ABSTRACT&REFERENCES

MATHEMATICS AND CYBERNETICS - APPLIED ASPECTS

RATIONALIZING THE TRANSPORT AND TECHNOLOGICAL SCHEMES FOR PACKAGED CARGO DELIVERY (p. 4-6)

Nikolay Nefodov, Natalya Potaman, Mariya Cherkashina

The method of determination of rational transport and technological schemes for the delivery of goods in the supply chain is worked out. The overall cost of the products delivery in the supply chain is used as an efficiency criterion.

The supply chain is a structural element of the products supply chain. However, the study of supply chain production entails the building of complicated mathematical models. The use of such a measure as a degree of concentration / decomposition of material flow allows allocating the products supply chain and taking into account the cost changes depending on changes in the volume of material flow.

The studies were conducted on the basis of two the most common transport and technological schemes of product delivery. The dependence of the total discounted costs accounts the index of concentration / decomposition of the material flow, which allows allocating the product supply chain and takes into account the cost changes depending on the change of the material flow.

The numerical results for the identification of areas of the most efficient use of transport and technological schemes for the products delivery in the supply chain were determined

Keywords: products supply chain, costs, distribution warehouse, end supplier, delivery and logistics

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PROCEDURE FOR FORMING A FORECAST PASSENGER FLOW MODEL FOR RAIL LINES (p. 7-10)

Larysa Parkhomenko

The article deals with formation of a traffic assignment forecast model on railway lines while introducing high-speed trains. The procedure for adjusting a forecast model based on a genetic algorithm with coding has been proposed. The main aim of the research is to improve a traffic assignment forecast model on railway lines while introducing high speed trains based on evolution modelling. Methods of fuzzy algebra, genetic algorithms and mathematic programming have been implemented to solve the scientific problem under consideration. It enabled to develop a procedure for adjusting a mathematical model based on an objective function which minimizes an average relative error in forecast and actual data of the testing set. Apart from a search for a fuzzy relation in a relational equation, the article proposes a method to adjust membership functions of output linguistic terms for a variable models (within a genetic algorithm) to improve the accuracy of adjustment for a forecast model. The adjustment procedure proposed has improved the forecast model accuracy. A relative error in a forecast model for the testing set is less than 10,0144%. The results of the research can be implemented on railways while designing automated programme complex for traffic assignment forecast between cities in strategic planning

Keywords: rail transport, high-speed transportation, forecasting, genetic algorithm

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INFORMATION TECHNOLOGIES OF QUANTITATIVE EVALUATION OF RISK GROUPS OF HUMAN IMMUNODEFICIENCY VIRUS INFECTION (p. 10-15)

Oksana Mulesa

The problems of estimating quantitative characteristics of objects and groups appear in various areas of economy and production. One of them is the task of evaluating the quantitative characteristics of different social groups in general and high-risk groups of HIV infection in particular. Mathematical model of evaluating the quantitative characteristics of these groups and the task decomposition into the task identification and clustering was developed in the paper.

The analysis of information technologies was made for solving the problem of estimating the number of members of groups with high risk of HIV infection and the grade of the person membership to such group. Advantages and disadvantages of the analyzed information technologies for solving these problems were defined. The need

of developing new information technologies is shown for solving the problems of estimating the quantitative characteristics of high-risk groups of HIV infection, which would allow taking into account such sources of input data as professional opinion of the person, capable of decision-making and expert judgments

Keywords: risk-group of human immunodeficiency virus infection, clustering technologies, identification technologies

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IMPACT OF EXPONENTIAL MODULATED PULSES ON STIMULATION OF EYE MUSCLES (p. 16-19)

Leonid Verevkin

The use of electric pulses for oculomotor muscles stimulation allows restoring the weakened contractility of muscles and achieving positive therapeutic effect.

For myostimulation purposes the paper proposes to use exponential pulses with ascending and descending edges and adjustable basic frequency. The use of a microcontroller in the circuit of portable electrostimulator is relevant. It allows automating the process of affecting the muscle by impulsive complex-modulated current, not exceeding the pain threshold. The microcontroller determines the pain threshold, generates the code of stimulation pulses, not exceeding the threshold, has the function of pulse control and setting by personal computer, transfers the data on electrostimulation parameters to PC for further documentation, analysis and consultations over the Internet.

The circuit of the generator of exponential-modulated pulses was developed based on the programmed microcontroller. It provides information about the pulse in the form of numeric codes and transfers it to digital-analog converter

The obtained pulse parameters correspond to the modes of electrostimulation of oculomotor muscles according to standard procedures

Keywords: electrostimulator, exponential pulse, microcontroller, generator, frequency, relative pulse duration, amplifier

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POSSIBILITIES OF USING ROBUST REGULATORS FOR TECHNOLOGICAL FACILITIES (p. 19-22)

Nadya Gricenko, Yaroslav Smityuh, Anatoly Ladanyuk

The class of non-stationary, multidimensional and multiply connected facilities, in particular, three-column distillation-rectification unit (DRU) of indirect action, which is characterized by complex hydrodynamic, mass- and heat exchange processes, is considered in the paper.

For effective control of the class of facilities, a robust approach was selected, since the purpose of robust control synthesis is ensuring the required system quality, regardless of possible errors and changes in system parameters.

The main objective of robust control is guaranteed control in conditions of incomplete priori information about the object, ensuring the system stability and maintaining its quality in the presence of all types of uncertainties which are studied and clearly identified for the DRU.

The aim of the study is the use of robust approach for optimal control of the selected class of facilities to guarantee quality and stability of automated control system in cases of emergency situations of technological regime

Keywords: robust control principles, conditions of uncertainty, robust regulator

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AUTOMATED CONTROL SYSTEM OF SPECIALIZED MARINE COMPLEX WITH TOWED UNDERWATER VEHICLE (p. 23-27)

Olixandr Blintsov, Dyck Than Tam

The generalized structure of three-level system of automatic control of spatial motion of specialized marine complex "towing vessel - single-mess towed underwater vehicle" was designed to take high-quality photos, videos and hydroacoustic surveys of the bottom surface and underwater objects. Basic scientific applied tasks, the solution of which ensures effective functioning of the complex, were defined: the synthesis of algorithms for automated complex control for its basic operation modes; the synthesis of automated control system of towing vessel trajectory when operating in conditions of external wind-wave effects; the development of mathematical software for prompt formation of the bottom topography and calculation of safe trajectory of towing vessel motion aimed at proactive control of its motion height and for efficient formation of reports on results of specialized marine complex operation

Keywords: towed underwater vehicle, automatic control system

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EXTRACTION OF QUANTITATIVE ASSOCIATION RULES CONSIDERING SIGNIFICANCE OF FEATURES (p. 28-34)

Tatyana Zayko, Andrii Oliinyk, Sergey Subbotin

The solution of the problem of automating the extraction of quantitative association rules in the diagnosis and recognition of images is considered in the paper, and some results of our research in this area are given. The main purpose of the study is developing a method for extracting quantitative association rules, considering the significance of features. The use of modern methods of searching association rules allows extracting new knowledge from large amounts of information.

The issues of extracting the quantitative association rules are considered in the paper for identifying new knowledge when solving problems of diagnosing and recognizing of images. The proposed method allows extracting quantitative association rules from the transaction databases. We propose to use a priori information concerning the significance of features that reduces the search scope, the time of rules extraction, the number of extracted rules, and accordingly, increases the levels of generalization and interpretability of the synthesized base of association rules. The research results can

be used by researchers who study and analyze complex objects, processes and systems in order to identify new knowledge, as well as in decision support systems in technical and medical diagnostics

Keywords: association rule, rules database, fuzzy logic, transaction, fuzzification, membership function

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METHOD OF WEB SERVICES QUALITY EVALUATION (p. 34-39)

Oleg Rogov, Tatiana Duravkina, Anastasia Morozova

The paper gives the analysis of existing systems of service-oriented architecture control, which allowed concluding that although the considered systems provide comprehensive facilities of service monitoring and users informing in various situations, they do not provide the management of service quality policies. Also, the main quality parameters for SOA systems, such as response time, maximum bandwidth, accessibility and reliability, were defined.

The paper first proposed the method for monitoring QoS parameters for systems with service-oriented architecture on provider's side, which has two implementation modes – passive monitoring and active testing. The algorithms for selecting a particular service instance, which matches the specified quality parameters, were proposed

Keywords: web-services, SOA, response time, accessibility, reliability, service quality

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SELF-PROPELLED UNDERWATER SYSTEM CONTROL INTEGRATION WITHIN MARITIME TECHNOLOGICAL COMPLEX (p. 40-45)

Nadtoshy Nadtoshy

The concept of construction and generalized structure of an integrated system of automatic control of self-propelled subsea complex within the mother ship and self-propelled tethered underwater system as the only marine technological complex, which operates in conditions of uncertainty of external disturbances and non-stationarity of its parameters, were developed. The integrated system has five control levels – strategic, tactical, programming, execution and controlling.

The execution level consists of five automatic control subsystems, which provide a coordinated operation of actuating stabilization mechanisms of mother ship, cable winches, self-propelled underwater vehicle, underwater manipulator and its clamping unit. The implementation of the integrated ACS (automatic control system) will enable increasing the productivity and performance quality of complex technical underwater work using attached implements, such as remotely-controlled manipulators

Keywords: self-propelled tethered underwater system, automatic control system, external disturbances, manipulator

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COMPLEXITY OF HIDDEN ABELIAN GROUP ACTION PROBLEM IN QUANTUM COMPUTING MODEL (p. 45-49)

Andriy Fesenko

The paper first examines the Hidden Abelian Group Action problem's complexity in quantum computing model. This algebraic problem is fundamental in determining the hardness of a one-way function constructed on the basis of commutative and locally commutative maps and ciphers. In fact, finding new one-way functions that will be resistant in quantum computing model is very important for modern cryptography.

The main objective of the study is to assess the complexity of the Hidden Abelian Group Action problem by using a reduction to already known problems, such as the Hidden Subgroup problem and the Hidden Shift problem. In this paper, reduction of the Hidden Abelian Group Action problem to the Hidden Shift problem was first shown, and limitations that distinguish them were first demonstrated. As a result, on the one hand, the existing partial solutions to the Hidden Shift problem, and general Kuperberg's subexponential algorithm can be extended to the case of the Hidden Abelian Group Action problem. Moreover, more limitations give more chances to effective general solution to this problem. On the other hand, the reduction and similarity to a known challenge in quantum computing model also indicate the complexity of the Hidden Abelian Group Action problem, which leaves a chance for making a real stand one-way function in quantum computing model based on a locally commutative mapping

Keywords: quantum computation model, hidden shift problem, one-way function

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MEASUREMENT OF CARBON OXIDE IN EXHAUST GASES OF INTERNAL COMBUSTION ENGINES (p. 49-53)

Iliya Tymofieiev

The paper is devoted to the problem of searching the optimal parameters of time sampling of random stationary processes. Based on the analysis of existing approaches to this problem, the author suggests the approach developed by S. V. Dotsenko. This approach was applied for determining the optimal parameters of time sampling for the process, reflecting the change of carbon oxide content in exhaust gases of internal combustion engine. The algorithm for calculating the optimal parameters of time sampling was developed. Using the graphical environment of simulation modeling Simulink, the models of analog-digital and digital-analog converters are constructed. Simulation was carried out taking into account the optimal parameters obtained by the method, proposed by S. Dotsenko, and using the Nyquist sampling theorem. Based on the obtained results of relative errors of digital conversion, conclusions on advantages of the method, chosen by the author, were made

Keywords: optimal sampling, ADC, thermogas dynamic parameters of internal combustion engine

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ESTIMATING LOCAL APPROXIMATION ACCURACY WITH THE NETWORK OF HYBRID NEURON-LIKE UNITS (p. 53-59)

Sergiy Popov, Kristina Shkuro

Accuracy is one of the most important properties of the solution to any practical problem. Neuro-fuzzy networks usually generate point estimates of the process under consideration, and the accuracy is estimated on average for the whole dataset. This is the easiest way of accuracy estimation and it is justified for most cases, however it is not enough in some situations, where approximation accuracy may be clearly non-uniform across the dataset. In this paper, a network of hybrid neuron-like units is considered, which is expanded to deliver local accuracy estimates. The architecture is constrained by a priori information about the properties of the input signals and the system being modeled and is subsequently optimized on a synaptic level by an evolutionary algorithm. Introduction of a priori information into evolutionary process enables a gray-box approach to systems modeling. Local accuracy estimation provides vital information for subsequent decision making and increases method's value for the users. The proposed approach is quite general and can be applied to many popular neural networks, e.g. MLP, FIR networks or any other neural and neuro-fuzzy networks (including emerging ones) that are special cases of the network of hybrid neuron-like units.

Keywords: local accuracy estimation, evolutionary architecture optimization, approximation reliability enhancement

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MODELING OF HEAT CONDUCTIVITY INFLUENCE OF HEATING STRUCTURE ON THERMAL CONDITIONS OF ITS SURFACE (p. 59-63)

Anatoliy Slesarenko, Nickolay Romanchenko

The paper proposes a mathematical model of heat conductivity influence of a multilayer structure of electric thermal storage heating system of underfloor heating at livestock production facilities with various functional purposes, which allows, at the stage of project development, to obtain the data on geometric and energy characteristics of heat-generating plants, which form the standards of specified thermal conditions on the surface of multi-tier electrically heated floor and make it possible to forecast the temperature in technologically active areas of production facilities at a given height, taking into account weather conditions. The mathematical model of heat transfer in a multilayer structure is built on the basis of accepted physical model and boundary problem of heat conductivity, and reduced to a system of linear heterogeneous equations. The solution of this problem is a piecewise continuous function of coordinate X, layers di thicknesses, power of heat sources. Solutions of heat equations are given in analytical form

Keywords: electrical technologies, microclimate, automation, heat conductivity, physical model

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PARADIGMS OF SIMULATION MODELING IN STUDYING COMPLEX PARALLEL SYSTEMS

(p. 63-67)

Oksana Suprunenko

Today, simulation modeling is one of the most powerful tools for studying parallel systems, which are characterized by structural, functional and development complexity. Studying modern complex parallel systems requires new approaches based on integration of developed methods belonging to various paradigms of simulation modeling. The paper gives an overview of paradigms which were highlighted in current researches: dynamic systems modeling, discrete-event simulation, system dynamics and agent-based modeling. The element basis, the range of tasks, which can be studied using the considered paradigms, were analyzed, their advantages and disadvantages were described. The problems of simulation modeling, which arise in constructing simulation models for complex parallel systems, requiring the use of elements of various paradigms with continuous and discrete description of properties, were singled out. The requirements to modern modeling tools and promising ways of simulation modeling development were formed.

Keywords: simulation modeling, discrete-event simulation, system dynamics, agent-based modeling.

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