MATHEMATICALMODELING. METHODS AND SYSTEMS OF INFORMATION PROTECTION, INFORMATION SECURITY

Rozhkov N.N., Orlova N.A.
MATHEMATICAL MODEL OF A COMPREHENSIVE ASSESSMENT OF THE EFFICIENCY OF A UNIVERSITY BASED ON FUZZY INFORMATION ABOUT THE RELATIVE SIGNIFICANCE OF INDICATORS
A method is proposed for constructing a comprehensive assessment of the effectiveness of a university based on a set of indicators, the comparative significance of which is designed to reflect the priorities of a particular industry, profile for a given university. Data on the significance of indicators follow from the analysis of expert assessments and are fuzzy and non-numerical. A model describing a comprehensive assessment of efficiency is built by applying the method of randomizing weighting coefficients.
Keywords: *complex performance indicator, rating score, questionnaire survey, analysis of expert assessments, non-numerical and fuzzy information, randomization of weight coefficients*

Ivakin Ya.A., Potapychev S.N., Ivakin R.Ya.
RATIONALIZATION OF THE ALGORITHM FOR VERIFICATION OF RESEARCH HYPOTHESES BASED ON GEOCHRONOLOGICAL TRACKING
Information technology of geochronological tracking is a set of processes of accumulation and integration of data on the geographical movement of individuals for a specified period of time with the presentation of the results in the form of a generalizing graph in a GIS. Hypotheses about stable trends in migration are presented as subgraphs of the indicated graph. Testing such hypotheses will be reduced to finding and assessing the statistical significance of the isomorphism of the corresponding graphs. Fully functional development of computer interpretation of graph theory methods based on geochronological tracking can provide a new quality of historical research using modern GIS tools. It is expressed in providing the opportunity for the researcher to use quantitative methods of the corresponding logical-analytical apparatus in his subject area.
Keywords: *geographic information systems, gis technologies for research, geochronological tracking and tracking, graph isomorphism, rational algorithm, interdisciplinary research based on gis*

Ivakin Ya.A., Potapychev S.N.
MODEL FOR SUPPORTING THE DISPATCHING OF GEOSPATIAL PROCESSES BASED ON SITUATION MANAGEMENT
Dispatching of geospatial processes is the control and coordination of the management of geospatial processes in order to achieve the highest economic indicators, the implementation of traffic schedules, production programs, etc., with the unconditional fulfillment of safety requirements. A feature of dispatching is a constant change in the situation, adjustability and some inconsistency of schedules, traffic patterns, etc. The main tasks of dispatching are: control of the navigation status and safety, compliance with plans and traffic patterns. Modern, efficient dispatching means a reasonable balance of geospatial safety and transport and economic performance. Situational management (management) capabilities implemented within the framework of dispatching geospatial processes, allow to achieve increased efficiency and improve the quality of operation of various transport companies. Dispatching spatial processes using situational management tools and digital cartographic datasets is closely related to the implementation of a more advanced data processing model in traffic control automation complexes.
Keywords: *dispatching of geospatial processes, situational management, situational management, digital cartographic data, spatial data, maritime transport*

Pimenov V.I., Pimenov I.V.
OPTIMIZATION OF SEARCH OPERATIONS IN THE INFORMATION REFERENCE SYSTEM

OF THE MUSEUM COLLECTIONS
Methods for reducing the execution time of search operations based on the natural classification of museum items, represented by a vector of signs, are considered.
Keywords: *principal component analysis, discriminant analysis, multivariate clustering, feature ranking, decision rule, smart search*

Leonova E.B., Kotina E.D.
OPTIMIZATION ALGORITHM FOR IMAGE PROCESSING BASED ON DISCRETE SYSTEMS
The article deals with the problem of digital image processing based on discrete systems. An optimization algorithm for constructing a displacement field is proposed, based on the study of an integral functional on an ensemble of trajectories. An analytical form of variation of the functional is presented and a representation of the gradient of the functional is given, which makes it possible to use directional optimization methods to find the required parameters. This algorithm can be used to process various digital images, in particular, for radionuclide images in order to correct motion.
Keywords: *discrete systems, functional variation, optimization, image processing, radionuclide images, motion correction*

Kilin P.D.
MATHEMATICAL PROCESSING OF PET STUDIES OF THE BRAIN BASED ON CHAMBER MODELING
The article deals with the processing of PET studies of the human brain using the method of linear chamber models. On the basis of this method, a research model is selected and a physiologically significant parameter, the connection potential, is assessed. The paper compares the estimates obtained by the least squares method for the MRTMo, MRTM, MRTM2 models, as well as by the method of instrumental variables for the MRTMo model.
Keywords: *positron emission tomography (PET), chamber models, communication potential, PET brain studies, multilinear reference tissue models, instrumental variable method*

Kritsky I.N., Belaya T.I.
THE PROBLEM OF MULTI-GENRE GAMES: CAUSES AND SOLUTIONS
The article discusses the main problems of multi-genre computer games and suggests ways to solve them, presents a variant of the classification of games by genre.
Keywords: *multi-genre computer games, game mechanics, computer game problems*

CHEMICAL SCIENCES

Burinskaya A.A., Gazizullina A.R., Aitova A.N., Erokhina O.A., Akim E.L.
OBTAINING SILVER NANOPARTICLES ON HUMP FIBER
The article discusses the issues of obtaining silver nanoparticles on pretreated with enzymes and bleached hemp fiber. Various methods of obtaining nanosized silver particles are described and micrographs of the obtained samples are presented.
Keywords: *silver nanoparticles, hemp, enzymes*
Zykova I.V., Isakov V.A.
ADSORPTION OF PHENOLS AND PETROLEUM PRODUCTS IN CARBONIZED SAPROPEL OF LAKE LIPOVO, NOVGOROD REGION
Sapropel, a natural renewable organic mineral raw material, is promising for the synthesis of carbon-mineral sorbents. Thermal treatment of sapropel and sapropel - bentonite clay mixtures can produce a bifunctional carbon-mineral sorbent, which simultaneously exhibits sorption properties with respect to both polar and non-polar substances. It has been established that the optimum temperature for heat treatment of sapropel for the adsorption of phenols and petroleum products is 700 ° C. It is shown that the specific adsorption of resorcinol and oil products is higher on pure carbonized sapropel than on mixtures with bentonite clay. Based on the BET equation, the values of the maximum adsorption for phenol and oil products and the specific surface of the sorbent for resorcinol are calculated. The adsorption of organic substances on carbonized sapropel is 1.5-2,
Keywords: *sapropel, carbonation, adsorption, petroleum products, phenols*

Mikhailovskaya A.P., Klimova A., Pivovarova E., Maniecki T., Chichelsky R., Kiselev A.M.
ON THE INFLUENCE OF ANIONIC DETERGENTS ON THE STRUCTURE OF POLYPROPYLENE MATERIAL
A method for modifying polypropylene material by heat treatment with aqueous solutions of anionic surfactants has been developed. The analysis of the changes occurring in this case in the amorphous-crystalline structure of the polymer is carried out. The possibility of using the products of its hydrocracking for the production of diesel fuel of a higher quality is shown.
Keywords: *polypropylene, anionic surfactant, modification, polymer structure, hydrocracking, diesel*

Zykova I.V., Kashin D.S.
ACID-BASIC PROPERTIES OF HUMIC ACIDS ISOLATED FROM SAPROPEL OF LAKE LIPOVO, NOVGOROD REGION
Humic acids were isolated from the sapropel of Lake Lipovo, Novgorod region, and their acid-base properties were studied. Determination of the amount of the main functional groups of humic acids was carried out by potentiometric titration. The amounts of carboxyl and phenolic groups are 3.26 mmol / g and 6.26-6.99 mmol / g, respectively. A high content of phenolic groups is characteristic of young humic acids. Determination of conditional dissociation constants of ionogenic groups was carried out using the model of discrete regions. Calculated conditional dissociation constants of ionogenic groups at ionic strength I = 0.15 mol / dm3: pK1 = 3.9; pK2 = 9.1.
Keywords: *sapropel, humic acids, content of carboxyl and phenolic groups, potentiometric titration, dissociation constants of basic ionogenic groups*

Zykova I.V., Kashin D.S.
STABILITY CONSTANTS OF HUMIC ACID COMPLEXES ISOLATED FROM THE SAPROPEL OF THE LIPOVONGOROD REGION LAKE WITH METAL IONS
Humic acids were isolated from the sapropel of Lake Lipovo, Novgorod region. By the method of potentiometric titration, the conditional stability constants of complexes of humic acids with the metals under study were determined by the distribution coefficient at an ionic strength of I = 0.15 mol / dm3. The logarithms of the stability constants of HA complexes with Cd (II), Pb (II), and Cu (II) are 3.11, respectively; 4.34; 4.75. The stability constants of HA complexes with metals were determined by the method of reaction-binding centers. The logarithms of the stability constants of HA complexes with Cd (II), Pb (II), and Cu (II) at pH 6 are 3.20, respectively; 4.87; 5.03. The stability of metal complexes with humic acids increases in the series Cd (II), Pb (II), Cu (II).
Keywords: *sapropel, humic acids, potentiometric titration, stability constants*

Letenkova I.V.
STUDY OF COPPER (II) ION ADSORPTION FROM AQUEOUS SOLUTIONS BY FIBERGLASS MATERIALS
The regularities of the kinetics of sorption of copper (II) ions on glass and basalt fibers have been investigated. It was found that the adsorption of the Cu2 + ion proceeds in a mixed diffusion mode. The adsorption equilibrium on the glass fiber is well described by the Freundlich model, and on the surface of the basalt fiber - by the Temkin model.
Keywords: *adsorption of copper (ii) ions, glass fiber, basalt fiber, adsorption kinetics, adsorption isotherms*

Smirnova E.G., Lotsmanova E.M.
APPLICATION OF BACTERIAL CELLULOSE IN PAPER COMPOSITION FOR MECHANIZED RESTORATION OF ANCIENT DOCUMENTS
The effect of bacterial cellulose additives synthesized by the domestic strain Komagataeibacter xylinus (formerly Gluconacetobacter xylinus, formerly Acetobacter xylinum) on the strength of the seam between the restored document and the filling part during mechanized restoration of documents on paper was studied. It was found that the addition of bacterial cellulose to the paper pulp in an amount of 2-4% increases the strength of the seam between the restored

document and the filling part and contributes to the preservation of the seam strength after artificial heat-moist aging. The microstructural properties of bacterial cellulose fibers in paper have been investigated.
Keywords: *mechanized restoration, cellulose, bacterial cellulose, paper pulp, heat-damp aging, strength of the seam between the restored document and the filling part*

Shishkin A.I., Stroganova M.S., Antonov I.V.
REGULATION OF LOAD DURING DISCHARGE OF FLOWS OF PPI AT THE CROSS-BORDER SECTION OF THE VUOKSA RIVER
A planning model has been substantiated and a program for standardizing the load on a water body for a group of water users of the pulp and paper industry has been implemented on the example of a transboundary section of the Vuoksa River on a geoinformation basis. The results of a numerical experiment on the prediction and assessment of the effect of the actual discharge of effluents from the Svetogorsk PPM by limiting indicators for various parameters are presented.
Keywords: *load rationing, pulp and paper production, transboundary area, water body, numerical experiment, convective-diffusion transfer, water releases*

AUTOMATION AND CONTROL OF TECHNOLOGICAL PROCESSES AND PRODUCTIONS

Perevoznikov E.N., Lomteva E.Yu.
INSTABILITY AND CHAOS OF ECONOMIC PROCESSES OF ENTERPRISES ON THE EXAMPLE OF A MODEL SYSTEM
On the example of a mathematical model, the economic processes of the functioning of enterprises are considered. The model used describes the dynamics of three components of the activities of enterprises: production, management and consumed resources. Methods and criteria formulated by the authors earlier are used to analyze the dynamics. At the same time, new results of a practical nature were obtained; in particular, the calculation of the spectrum of small perturbations of the system is given depending on the input resource and the parameters of the system, the intervals of stability of the system and the regions of instability and chaos are indicated, the parameters most influencing the dynamics are revealed. It is shown that an increase in the financing of management stabilizes the processes in the system, and that the system loses stability both with a shortage and with an excess of resources.
Keywords: *mathematical modeling of economic processes, methods of analyzing dynamics, instability and chaos*

Lebedeva S.V., Kozlova N.V.
CORPORATE MOBILITY AS A MEANS OF CONDUCTING VIRTUAL BUSINESS
The article discusses the impact of the progress of mobile technologies on the development of virtual business.
Keywords: *enterprise architecture, virtual enterprise, mobile app, corporate mobility, mobile databases, immersive technologies*

Turkina N.R., Mustafaev F.Yu.
DEVELOPMENT AND STRENGTH ANALYSIS OF ANALYTICAL BALANCES WITH A MAGNETIC-ELECTRIC CONVERTER
The article presents the design of an analytical balance with a mechanical converter, created using the "Monoblock" technology, which allows, using electrical discharge machining, to obtain weighing accuracy up to 0.0001 g. The deformation and strength properties of the structure are considered in the Solid Works program.
Keywords: *analytical balance, monoblock technology, deformation, stresses, strength*

Markovets A.V., Mazin L.S., Gribkova T.S., Lugantseva T.A.
ANALYSIS OF ELASTIC AND DISSIPATIVE CHARACTERISTICS OF THE ELEVATOR CABIN BUFFER
The article deals with the problem of analyzing the movement of an elevator car when it is landing on a buffer in the pit of an elevator shaft. For the case of a buffer of energy storage type,

the conditions for the appearance of separation of the cabin from the buffer in the case of an oscillatory nature of movement are revealed. The analysis is carried out and conditions are presented under which the movement of the elevator car on the buffer will be aperiodic.
Keywords: *elevator, buffer, elevator car, periodic vibrations, aperiodic vibrations*