MATH MODELING. METHODS AND SYSTEMS OF INFORMATION SECURITY

A. V. Shatokhin, Ya. A. Ivakin, S. A. Krinitsky, S. N. Potapychev
APPLICATION OF COMPUTER MODELING FOR THE CONSTRUCTION OF UNDERWATER LIGHTING SYSTEMS

The effectiveness of the application, deployment, construction of means and systems for underwater lighting (SOPO) largely depends on the state and current hydrological, hydrometeorological and physical parameters of the aquatic environment. That is why, in historical retrospect, the development of appropriate hydroacoustic and nonacoustic means was accompanied by the development of adequate decision support tools for their use, for the optimal (rational) construction of underwater lighting systems based on such means. This article is devoted to the analysis of the experience of improving such tools, the presentation of the role of computer modeling in the modern process of substantiating decisions on the construction of these systems and the definition of ways to develop computer modeling methods in the interests of SOE.
Keywords: underwater lighting systems, hydroacoustic facilities and complexes, spatial system construction, computer modeling, simulation modeling, geoinformation system, decision support.

V. A. Desnitsky
MODELING AND VISUAL ANALYSIS OF DENIAL-OF-SLEEP ATTACKS IN WIRELESS SENSOR NETWORKS

The author models Denial-of-Sleep attacks that prevent the normal functioning of autonomous nodes of wireless sensor networks and their cyclic transition between energy consumption modes. The Denial-of-Sleep attack was modeled in several variations by using Arduino microcircuits and Digi XBee Series 2 wireless interfaces. Data visualization methods using transcripts were applied as one of the methods for analyzing and identifying such attacks.
Keywords: wireless sensor network, Denial-of-Sleep attack, security, modeling.

L. A. Vitkova, N. A. Krestiashin
METHODOLOGY FOR DETECTING SQL VULNERABILITIES OF THE WEB INTERFACE

Currently, a person's daily life is inextricably linked with digital technologies, which are accessed through web interfaces. One of the main vulnerabilities that web interfaces are exposed to is SQL injection. When using it, the violator can gain access to confidential data. SQL injection allows you to manipulate the behavior of the system and violate the logic of the database through the use of SQL commands in the login and password fields. The article proposes a method for detecting SQL vulnerabilities of the web interface, which can be used to check the interface for the presence of such vulnerabilities. It is assumed that testing and detecting vulnerabilities will allow us to develop recommendations and measures to improve the level of information security of the web interface.
Keywords: SQL vulnerability, SQL injection, Web interface, web application, vulnerability detection.

V. V. Puchkov, E. D. Edemskaya, L. A. Vitkova
METHODOLOGY FOR DETECTING VULNERABILITIES IN THE SMART HOME NETWORK

The development of modern technologies has led to the emergence of such a concept as a «Smart home». More and more device controls and sensors are being integrated into home telecommunications networks. Voice assistants, smart locks, lamps, sensors, switches and much more are appearing in homes. Separately and together, all this is combined by the «Smart Home» technology. The introduction of such technologies in all spheres of society significantly reduces the level of security. The article proposes a technique for detecting vulnerabilities in the Smart Home network, taking into account the structural connections between elements in the network, and providing testing of devices for the presence of flaws in software and hardware that can be used to implement security threats.
Keywords: Internet of Things, Smart home, threat, vulnerability, vulnerability detection, vulnerability detection methodology.

A. A. Popov, O. V. Fedorova, A. Yu. Tsvetkov
INVESTIGATION OF ACTUAL MECHANISMS TO ENSURE THE PROTECTION OF TERMINAL DEVICE RUNNING THE LINUX OS FAMILY FROM ATTACKS USING ROOTKIT

Malicious software (software) is any malicious code that can be used to compromise the system, collect confidential information, gain access to private computer resources and perform any illegal actions with data, hosts or networks. In the modern world, malware acts using various hidden methods to avoid detection. It will also help to charge and use the resources of various system platforms. These changes and advanced work patterns have led to the fact that the signature-oriented approach is becoming less effective. This is especially important when trying to detect malware of the OS kernel, since it is easier to hide and mask your traces in it.
Keywords: RootKit, Linux, unauthorized access, machine learning, hooks, kernel.

S. I. Shterenberg, Yu. S. Danilova
CODE SUBSCRIPTION METHODOLOGY IN GITLAB

The current situation in the world is forcing employees of IT companies to work from home. The software development process has completely switched to a remote work format. And here there is a huge information security risk associated with the fact that the program code can move on the insecure Internet. If additional protective measures are not applied, the program code can be compromised and replaced with malicious one. The authors describe the methodology by which code signing can be implemented in any IT company.
Keywords: code signing, information security, CI\CD, GitLab.

A. V. Krasov, N. V. Paskidov, A. S. Salita
USING MACHINE LEARNING METHODS TO DETECT NETWORK STEGANOGRAPHY
The authors discuss the possibility of analyzing network traffic using machine learning technologies. This technology allows to consider a larger number of factors and use less computing resources to identify attachments in TCP packet headers.
Keywords: steganography; network steganography; security; machine learning, channel steganography; concealment of information; protection of information.

G. L. Vinogradova, O. V. Shchekochikhin
THE POSSIBILITIES OF BPMN NOTATION IN MODELING PROCESSES IN THE FIELD OF INFORMATION SECURITY KOSTROMA STATE UNIVERSITY
The article considers an approach to building models of the processes of organizations in which confidential information circulates. To analyze possible attacks and make decisions to protect information at the first stage of threat identification, it is advisable to develop a comprehensive model that provides input data on the enterprise in the form of a set of processes, performers, performed functions and operations, categories of processed information. Application of notation BPMN for modeling processes and possible attacks on information objects of the organization is shown. Examples of models of processes of the industrial enterprise and the state organization with inclusion to the processes of the elements of information security: attackers, confidential information and its protection means are considered. These models describe existing situations with processes, the so-called «as is» models. Construction and analysis of models of this type allows to visualize the potential possibility of implementation of actual threats and become the basis for the development of the next stage of building information security systems — the process model «as it should be».
Keywords: information security, process modeling, information security threats, intruder, BPMN notation.

M. A. Kanevsky
APPLICATION OF ARTIFICIAL INTELLIGENCE TO SUCCESSFUL PROCESSING SEARCH REQUESTS OF USERS IN ONLINE FASHION STORES
For many years, the fashion industry has been actively applying artificial intelligence technologies in the production and sale of goods, forecasting and planning consumption as well as inventory management in the supply chain. Natural language processing (NLP) is a section of artificial intelligence and mathematical linguistics, which is a base for various e-commerce applications growing rapidly. In this article, we will look at examples of using NLP tools and machine learning to successfully process user requests from online fashion stores.
Keywords: fashion, computer science, data science, artificial intelligence, cognitive technologies, machine learning, natural language processing, natural language understanding.

M. A. Kanevsky
HOW VISUAL SEARCH IS TRANSFORMING E-COMMERCE IN FASHION
The fashion industry has been actively applying artificial intelligence technologies for many years in the production and sale of goods, forecasting and planning of consumption, as well as inventory management in the supply chain. Computer vision is a field of artificial intelligence that is used to recognize and describe images. In this article, we will look at examples of the successful application of computer vision and machine learning technologies in online fashion retailing.
Keywords: fashion, computer science, data science, artificial intelligence, computer vision, e-commerce, IBM, Google, Amazon.

CHEMICAL SCIENCES

K. I. Smyslyaeva, K. A. Kuzmin, V. A. Rudko, V. G. Povarov, I. N. Pyagay
METHODOLOGY FOR DETERMINING THE MOLECULAR FORMULAS OF ASPHALTENES OF DIFFERENT GENESIS
The study of asphaltenes contained in significant quantities in oil residues is a key task for improving the depth of oil refining. The diverse and complex structure of asphaltenes poses serious obstacles to a definitive understanding of their properties and to modeling processes involving asphaltenes. This study proposes the use of cryoscopic molecular weight determination, X-ray fluorescence and CHN-analyses to establish the gross formulas of asphaltenes. The data obtained allow us to determine the difference between the properties of asphaltenes obtained from different sources, as well as to apply the molecular formulas to analyze the efficiency of oil residue processing technologies.
Keywords: asphaltenes, molecular formulas of asphaltenes, molecular weight of asphaltenes.

I. V. Zykova, V. A. Isakov
INVESTIGATION OF THE EFFECTIVENESS OF THE USE OF VARIOUS COAGULANTS

AND FLOCCULANTS IN WATER TREATMENT AT PULP AND PAPER ENTERPRISES

The efficiency of the coagulation process using aluminum and iron-based coagulants and flocculants for the purification of high-color and turbid waters at pulp and paper enterprises was studied. It was found that at the optimal doses of POHA coagulants 50 mg/dm3 and Ferix-3 40 mg/dm3, the value of the water color index for obtaining high-quality cellulose is not achieved. A decrease in the color of water below 5°C and the residual iron concentration corresponding to the requirements of SanPiN 1.2.3685–21 is achieved using Ferix-3 coagulant at a dose of 30 mg/dm3 with the addition of an alkalizing reagent (soda or lime). The combined use of coagulants and flocculants has shown that the most effective flocculant both when using POHA and Ferix-3 as a coagulant is the natural anionic flocculant sodium alginate, however, the indicators of water color, suspended matter concentrations, residual concentrations of iron (III) and aluminum (III) ions, which are at the level of water quality indicators that allow obtaining high-quality cellulose, are achieved when using POHA and sodium alginate as a coagulant.
Keywords: pulp and paper industry, water color, suspended solids, pH, coagulants, flocculants.

A. Zh. Adylova, M. S. Stroganova
DETERMINATION OF THE OXIDATION RATE CONSTANT OF EASILY OXIDIZED ORGANIC SUBSTANCES FOR WASTEWATER OF SULFATE-PULP MILL

The work is devoted to the study of water quality at the place of wastewater discharge from a mill producing sulfate pulp. The results of chemical and microbiological studies are presented; the dependences of the mutual influence of biochemical oxygen consumption for different periods of time, dissolved oxygen and the content of microorganisms involved in the processes of biochemical oxidation are constructed. The rate constants of oxidation of easily oxidized organic substances are calculated for wastewater from sulfate-pulp mill in the zones of initial and basic dilution.
Keywords: oxidation rate constant, organic substances, waste water of the pulp and paper mill, sulfate-pulp mill, BOD, dissolved oxygen, microorganisms.

S. A. Yakimov, A. V. Koksharov, E. V. Belykh
THE EFFECT OF THE COOKING CONDITIONS ON THE RESIN CONTENT IN HARDWOOD SULFATE PULP

In laboratory conditions, the influence of the sulphate cooking conditions of hardwood chips from a mixture of aspen and birch (70:30) on the resin content in unbleached hardwood pulp was studied. The variable parameters were the temperature and consumption of white liquor. Based on the results of laboratory experiments, it was found that the content of extractives in unbleached hardwood pulp correlates with the kappa number of unbleached pulp, regardless of the cooking temperature and consumption of white liquor.
Keywords: hardwood sulfate pulp, kappa number, white liquor consumption, content of extractives.

E. R. Mkrtchyan
ORGANISATIONAL, TECHNICAL AND TECHNOLOGICAL ASPECTS OF RECYCLING DEVELOPMENT

The article provides data on the forecast for the waste management industry in Russia and looks at the recycling of different types of glass waste.
Keywords: recycling, glass waste, glass scrap.

I. V. Zykova, V. A. Isakov
INVESTIGATION OF THE PHYSICO-CHEMICAL PROPERTIES OF THERMALLY OXIDIZED SAPROPEL

The study of the physico-chemical properties of thermooxidized sapropel was carried out. The volume of meso — and micropores of thermooxidized sapropel at different temperatures was determined by the method of» molecular probes «for methyl orange and iodine. It was found that the largest volume of meso-, micro — and total volume has a thermooxidized sapropel at a temperature of 600 °C. The results of processing the kinetic dependences of resorcinol adsorption on thermally oxidized sapropel at temperatures of 293 and 313 K allow us to conclude that the parameters of the adsorption process satisfy the pseudo-second-order kinetic model, and the calculated activation energy value suggests that the limiting stage of the resorcinol adsorption process is internal diffusion in the pores. The adsorption of resorcinol under static conditions on thermooxidized sapropel was studied. The values of the characteristic adsorption energy, the maximum value of adsorption and the pore volume are calculated using the Dubinin-Radushkevich equation.
Keywords: hermooxidized sapropel, the method of «molecular probes», adsorption, resorcinol.

A. E. Baranova, I. I. Osovskaya
FEATURES OF FILM-FORMING AND GEL-FORMING PROPERTIES OF SEAWEED AGAR

Seaweeds are a unique raw material for the production of a number of preparations with a wide range of biologically active substances with antimicrobial, antiviral and antibacterial activity. An important natural gelling agent, thickener and stabilizer, agar-agar, is obtained from red seaweed. In the work, agar was isolated from dried red seaweeds of the genus Porphyra. The isolated agar had indicators that met the regulatory requirements. The rheological and gelling properties of agar are shown by viscometry, solubility and swelling methods. The dependence of the influence of the concentration of the agar solution on the gel-forming ability was obtained. The range of concentrations at which gel formation occurs (1.0–10.0%) was revealed. The choice of optimal conditions (concentration, temperature) for obtaining films is substantiated. The influence of the plasticizer on the quality of the films is shown. A direct dependence of the change in film swelling in water on time and temperature, which are objective characteristics for their use in practical applications, is revealed. An improvement in the properties of textile materials coated with an agar solution has been established: a decrease in wrinkling and an improvement in the luster of the fabric, the manifestation of a skin pattern. Problems that need to be solved in further research are

shown.

Keywords: red algae, agar, degree of swelling, viscosity, jelly, gelation, film formation, solubility.

N. A. Ivanov, A. M. Kiselev
SORPTION OF AROMATIC AMINES BY A MIXED TEXTILE MATERIAL IN THE SYNTHESIS OF COVALENTLY FIXED AZO DYES

The sorption of aromatic amines in the process of dyeing a mixed textile material of viscose and polyester fibers by synthesis of insoluble azo dyes capable of covalent fixation on a fibrous substrate with formation of colors with high coloristic and strength properties has been studied.

Keywords: mixed textile material, dyeing, azo dyes, sorption, aromatic amine, vinilsulphone reactive group, covalent fixation, colour quality.

S. S. Sodikova, I. N. Ganiev, R. H. Saidzoda
OXIDATION KINETICS OF Zn-Pb SYSTEM ALLOYS

Alloys of zinc with lead at high temperatures and aggressive environments. In this work, the kinetics of oxidation of alloys of the Zn-Pb system containing up to 2.0 wt.% lead was studied by thermogravimetry. It has been established that the addition of lead to zinc increases its resistance to oxidation in the solid state. It is shown that the oxidation of alloys proceeds according to the hyperbolic mechanism and has an order of 10–4 kg·m-2·s-1.

Keywords: Zn-Pb alloys, thermogravimetric method, oxidation kinetics, true oxidation rate, activation energy.

Sh. Yakubov
EFFECT OF BARIUM ADDITIVES ON THE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF AlFe5Si10 ALUMINUM ALLOY

The paper presents the results of an experimental study of the effect of barium on the specific heat capacity of the aluminum alloy AlFe5Si10. It is shown that the addition of barium slightly reduces the specific heat capacity of the original aluminum alloy AZh5K10.

Keywords: aluminum alloy AlFe5Si10, barium, «cooling» mode, specific heat capacity, heat transfer coefficient, enthalpy, entropy, Gibbs energy.

M. E. Sirojidinov, I. N. Ganiev, J. H. Sharipov, Z. R. Obidov
EFFECT OF THALLIUM ON THE ANODIC BEHAVIOR OF Zn55Al ALLOY, IN ACID, NEUTRAL AND ALKALINE ENVIRONMENTS

Using the potentiostatical method in the potentiodynamical mode with a potential sweep rate of 2 mV/s in acidic, neutral and alkaline environments of HCl, NaCl and NaOH electrolytes, it was found that thallium additions in the range of 0.01÷0.1 wt% increase the anodic stability of the Zn55Al alloy in 2 rate, especially in neutral environment. In this case, there is a shift in the potentials of corrosion, pitting formation and repassivation of alloys to the region of positive values.

Keywords: Zn55Al alloy, thallium, potentiostatical method, corrosion rate, anodic behavior.

Firuzi Hamroqul, U. R. Jobirov, I. N. Ganiev, Z. R. Obidov
KINETICS OF OXIDATION OF Zn 0.5 Al Zinc Alloy, DOPED WITH NEODYMIUM AND ERBIUM

The effect of alloying additions (on 0.01÷1.0 wt%) of neodymium and erbium on the kinetics oxidation of Zn0.5Al zinc alloy in the temperature range of 523–623 K was studied with thermo gravimetrical method. Showed that alloying contributes to an increase in the oxidizability of alloys. Determined that on the surface of the alloys during oxidation are formed ZnO, Al2O3, Nd2O3, Er2O3, ZnAl2O4.

Keywords: zinc alloy Zn0.5Al, neodymium, erbium, thermogravimetrical method, kinetics oxidation, activation energy.

E. L. Lebedev, A. O. Repin
THE INFLUENCE OF LUBRICANTS BASED ON LOW-MELTING METALS ON THE MECHANICAL PROPERTIES OF BALL BEARING STEEL SHX 15

The authors examine the influence of lubricants, which include low-melting metals Ga and In, on the resource of space industry devices, in the design of which there are ball bearings. Using the method of dynamic indentation, an experimental study of the effect of a Ga-based alloy with the effect of liquid metal embrittlement on the physical and mechanical characteristics of ball bearing steel SHX 15 was carried out.

Keywords: resource, lubricant based on fusible metals, ball bearing, gallium, surfactants, dynamic indentation.

AUTOMATION AND MANAGEMENT OF TECHNOLOGICAL PROCESSES AND PRODUCTION

D. A. Kovalev, V. A. Sharyakov, O. L. Sharyakova, V. A. Lebedeva
SYNTHESIS OF A TWO-CIRCUIT AUTOMATIC WATER LEVEL CONTROL SYSTEM FOR A STEAM BOILER

When synthesizing automatic control systems, there is a problem with complex determination of the regulator parameters, and the main criterion becomes the achievement of stable operation, and the quality of the transient becomes of secondary importance. Such problems can arise in the presence of two or more integrating links in the initial system whose time constants are almost the same or of the same order. The correct synthesis of such systems is possible by using the structure of slave control that enables to replace the loop with an integrating link by an equivalent aperiodic link of the first order. The paper demonstrates the principle of building a slave control structure

and the synthesis of such a system by the example of an automatic water level control system.
Keywords: Simulation modeling system, control object, heat source, increase of operation efficiency, automatic control system water level, cascade control scheme.

U. I. Sidelnikov, I. V. Remizova, A. V. Koksharov
APPROXIMATE MATHEMATICAL MODEL OF THE PAPER STRENGTH INDEX ON THE EXAMPLE OF RESISTANCE TO END COMPRESSION
The article is devoted to the development of a mathematical model of the resistance to mechanical compression, which allows us to evaluate the influence of individual process parameters on the physical and mechanical parameters of the products produced. Developed on the basis of experimental data, the mathematical model of the fluting end compression resistance (CST) reflects the dependence of the CST on the value of the mass of 1 m2, humidity, composition and degree of grinding of individual components.
Keywords: paper machine, mathematical model, quality indicators, fluting..