties of vitality plan forming freight trains on the railways of Ukraine . The main objective of the study is to improve the theoretical approaches to the analysis of survival of freight on the railways. To solve this problem, research methods were used percolation theory, theory of graphs and mathematical programming, which made it possible to develop a pro-

cedure for the analysis of survival in a destructive impact on solving the problem of percolation sites. As part of the task percolation on a graph assignment plan forming trains was investigated critical state of transportation system. Dependences of the average inverse path between the network nodes and the diameter of the graph structure from destruction steps in a random failures and planned stations in the networks.

Were taken to prove the stability of the network assignment plan forming trains to random failures, while graph network is extremely vulnerable to coordinated attacks. To select the most stable structures on the destinations trains in articles calculated k-core of the largest components of the graph has reached a critical point in the course of random and correlated percolation. In practical terms, these results allow us to establish the most important stations on the network performance which strongly influences the capacity of the railway network as a whole

**Keywords:** plan forming freight trains, capacity, survivability, percolation theory

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### MATERIALIZED VIEWS MANAGEMENT TECHNOLOGY BASED ON WORK SCHEDULE OF ORGANIZATIONS (p. 11-14)

Oleksii Kungurtsev, Yuri Vozovikov, Olena Kungurtseva

There are various software methods of increasing the productivity of informational systems based on using of relational data bases. One of them anticipates using of materialized views. Materialized views stores result of certain request to the data base and at following entry of this request to the informational systems allows getting answer very fast. However the practical use of materialized views in separate informational systems is impossible without preliminary study of this informational system. As materialized views is a result of request which uses number of data bases tables the refreshing of certain data in those tables leads to necessity of refreshing materialized views too. At frequent refreshing of data the using of materialized views could not increase but decrease the effectiveness of informational systems.

In this book the periodical connection and disconnection of materialized views is offered. The basis for this is an evident periodicity in resolving of different tasks for the most of organizations

**Keywords:** information systems, the performance of the information system, query language, materialized views, request

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### METHOD OF JUSTIFICATION OF ORGANIZATIONAL AND TECHNICAL MEASURES FOR IMPROVEMENT OF SHIP EQUIPMENT OPERATION (p. 14-17)

Vadim Kryntsylo

The method of justification of practical recommendations on the improvement of operating processes of ship technical means (hereinafter – STM) by estimating the efficiency and safety of the specified processes is proposed in the paper.

The essence of the method lies in the formalized representation of the STM operating process as the graph of work, source data formation in the structure of probabilistic and resource characteristics for each operation of the process under investigation with further phased recalculation of these characteristics during the integration of the graph of work. As a result, the technical condition of STM is defined, effectiveness and safety indexes of the whole operating process are calculated, the analysis results of which allow the decision-making on the further improvement of the process under investigation.

Unlike the existing methods, the developed method allows taking into account many technical states of STM and types of personnel errors, as well as assessing not only the correctness and timeliness of taking the operational measures, but also the safety of the operating processes of STM

**Keywords:** efficiency, safety, ship technical means, Ukrainian naval forces, operating process, accident rate

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### GEOINFORMATION SERVICE OF SOIL QUALITY EVALUATION (p. 18-25)

Svitlana Kokhan, Antonina Moskalenko, Lyubov Shylo

The structure of geospatial database (GDB) in the form of a set of models (conceptual and logical) was developed in the study. The conceptual model of GDB is constructed on the basis of the unified modeling language UML (Unified Modeling Language). Physical implementation of the model for ensuring the qualitative evaluation of soil is shown.

The paper gives the analysis of the use of various interpolators (distance weighting, bicubic spline, universal kriging) with the purpose to obtain digital continuous surfaces on the example of the humus content in soils. Significant difference in the application of various interpolators was not found. The GRID-model, obtained on the basis of the data of agrochemical inspection of soils was used as the digital image of the link.

Interpolation as a component of geoinformation mapping can be effectively used for the reduction of the cost of agrochemical inspections due to the optimization of the number of soil samples

**Keywords:** geoinformation mapping, geospatial data base, conceptual model, interpolation

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#### USE OF FUZZY KNOWLEDGE BASE OF MAMDANI-ZADEH FOR SPATIAL INTERPOLATION OF POPULATION DENSITY (p. 26-29)

Volodymyr Dubovoy, Alexander Solskyi

For early detection of pests (plant diseases) in the fields of agricultural enterprise and taking the appropriate measures on plant protection, it is necessary to conduct constant phytosanitary monitoring, which requires specific knowledge and resources, which may be inaccessible.

The propagation of pests is influenced by many factors, most of which are not formalized, or mathematical description is very difficult, information about these factors may be fuzzy or incomplete. In such conditions, the results of interpolation are also fuzzy in nature.

This paper proposes the solution to the problem of spatial interpolation of the number of pests using the fuzzy-set theory and fuzzy logic.

The proposed geoinformational model is based on the fuzzy knowledge base of Mamdani-Zadeh. The developed model is one of the main IT models in plant protection

**Keywords:** spatial interpolation, plant protection, Mamdani, Zadeh, geoinformational technology, fuzzy knowledge base

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#### APPROACHES TO THE ESTIMATION OF THE LEVEL OF ECONOMIC SECURITY: A COMPARATIVE ANALYSIS (p. 30-34)

Elena Antonian, Svitlana Afanasieva

The comparative analysis of existing approaches to the estimation of the economic security level of enterprises was made. The following common approaches to the estimation were compared: indicator (threshold), resource-functional, special-purpose programme, economic and mathematical (cost), dynamic, accounting and graphical approaches, etc.

Based on the analysis results, their nature, implementation stages, scientific basis, mathematical framework, positive and negative sides were determined. All this allowed to reveal that various interpretations of the basic concepts, ambiguity and diversity of principles and laws are inherent in the formation of theoretical bases of economic security.

Based on various types of analysis (structural, functional, comparative, etc.), the synthesis of the obtained results, which were the basis for the concretization of establishing the criteria for the selection of indicators of the economic security level estimation such as quantification, accessibility, clarity, balance, relevance and availability of general definition, was carried out. The result of the comparison of existing approaches to the estimation of economic security of enterprises was also the definition of four groups on the estimation object: profit, threats and risks, investment, functional components

**Keywords:** economic security, enterprise, economic security level, criterion, analysis

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## NEW SOLUTIONS IN DESIGNING MECHANIZED HUMP YARDS (p. 34-38)

Mykola Berezovy

For the reduction of investments in the construction and operational costs, associated with the breaking-up and making-up of trains on the mechanized hump yards, the new approach to the design of the plan of yard necks of classification yards was proposed.

Transfer of the park brake position to the straight segments within the curved beyond the last railroad switches allows to reduce the length of the calculated path of rolling of cuts and consequently to reduce the cost of the humping track and braking of cuts. Thus, the required brake power of retarders of the drain part of the hump yard and the park brake position is reduced.

New design solutions on the placement of retarders of park brake position on tracks with minimal inter-track space were developed, namely the allocation of retarders of one bunch in the general cut-off trench with the arrangement of steps in each inter-track space on both sides of the trench; the displacement of the control equipment of retarder on the inter-track space axis for compliance with the loading gauge and structure gauge, and the corresponding displacement of the high-pressure air pipelines for the switching-on of retarders

**Keywords:** classification yard, hump elevation, brake position, breaking-up of train

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## CAPACITY ASSESMENT OF STREET AND ROAD NETWORK IN TRAFFIC CONTROL SYSTEMS (p. 38-42)

Maryna Öztürker

Promising way of traffic control is the introduction of automated traffic control systems, the effectiveness of which depends on the traffic model adequacy. The possibility and correctness of using the classical gas dynamics device (gas-dynamic analogy) for the town-planning capacity assessment of the main street and road network was examined.

The method of the town-planning capacity assessment of the main street and road network was developed on the basis of the gas-supply network coordination method and taking into account the functioning features of the transport-planning systems of cities. The method allows assessing the current state of the transport-planning system and further effect of the measures on its regulation. It does not depend on the size of the city and allows considering the settlement and its influence zone as a unit

**Keywords:** capacity, street and road network, traffic control system

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## PROBLEMS OF DESIGN OF NON-ORIENTED BOTTOMHOLE ASSEMBLIES OF DRILL STRING (p. 43-46)

Andrew Yurych

According to the results of the analysis of literary sources and publications in the research area, it was found that currently developed mathematical models of the study of the stress-strain state of BHA in the borehole do not fully take into account its operating

conditions. In the design process, the BHA is considered as a beam, located in the straight or curvilinear borehole with certain imposed boundary conditions, which reflect the interaction of the elements of assembly and rock massif in static conditions.

To ensure the high accuracy of drilling using non-oriented BHA it is necessary, at the design stage and directly in the drilling process, to have information on the actual conditions of the operation and interaction of the assembly at the bottom-hole that is possible only when using the special measuring devices in the borehole design.

The primary goal in solving difficult scientific-technological task is the improvement of the mathematical models of design by including the maximum number of various factors, which influence the stress-strain state of BHA in the borehole. The improved techniques must allow prompt estimation of the expediency of the assembly use based on the results of measuring the forces, occurring in the assembly.

To estimate the stress-strain state and actual operating conditions of the assembly at the bottom-hole it is necessary to develop designs of special devices, which would be reliable and inexpensive to use

**Keywords:** non-oriented bottom-hole assembly of drill string, borehole profile

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## METHOD OF FORMING REQUIREMENTS TO THE BALLISTIC COEFFICIENT OF THE KINETIC WEAPON THROWING ELEMENT (p. 46-49)

Alexander Bilenko

For ensuring the specified effect on the target, the throwing element of the weapon must have sufficient but not excessive kinetic and specific energies at all distances of weapon employment. The range of weapon employment distances greatly depends on the throwing element speed drop dynamics, which is significantly influenced by its ballistic coefficient.

Therefore, there is a need for methods, which allow calculating such ballistic coefficient value, which ensures the acceptable speed drop of the throwing element.

Using the methods of exterior ballistics, the dependence, connecting the ballistic coefficient value of the throwing element with its energy characteristics and the range of weapon employment distances was determined.

On this basis, the method of forming the requirements to the ballistic coefficient, which allows the definition of the maximum acceptable value of the ballistic coefficient that ensures certain energy characteristics of the throwing element at the specified weapon employment distances, was developed.

The developed method allows to form the requirements to the ballistic coefficient of the throwing element of military weapons, kinetic non-lethal weapons and military weapons with the limited distance of wounding effect, and also to carry out the preliminary analysis of the possibility of a solution of the specified problems

**Keywords:** ballistic coefficient, throwing element, kinetic weapon, requirements

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## MODEL OF PROBABILISTIC ASSESSMENT OF TREND STABILITY AT FINANCIAL MARKET

(p. 50-54)

Oleg Lutsenko, Oleg Baybuz

The probabilistic model of assessing the state of the financial market, allowing to assess the probability of the trend reversal at the financial market was developed.

A distinctive feature of the risk evaluation method, proposed in this paper, is that the time series of currency quotations are considered not as a set of individual points, but as a set of segments of stationarity, into which it is split by change-points. Finding of the change-points of the series allows to divide the series into the segments with similar statistical properties that corresponds to one of the main paradigms of the technical analysis – the division of the time series into segments with a constant trend.

For the solution of the problem of the series splitting, two methods are used, such as the graphical method for finding the inflection points of the diagram, aimed at finding the reversal points a posteriori, and the CUSUM algorithm, relating to the methods of sequential detection of change-points.

Splitting the diagram into segments using the change-points generates the random vector, comprising the segment duration in time and the difference between the prices at the beginning and the end of the segment.

For the estimation of the probability density function of the vector, B-splines, constructed on a rectangular grid with the restoration of the intermediate points, were used.

Based on the basic principles of financial market functioning, the assumptions were accepted, allowing to calculate the probability of the next change-point during the time interval in the future at each step of observation

**Keywords:** probability, B-spline, probability density estimation, change-point detection, financial market

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