

MATH MODELING. METHODS AND SYSTEMS OF INFORMATION SECURITY

A. G. Makarov, N. V. Pereborova, A. M. Litvinov, N. S. Klimova

DEVELOPMENT OF CRITERIA FOR CONFIDENCE PREDICTION OF DEFORMATION AND RELAXATION PROCESSES OF POLYMER TEXTILE MATERIALS

The article deals with the development of criteria for confidence prediction of deformation and relaxation processes of polymer textile materials. The developed criteria for the optimal choice of a mathematical model of the mechanical properties of these materials are based on the minimization of the integral functional-convolution, corresponding to the defining equation of state.

Keywords: *mathematical modeling, polymer textile materials, deformation properties, relaxation, creep, optimal prediction criteria*

S. I. Shterenberg, A. V. Krasov

DEVELOPMENT OF A METHODOLOGY FOR BUILDING A TRUSTED ENVIRONMENT BASED A HIDDEN SOFTWARE AGENT. PART 1. RESEARCH

For more than 10 years, the scientific community has been developing various models of insider actions in the information system of the trusted zone and ways to identify them. A common problem throughout all these years has been and remains the problem of the availability of a high-quality sample of data for analysis and testing, and the availability of reliable information about the attack is extremely important for any research or detection of attempts to steal and compromise legal software. Unfortunately, it is still practically impossible to get it, even though certain attempts are being made to collect it. Either the available information on incidents is insufficiently complete or accurate, or it is absent in principle.

Keywords: *insider, trusted zone, steganography, software agents*

V. A. Desnitsky

ANALYSIS OF THE MODEL OF ENERGY DEPLETION ATTACKS IN CYBER-PHYSICAL SYSTEMS

The paper analyzes energy depletion attacks aimed at autonomously functioning devices of contemporary cyber-physical systems. Such devices performing communication in the network by using wireless communication channels can be exploited by a potential intruder, affecting the available network interfaces. Two application fields of cyber-physical systems, which devices of are subject to this type of attacks are described. The analysis of the constructed model of energy depletion attacks with the formation of a qualitative integral evaluation of the criticality of each of the attacks is fulfilled.

Keywords: *energy depletion attack, security, cyber-physical systems*

A. G. Makarov, D. O. Redkin

MATHEMATICAL MODELS OF DEFORMATION PROPERTIES OF NONWOVENS

The most commonly used mathematical models for the system analysis of deformation properties of nonwoven materials are considered in the article. The basic mechanical characteristics are described and their mathematical models are defined. The criteria for evaluating the applicability of the described models have been determined.

Keywords: *mathematical model, viscoelasticity, nonwoven materials, polymeric materials, relaxation, creep, plasticity, Mooney- Rivlin model, Ogden model*

S. N. Shemyakin, I. E. Pestov, P. O. Fedorov, S. A. Kosheleva

USING GRAPH THEORY TO MODEL THE SECURITY OF CLOUD SYSTEMS

The article discusses the security problems of cloud systems. It also contains a model of cloud systems that allows you to formally describe various security issues. The proposed model is based on graph theory and describes the main features of virtual machines in cloud systems. This allows you to identify several cloud security issues. The article also discusses other security issues of shared virtual machines in the cloud.

Keywords: *Cloud Infrastructure, information security, virtualization, model, graph theory*

A. S. Salita, A. V. Krasov

CREATING A STEGANOGRAPHIC CHANNEL USING IPV4 AND TCP HEADER FIELDS

The possibility of creating a steganographic channel based on the headers of the IPv4 and TCP protocols, calculated the capacity of the created channels and considers libraries using which an attacker can create steganographic channel is considered in this work.

Keywords: *steganography, network, security, channel steganography, information concealment, information protection, data networks, channel capacity*

N. V. Pereborova, N. S. Klimova, A. M. Litvinov, E. A. Ageeva

MATHEMATICAL MODELING OF OPERATIONAL PROCESSES OF POLYMER TEXTILE MATERIALS

The most reliable study of the mechanical properties and forecasting of the operational processes of polymer textile materials is based on mathematical modeling of viscoelastic properties based on the data of a simple experiment. Mathematical models of the mechanical properties of polymer materials to a greater or lesser extent reliably describe their operational processes.

Keywords: *mathematical modeling, operational processes, polymer textile materials, deformation properties, relaxation, creep*

S. V. Kiselev, A. A. Kozlov, A. M. Litvinov, A. A. Makarova

DEVELOPMENT OF MATHEMATICAL MODELS OF DEFORMATION PROPERTIES OF POLYMER TEXTILE YARNS

A variant of the mathematical model of the deformation properties of polymer textile yarns is proposed, which is used to predict operational processes of various complexity - from simple relaxation and simple creep processes to complex deformation-recovery processes and reverse relaxation processes with alternating loads.

Keywords: *mathematical modeling, polymer textile materials, deformation properties, relaxation, creep*

O. M. Vinogradova, V. I. Andrianov

STUDY OF PREPARATION FOR THE MODERNIZATION OF THE STRUCTURAL SAFETY OF AN EDUCATIONAL INSTITUTION BASED ON THE FULFILLMENT OF THE REQUIREMENTS OF THE FEDERAL STATE EDUCATIONAL STANDARD AND OTHER NORMATIVE DOCUMENTS

Today an important criterion for the success of the professional training of an information security officer is the demand for graduates in the labor market. For this, it is necessary to optimally coordinate the reproduction of the necessary personnel with the needs of the economy. The purpose of this article is to consider in detail and bring it closer to modeling the process of an automated mechanism for the competitive distribution of KTsP for the direction of programs implementing bachelor's and specialty in the areas of «Information Security». In order to speed up the process of professionalization of university teachers, it is necessary to identify the most important competencies for it and create conditions for their formation. This formulation of the UAIS problem leads to the need to design a methodological system for professional training of a future teacher of higher education, since teachers need not only scientific, but also thorough methodological training in strict accordance with the disciplines read by the releasing profile department.

Keywords: *fses, KTsP, information security training, UAIS, FSTEC*

A. A. Kozlov, A. M. Litvinov, S. V. Kiselev, M. A. Egorova

MATHEMATICAL MODELING AND COMPUTER PREDICTION OF ELASTIC, VISCOELASTIC AND PLASTIC DEFORMATION OF POLYMER TEXTILE MATERIALS

The article deals with mathematical modeling and computer prediction of elastic, viscoelastic and plastic deformation of polymer textile materials. The separation of the total deformation of polymer textile materials into components allows us to solve the problem of evaluating their functional properties.

Keywords: *mathematical modeling, forecasting, polymer textile materials, elasticity, viscoelasticity, plasticity, deformation*

G. Ya. Frolov, A. V. Epifanov

INVESTIGATION OF THE DEPENDENCE OF THE DIRECTION AND SPEED OF THE CURRENT ON THE WIND DIRECTION

The article deals with the theoretical foundations of wind flow modeling and methods of water body typification. The main hydrological, meteorological, and morphometric parameters affecting the unsteadiness of wind currents are determined. An empirical method for assessing the applicability of the stationary model for calculating wind currents for the shallow sea model is developed. The obtained dependences are tested on the example of a section of Lake Ladoga in the area of Petrokrepost Bay.

Keywords: *mathematical modeling, wind currents, shallow-water model, hydrological parameters, meteorological conditions*

CHEMICAL SCIENCES

O. V. Lepilova, S. A. Koksharov, S. V. Aleeva

TECHNOLOGY FOR PRODUCTION OF HYBRID COMPOSITE SORBENT BASED ON PLANT RAW MATERIALS AND MONTMORILLONITE

*The technology of biomodification plant raw materials was used to preparation hybrid nanocomposites based on Burdock *Arctium Lappa L* biomass and montmorillonite. It was founded that biomodification allowing releasing pectin into the biomass Burdock structure and forming of additional macropore spaces that good to fixing clay mineral particles onto biomass. It was founded that the increase of mesopore spaces increases the internal specific surface. These is allow increasing the adsorption capacity of hybrid nanocomposites to zinc ions and methylene blue to 52.2 and 166.9 mg/g respectively that is 3.5 and 9 times more than adsorption capacity for initial plant Burdock.*

Keywords: *hybrid composite, modification, Burdock biomass, montmorillonite*

V. V. Martsenyuk, O. V. Astashkina, A. A. Lysenko, A. V. Pimenova

INVESTIGATION OF THE ELECTROPHYSICAL PROPERTIES OF POLYMER MATERIALS WITH CARBON DISPERSIONS-FILLERS

Conductive film composite materials based on carboxymethyl cellulose, polyvinyl alcohol, and fluoroplastic F-2M have been obtained. For each polymer binder, the concentration of the molding solutions is set. Specific volume electrical resistance is determined for carbon fillers and manufactured film composites. It is shown that for all polymer film composites, with an increase in the concentration of the carbon filler, a decrease of specific volume electrical resistance is observed, which is especially noticeable in the range of filler concentrations from 10 to 20 wt. %.

Keywords: *polymers, carboxymethyl cellulose, polyvinyl alcohol, fluoroplastic F-2M, film composites, resistivity, carbon black, cut carbon fibers*

D. Y. Uvarova, A. A. Pekaretz, E. L. Akim

RESEARCH OF CARBONIZED FIBER OF INDUSTRIAL HEMP FOR THE ABILITY TO ABSORB PETROLEUM PRODUCTS

The authors discuss the areas of application of technical hemp, in particular, the study of the ability of carbonated technical non-narcotic hemp to absorb petroleum products.

Keywords: *industrial hemp, carbonized fiber, absorption of petroleum products, sorption of petroleum products, biomaterial*

O. I. Gladunova, A. A. Lysenko

WORLD AND RUSSIAN MARKET OF POLYMER COMPOSITE MATERIALS. TRENDS AND PROSPECTS

The authors examine the current state of the market for polymer composite materials in the world and in Russia. The main driving and restraining factors of the market development are formulated. The promising areas of application of composite materials and current research directions are shown.

Keywords: *polymer composites, global composites market volume, Russian composites market volume*

E. V. Kudriavtseva, A. A. Burinskaya

INVESTIGATION OF THE EFFECT OF STABILIZERS ON THE STABILITY OF COLLOIDAL SOLUTIONS OF BIMETALLIC COPPER-SILVER NANOPARTICLES

The authors discuss the issues of obtaining the stable colloidal solutions containing bimetallic copper-silver nanoparticles by using different stabilizers (polyvinyl alcohol, gelatin, manutex RS, ammonium hydroxide) by means of the difference in the oxidative potentials (E_0) of the Ag^+/Ag_0 and Cu^{2+}/Cu_0 couples.

Keywords: *nanotechnology, bimetallic nanoparticles, silver, copper, polyvinyl alcohol, gelatin, manutex RS, ammonium hydroxide, antibacterial properties*

I. N. Ganiev, L. Z. Alieva, A. E. Berdiev, S. D. Alikhonova

INFLUENCE OF SODIUM ON HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF ZINC ALLOY TSAMSV4-1-2.5

In the work, the heat capacity of the zinc alloy TsAMSV4-1-2.5 with sodium additions was determined in the «cooling» mode according to the known heat capacity of the reference aluminum sample. For this, polynomials describing their dependences were obtained by processing the curves of the cooling rate of samples from the zinc alloy TsAMSV4-1-2.5, doped with sodium and the standard. Further, according to the experimentally found values of the cooling rates of the standard and samples from alloys, knowing their masses, the polynomials of the temperature dependence of the heat capacity of the alloys and the standard are established, which are described by a four-term equation. Using the integrals of the specific heat capacity, the temperature dependences of changes in enthalpy, entropy, and Gibbs energy are calculated for the sodium-doped TsAMSV4-1-2.5 alloy. Using the obtained polynomial dependences, it is shown that with increasing temperature, the heat capacity, enthalpy, and entropy of alloys increase, while the Gibbs energy decreases.

Keywords: zinc alloy TsAMSV4-1-2,5, sodium, «cooling» mode, heat capacity, enthalpy, entropy, Gibbs energy

E. G. Smirnova, E. M. Lotsmanova, E. S. Bystrova

STUDY OF THE AGING RESISTANCE OF PAPER MADE OF PULP WOOD EUCALYPTUS

The resistance to artificial aging of paper samples made of pulp from plantation-grown eucalyptus wood is investigated. Two methods of artificial aging are applied: heat-wet and light. It was found that upon completion of both heat-wet and light aging, samples of paper made of eucalyptus pulp and leaf pulp of the LS-1 brand lose more than 95 % of the fracture strength, and more than 27 % of the tensile strength. The content of aldehyde groups in the paper samples increases during the heat-wet aging process and by 30 days is 0.46-0.47 % for both samples. Light aging has a greater impact on the paper. Thus, the number of aldehyde groups in the samples of paper from leaf pulp increases to 0.66 % by 10 o'clock, from eucalyptus - to 0.56 %. eucalyptus pulp paper samples showed greater resistance to light aging than LS-1 leaf pulp paper samples.

Keywords: deciduous pulp, Eucalyptus wood pulp, light aging, heat-wet aging, mechanical strength, carboxyl groups, carbonyl groups

A. A. Prikhodko, I. I. Osovskaya, A. E. Baranova

ISOLATION OF POLYPHENOL EXTRACTS FROM BIOMASS OF BROWN FUKUS ALGAE OF GENUS FUCUS VESICULOSUS

The purpose of this work is to extract polyphenols from brown fucus algae of the species Fucus vesiculosus, which grow in the White sea. The maximum polyphenol - phlorotannin content (13,3 %) was found in F. vesiculosus by extraction with 70 % acetone. The presence of polyphenols was determined by qualitative analysis using iron (III) chloride. The obtained data can be used to optimize technologies of obtaining biologically active substances from brown algae in the medical, food, pharmacological and cosmetic industries.

Keywords: brown algae, fucus, extraction, biological activity, polyphenols, polar solvents, florotannins, extract

AUTOMATION AND MANAGEMENT OF TECHNOLOGICAL PROCESSES AND PRODUCTION

N. P. Midukov, V. S. Kurov

3D TECHNOLOGY FOR CREATION OF EQUIPMENTS DETAILS IN CHEMICAL TECHNOLOGY

The article is devoted to one of the new, actively developing areas of use of 3D press technology in the scientific and technical work of students. An example of creating a pump runner was considered in detail. In this case a modern graphic program was used for 3D modeling, then the model was translated into a three-dimensional coordinate system of applying material over time. The results of the work were used in the educational process. In addition, material was presented on the successful use of 3D printing technology in the research work of the University of Industrial Technologies and Design.

Keywords: 3D printing technology, centrifugal pump impeller, scientific and technical work

V. A. Kolesnikov, N. V. Rokotov

DEVELOPMENT AND ANALYSIS OF EQUIPMENT FOR THE PRODUCTION OF POLYSTRUCTURAL WINDING PRODUCTS

The article presents the results of computer modeling of winding structures. In case of accidental winding, there is a significant change in the structure of the winding product, even with a slight increase in the packing diameter. With precision winding, slight deviations in the pitch of the lifting turns of the thread lead to a significant change in the structure of the winding product. The kinematic scheme of an experimental polystructural winding stand is presented, as well as the obtained experimental sample of a polystructural winding product.

Keywords: computer simulation, precision winding, polystructural winding, winding stand, experimental sample

V. V. Sigacheva, I. E. Menyailo

DEVELOPMENT OF A BUILT-IN SYSTEM FOR MONITORING THE TECHNICAL CONDITION OF THE WEAVING MACHINE STB

The structure of the built-in automated system for monitoring the state of the weaving machine, based on vibration sensors, a programmable controller for collecting and processing data, a database, has been developed.

Keywords: *weaving machine, built-in diagnostic system, hardware and software complex, controller, diagnostic parameters, analysis, technical condition*

S. L. Gorobchenko, D. A. Kovalev, A. I. Alesin

MODERN APPROACH TO IMPROVING ELECTRONIC DOCUMENT MANAGEMENT IN A VALVE MANUFACTURING COMPANY BY USING CALS-TECHNOLOGIES

The current state of electronic document management at valve manufacturing companies and machine-building enterprises is shown. The main types of software and information platforms that are optimal for use in machine-building enterprises are highlighted. The practical application of the sequence of translation of documentation to electronic document flow is demonstrated on the example of an electromechanical product. One of the most significant trends in the development of CALS-systems at valve and machine building industry is the trend of creating client portals created by equipment suppliers.

Keywords: *electronic document management, CALS-technologies, integrated platforms of information support for machine-building enterprises, PLM for valve's manufacturers, cad, CAM and Autodesk Fusion 360 software for electromechanical products*

F. S. Grekov, N. R. Turkina, A. E. Shashurin, A. N. Chukarin

MODELING THE IMPACT OF A VEHICLE WITH A PROTECTION DEVICE

В работе проведен расчет отклика заградительных сооружений на ударное воздействие транспортных средств. Рассмотрены особенности поведения конструкционных материалов и приведены результаты моделирования отклика заградительных сооружений при динамических нагрузках на различных скоростях соударения в программе ANSYS WORKBENCH.

Keywords: *computer modeling, finite element model, impact interaction, deformable solid, barrage device*

JUBILEE

EVGENY NIKOLAEVICH SUZDALOV