

## **MATH MODELING. METHODS AND INFORMATION PROTECTION SYSTEMS, INFORMATION SECURITY**

**Ivakin Ya.A., Potapychev S.N.**

### ***GEOCHRONOLOGICAL TRACKING DURING RETROSPECTIVE RESEARCH OF PECULIARITIES OF APPLICATION OF PRODUCTS OF HYDROACOUSTIC TECHNOLOGY***

*The scientific and methodological tools of geochronological tracking have found the widest application in retrospective studies of the features of the use of individual products of high-tech and expensive technology of various types. The results of such studies are the basis for organizing service, building logistic supply schemes, deploying supply networks, etc. The feasibility of such studies is especially relevant today for products of domestic hydroacoustic equipment for civil purposes. The competitive state of the responsible industry of precision marine instrumentation objectively requires a systematic approach to studying the characteristics of demand and application for these products. It is the geochronological tracking toolkit that can become the basis for a new marketing approach to planning the promotion of products of domestic hydroacoustic equipment to the Russian and international markets. This article is devoted to the consideration of the qualitatively new capabilities of the specified tools, as well as the rationalization of the corresponding algorithmic apparatus.*

**Keywords:** *hydroacoustic technology, geographic information systems (GIS), technologies for logistic research, geochronological track and tracking, graph isomorphism, algorithm optimization, retrospective research in GIS*

**Egorov I.M., Pereborova N.V., Kobaykova Yu.V., Ananichev E.A., Kalanchuk O.E.**

### ***MATHEMATICAL MODELING OF DEFORMATION PROCESSES OF POLYMER PARACHUTE SLINGS - THE BASIS FOR A QUALITATIVE ASSESSMENT OF THEIR OPERATIONAL PROPERTIES***

*The article discusses a variant of mathematical modeling of deformation processes of polymer parachute lines, on the basis of which qualitative assessments of their operational properties are carried out. Qualitative assessments of the operational properties of polymer parachute lines allow optimization of the structure of domestic parachute systems, which increases the safety, functionality and competitiveness of parachutes.*

**Keywords:** *polymer parachute lines, mathematical modeling, system analysis, deformation properties, qualitative assessment, organization of production, increasing competitiveness*

**Meleshko A.V., Desnitskiy V.A.**

### ***AN APPROACH TO SIMULATING ATTACKS IN SELF-ORGANIZING WIRELESS SENSOR NETWORKS OF A DIGITAL CITY***

*Currently, wireless self-organizing sensor networks are increasingly developing and spreading to solve the problems of organizing operational processes in the systems of the Digital City. Such networks are used to collect and aggregate data from physical sensors of devices, as well as their processing and transmission over the network under conditions of time-varying load characteristics of communication channels, the location of devices and their modes of operation. The paper discloses an approach to modeling and analyzing attacks aimed at compromising devices, data and services of the Digital City systems built on the basis of self-organizing wireless sensor networks.*

**Keywords:** *self-organizing networks, wireless cyber-physical systems, devices, security*

**Minyaev A.A., Krasov A.V.**

### ***METHODOLOGY FOR ASSESSING THE EFFICIENCY OF THE INFORMATION PROTECTION SYSTEM OF TERRITORIAL DISTRIBUTED INFORMATION SYSTEMS***

*The work is devoted to the development of a methodology for assessing the effectiveness of protection systems for geographically distributed information systems. Researches of geographically distributed information systems from the point of view of IT infrastructure, information processing technologies and security systems have been carried out. The key features*

*of such systems have been identified. The importance and obligation of owners of information systems in assessing the conformity and effectiveness of information security systems is noted. The disadvantages of existing methods for assessing the effectiveness of information protection systems are identified. Based on the requirements for the protection of information and the criteria established in this work, a method is proposed for assessing the effectiveness of the protection system for geographically distributed information systems. The developed method is implemented on a fuzzy productive network with optimal parameters and a fuzzy inference algorithm established as a result of research and experiments. The developed methodology is implemented using software developed by the author, and is intended to assess the effectiveness of information security systems at the stages of design and implementation of design solutions for information security, which, in turn, allows the owner of the systems to timely make changes to information security solutions to comply systems requirements for information security.*

**Keywords:** *performance assessment, geographically distributed information systems, information security systems, fuzzy productive networks, performance assessment criteria*

**Vitkova L.A., Saenko I.B.**

#### **ARCHITECTURE OF THE SYSTEM FOR DETECTING AND COUNTERING UNWANTED INFORMATION IN SOCIAL MEDIA**

*A huge number of individual web pages, including web pages based on social media domains, are created every day. Any user can create a message and publish it in the public domain from a phone or from a computer. And the issue of developing a system for identifying and countering unwanted information both on the Internet in general and on social networks, in particular, seems relevant. In the article, the authors propose a system architecture that differs from the existing ones in that it is divided into levels and individual components. The components are interconnected by the software manager, but work independently of each other. This approach to building the system makes it flexible and capable of handling extremely large amounts of data.*

**Keywords:** *architecture of the monitoring system, protection against unwanted information, information disseminator, data analysis, analysis of social networks*

**Shterenberg S.I., Danilova Yu.S.**

#### **DEVELOPMENT OF A METHOD FOR IMPLEMENTATION AND IDENTIFICATION OF THE EFFICIENCY OF A SIEM SYSTEM**

*The main goal of the article is to create a clear methodology consisting of a step-by-step algorithm for introducing a SIEM system into a commercial organization with a detailed description of each step. Also, the article discusses the method for calculating the efficiency of the system, which makes it possible to identify the feasibility of its implementation. This technique will be useful for familiarizing all managers and chiefs of security services in organizations that plan to install a SIEM system.*

**Keywords:** *information, threat model, siem system, efficiency*

**Shchegoleva D.I., Vinogradova O.M., Shterenberg G.I.**

#### **METHODS OF IMPLEMENTING DALLAS LOCK ACCESS LIMITATION SYSTEM INTO AN ORGANIZATION FOR DISTRIBUTED INFORMATION NETWORK**

*Protection of information from unauthorized access is one of the primary tasks in ensuring information security of any company, since counteracting theft and unauthorized distortion of data stored and processed on a computer helps to avoid additional costs of time, financial and human resources. Regulatory, guidance and methodological documents of FSTEC, FSB of Russia and GOST establish requirements for the protection of confidential data when processing them in automated systems and levels of security. At the moment, the Russian market of information security systems from NSD is unique, as it offers a large number of certified products for servers and workstations. The main problem is that in the selection process, questions inevitably arise about the main differences between different solutions,*

**Keywords:** *data protection, information security system, unauthorized access*

**Pimenov V.I., Pimenov I.V.**

#### **APPLICATION OF A GENETIC ALGORITHM TO OPTIMIZE THE DISCRETE STRUCTURE OF A DECISION TREE**

*Algorithmization of procedures based on evolutionary search for constructing an optimal decision tree as a whole is considered. The questions of topological correspondence in multidimensional continuous spaces between images of classes and visualizers of the decision tree after the application of the genetic algorithm are investigated.*

**Keywords:** *multivariate data analysis, decision tree, flat tree, genetic algorithm, semantic interpretation, visualizer*

**Pereborova N.V., Kobyakova Yu.V., Ananichev E.A., Kalanchuk O.E.**

**MATHEMATICAL MODELING OF RELAXATION PROCESSES OF MEDICAL TEXTILE ELASTOMERS WITH THE PURPOSE TO ASSESS AND IMPROVE THEIR FUNCTIONAL CONSUMER PROPERTIES**

*The article deals with the issues of mathematical modeling of relaxation processes of medical textile elastomers for surgical implantation. Mathematical modeling and subsequent computer prediction of these processes allow a qualitative assessment of the functional and consumer properties of surgical implants, which is especially valuable for their improvement.*

**Keywords:** *mathematical modeling, forecasting, relaxation of textile elastomers, surgical implants, functional and consumer properties*

**Mezyak F.D., Blazhevich V.N., Barkovsky E.V.**

**MATHEMATICAL ANALYSIS OF FISCAL INFORMATION IN ADOBE ILLUSTRATOR**

*This article contains information on the impact of scripting when working with graphics software Adobe Illustrator. The article presents a developed algorithm for creating scripts for processing line originals. The scientific novelty of the work lies in the mathematical approach to the study of the use of scripting. The article also presents fragments of the program code of the algorithm for the analysis of pictorial information.*

**Keywords:** *script, digitization, javascript, adobe illustrator*

**Pereborova N.V., Kiselev S.V., Makarova A.A., Chalova E.I.**

**MATHEMATICAL MODELING AND PREDICTION OF FUNCTIONAL AND OPERATIONAL PROPERTIES OF POLYMER FABRICS FOR PARACHUTE DOME**

*The article discusses the methods of mathematical modeling and computer forecasting in the study of relaxation and deformation processes of polymer fabrics for canopies of parachutes. Based on mathematical modeling and computer prediction of deformation and relaxation processes of polymer fabrics for canopies of parachutes, which are fundamental processes in the theory of viscoelasticity of polymers, a qualitative assessment of their functional and operational properties is carried out, which makes it possible to identify materials with the best operational and functional properties.*

**Keywords:** *polymer fabrics, viscoelasticity, deformation processes, mathematical modeling, relaxation, creep, computer prediction, qualitative analysis, parachute construction*

**Suzdalov E.G., Kravets T.A.**

**OPTIMIZATION OF THE NUMBER OF SELLERS-CASHIERS AND JUSTIFICATION OF THE COMPOSITION OF FURNITURE IN THE CAFE-PASTRY**

*The process of servicing cafe visitors who come to buy goods, drink coffee (tea, water) or just get acquainted with the range and prices was investigated using the method of mathematical modeling. At the same time, a mathematical model of the queuing system of the first and second phases is used as a model of a cafe, and software packages MS Excel, Mathcad are used as modeling tools. An algorithm for optimizing the number of sales clerks and justifying the composition of furniture is proposed.*

**Keywords:** *mathematical model, queuing system, efficiency indicator, objective function, optimization, cafe-confectionery*

## **CHEMICAL SCIENCES**

**Slobodova D.A., Gorshkova R.M., Elokhovsky V.Yu., Panarin E.F., Novoselov N.P.**

**SOME ASPECTS OF THE PRACTICAL APPLICATION OF CRYOPHYLACTIC MEDIA BASED ON OLIGOSACCHARIDES**

*On the basis of oligosaccharides obtained by the method of combined fractionation from the secondary phytomass of apple pomace and albedo pomelo, cryophylactic media have been created for the first time, possessing physicochemical stability in a wide temperature range. The main rheological and temperature characteristics of the obtained compositions have been studied and the possibility of the practical use of oligosaccharides as components of medical preparations for special purposes in liquid dosage form has been shown.*

**Keywords:** *oligosaccharides, dextran, cryophylactic media, combined fractionation, rheology*

**Kashurin R.R., Litvinova T.E., Zhadovsky I.T., Titova M.E.**

*Dissolution of carbonates and hydroxides of rare earth metals in carbonate media*

*The study examines the process of dissolution of precipitates of hydroxides and carbonates of rare earth metals when the concentration parameters of the system change. The main task of the study is to determine the nature of the dissolution process for various compositions of the studied media. The results obtained show the dependence of the solubility of precipitates of rare earth metals on the nature of the solvent and its concentration. There is a possibility of using the research results in the extraction of rare earth metals from the components of red mud by carbonate leaching.*

**Keywords:** *potassium carbonate, sodium carbonate, ammonium carbonate, isotherm, dissolution, rare earth metals, technogenic raw materials, lanthanides, sludge*

**Slobodova D.A., Gorshkova R.M., Pankov S.A., Yorova B.S., Elokhovsky V.Yu., Panarin E.F., Novoselov N.P., Khalikov D.Kh.**

*RHEOLOGY OF AQUEOUS SOLUTIONS OF OLIGO- AND POLYSACCHARIDES IN A WIDE RANGE OF TEMPERATURES*

*For the first time in a wide temperature range, the rheology of aqueous solutions of oligo- and polysaccharides obtained by the method of combined fractionation from the secondary phytomass of apple pomace and albedo pomelo has been studied. The values of the freezing point have been determined and the possibility of the practical use of oligosaccharides as components of special-purpose preparations in liquid dosage form has been shown.*

**Keywords:** *pectin substances, oligosaccharides, combined fractionation, rheology*

**Durova A.S., Grebyonkin A.A., Grebyonkin A.N., Akim E.L.**

*STUDY OF THE INFLUENCE OF SOIL MELIORANTS ON THE INDICATORS OF BIOLOGICAL ACTIVITY OF SODDY-PODZOLY SOIL CONTAMINATED WITH HEAVY METALS*

*This article opens a series of works devoted to research on the development of a technology for reclamation of soils contaminated with metal salts belonging to different hazard classes (molybdenum, manganese, iron, chromium). The effect of two types of ameliorants (charcoal and cellulose-mineral sorbent) on the rate of self-recovery of biogenic intrasoil processes in soddy-podzolic soil has been studied. It was found that the most effective on sod-podzolic soil was an ameliorant in the form of a cellulose-mineral sorbent obtained from pulp-and-paper waste.*

**Keywords:** *metal salts, pollutants, charcoal, soil, cellulose-mineral sorbent, ameliorants*

**Ivanov K.G., Ivanov D.K., Shcherbakov A.P., Ivanov A.D.**

*CALCULATION OF THE SHAPE OF THE PULSE CURRENT LINE THROUGH CARBON FIBER*

*Carbon fiber (CF) heated to high temperatures by a pulsed current determines a certain character of the dynamics of the emergence and development of plasma, which was observed in the experiment. The simulation of the effects arising when pulsed currents pass through the shock wave. Possible areas of application of the results of these studies are discussed.*

**Keywords:** *plasma, pulse currents, carbon fiber*

**Ivanov K.G., Ivanov D.K., Shcherbakov A.P., Krylov A.V., Ivanov A.D.**

*DIGITAL STUDY OF THE EXPERIMENTALLY OBTAINED FEATURES OF THE CONDUCTIVITY OF CARBON FIBER AND PLASMA*

*When passing pulsed currents through the carbon fiber, the current and voltage were measured with a two-channel USB oscilloscope. At the same time, in digital form, 250 or more digits were*

obtained in each of the two recording channels. A detailed analysis of the average values of current, voltage and resistance, and measurements at direct current made it possible to compare the resistance of carbon fiber and plasma during discharge, which, as it turned out, differ tenfold. This difference makes it possible to place, for the duration of the discharge, (any material) carbon fiber in an electric field with an intensity of tens of kV / m without destroying it and changing its properties significantly by the field.

**Keywords:** impulse currents, plasma, type of conductivity

**Sverdlova N.I., Vinogradova L.E., Shtyagina L.M., Kostyukhina Ya.V., Uvarova N.F.**  
**ARTIFICIAL SUBSTRATES AS A PART OF CONTEMPORARY ENVIRONMENTAL TECHNOLOGIES**

*This work is devoted to solving one of the most important problems in the cultivation of plants in artificial conditions - the creation of full-fledged root habitats.*

**Keywords:** artificial substrate, environmentally friendly technologies, waste from textile enterprises, configuration of fibrous substrates, biodegradation, grass lawns, vegetable crops, mushrooms

**AUTOMATION AND CONTROL OF TECHNOLOGICAL PROCESSES AND PRODUCTIONS**

**E.N. Perevoznikov**

**ANALYSIS OF THE DYNAMICS OF THE INSTALLATION MODES OF THE ENTERPRISES ON THE EXAMPLE OF A MODEL SYSTEM**

*The dynamics of the installation-test modes of operation of enterprises is considered on the example of the mathematical model of PUR. The used SDI model describes the dynamics of three spheres of economic activity of enterprises - production, management and resource. To analyze the dynamics, the stability criteria formulated by the authors earlier are used. At the same time, the calculation of the spectrum of small disturbances of these modes is given, depending on the input resource and the parameters of the systems. It is shown that these modes are unstable in a wide range of parameters.*

**Keywords:** mathematical modeling of economic processes, methods of analysis of dynamics, instability and chaos

**Belyaev B.V., Fedorova L.A., Sof'in A.P., Gorelov S.K., Mikhailenko A.V.**

**TO CALCULATION OF PNEUMATIC FRAME ELEMENTS OF LARGE-SIZED INFLATABLE STRUCTURES**

*The analysis of the conditions for using inflatable pneumo-frame elements is considered. It is proposed to consider pneumatic elements (tubes) in the form of separate beams loaded with unfolding moments. It is supposed to be more convenient to assume that the pressurization occurs after the tubes are straightened out. On the basis of the above and justified assumptions, a procedure for calculating the bending moment, as well as normal and transverse forces in the tube design, is proposed. This calculation can be considered as a tool for calculating the geometric parameters of flexible rods or for checking the performance of an already installed or selected system.*

**Keywords:** method, rod, moment, force, structure, energy, deflection, curvature