
Summaries

UDC 519.2

Rozhkova S.V.
**THE RESEARCH OF THE EFFICIENCY
OF SIGNAL OPTIMAL TRANSMISSION**

The article considers the task of studying the efficiency of stochastic process optimal transmission through the continuous-discrete channels with memory and delay.

UDC 519.2

Rozhkova S.V.
**RECOGNITION OF STATES OF STOCHASTIC
SYSTEMS WITH FIXED MEMORY**

The article considers the task of recognizing the arbitrary number of hypotheses when the process observed is the process with continuous time; it represents the totality of processes with continuous and discrete time with fixed memory of random multiplicity.

UDC 517

Churikov V.A.
**THE DERIVATIVES AND INTEGRALS OF FRACTIONAL
COMPLEX ORDERS OF DISCRETE VARIABLE FUNCTION**

The article introduces the discrete d -operator of fractional integro-differentiation of complex orders. The algorithm of discrete differentiation and digital integration of discrete variable function is considered.

UDC 519.2

Ustinova I.G.
**SELECTION OF DISPERSION TREND OF RANDOM PROCESS
FOR POISSON CURRENT OF MEASURING MOMENTS**

The authors have obtained the estimations of explicit dispersion trend at Poisson current of measurement moments. Special cases of the trend: linear, square and in the form of first-order spline were considered. The statistical characteristics of the estimations obtained were studied. Their nonbias was shown; the covariance matrix of trend parameters estimations was determined.

UDC 519.25 (550.831.05)

Ustinova V.N., Ustinova I.G.
**ESTIMATION OF AUTOCORRELATION FUNCTION
IN THE FORM OF FIRST-ORDER SPLINE**

The authors have proposed the technique for selecting autocorrelation function trend in the form of first-order spline. By the example of model seismic trace and Bessel function it was shown that the technique proposed approximates better the autocorrelation function than the approximation obtained when using the standard formula for estimating the autocorrelation function.

UDC 519.874

Kitaeva A.V., Stepanova N.V.
OPTION RESOURCE CONTROL

The article considers the model with one resource type with limited life time supplied at the beginning of production cycle. The demand for the resource during production is of random nature: the

request stream forms steady process, the request volumes are independent equally distributed random variables with specified mean and dispersion. The asymptotic distributions of the total volume of demand for raw materials during the production cycle and time of resource use were determined. The authors have obtained the equations for statistical estimation of the required parameters and approximate value of optimal volume of option resource in the matter of maximum of the enterprise average profit.

UDC 519.6

Reyzlin V.I., Orlov V.A.
**INTERACTIVE PROCEDURE OF SOLVING VECTOR
OPTIMIZATION PROBLEMS WITH UNCERTAIN PARAMETERS**

The article considers the technique of solving multicriteria optimization problems with mathematical models containing variables; their values are not controlled by a decision-maker. The notion of alternate solution tolerance is introduced. The latter is related to stability, vitality.

UDC 519.6:004.93

Luneva E.E., Avramchuk V.S.
**THE ANALYSIS OF WAYS FOR INCREASING
THE EFFICIENCY WHEN CALCULATING
TIME-AND-FREQUENCY CORRELATION FUNCTION**

The article considers the techniques for increasing the efficiency of mathematical computing on multiprocessing systems using graphic processors NVIDIA CUDA. It was shown that the graphic processors exceed general-purpose ones in speed when solving the problems connected with computation. The efficiency of using the Microsoft.NET Framework technique depends totally on a number of computing kernels in the processor. CUDA technique application allows invoking the unique computational architecture of graphic processors and decreasing considerably the total calculation time.

UDC 004.492.2

Kukalo I.A., Kshnyankin A.P., Grivtsov S.N.
**THE MODEL OF PHYSICAL SECURITY THREATS TO LINEAR
PART OF OIL PIPELINE**

The paper indicates the feature of controlling security of such extended object of federal importance as linear part of oil pipeline. The hierarchical model of threats to typical linear part of oil pipeline has been proposed. The article introduces the daily estimation of probability of occurrence of threats to its physical security applying the technique based on statistical data for linear part of oil pipeline «Tsentr sibnefteprovod». The groups of factors effecting the model as well as weight coefficients considering each factor contribution were determined. The authors made illustrative estimation of line distribution of probability physical threat occurrence for linear part of oil pipeline «Aleksandrovskoe-Anzhero-Sudzhensk».

UDC 519.688:622.279.23

Naymushin A.G., Sergeev V.L.
**IDENTIFICATION OF EVOLUTION PROCESSES OF A SYSTEM
LIFE CYCLE CONSIDERING A-PRIORI INFORMATION**

The article considers the problems of parametric identification of evolution processes. The integrated systems of phenomenological models are proposed to be used for solving the problems considering

a-priori information. The paper introduces the examples of solving the tasks of identification and prediction of accumulated production life cycle while oil deposit developing.

UDC 681.5

**Kurgankin V.V., Zamyatin S.V.,
Zamyatin V.M., Pushkarev M.I.
SYNTHESIS OF EMBEDDED SINGLE-CIRCUIT AUTOMATED
CONTROL SYSTEM WITH SELF-TUNING CONTROLLER
AND ITS ROBUSTNESS ESTIMATION**

The authors consider the possibility of applying the dynamic compensation principle for synthesis of embedded single-circuit automated control system with self-tuning controller. The paper introduces the results of full-scale experiments. The robustness properties of the synthesized system were analyzed.

UDC 622.333.03:556.3

**Odnokopylov I.G., Gneushev V.V.,
Sizikov D.A., Shishlyayev V.V.
INJECTION AUTOMATION AT HYDRODYNAMIC
RESEARCHES OF COAL SEAMS FILTRATION
CHARACTERISTICS**

The improvement of methods for researching the formations of porous fractured reservoir rocks with average and low permeability is the urgent task when selecting the techniques of development of coalbed methane reservoirs. The paper considers the engineering solutions of automation of fluid injection control at coal seams overbalance hydrodynamic researches (injection-falloff test).

UDC 004.352.242

**Marchenko V.V., Berestneva O.G.,
Devyatykh D.V., Sukhanova E.F.
THE RESEARCH OF NONPARAMETRIC ESTIMATE
METHOD FOR THE PERIOD LENGTH
AND SIGNAL PERIODIC COMPONENT**

The paper considers the techniques of signal hidden periodic component. The nonparametric estimate method for the period length and periodic components has been selected as the principle and the most suitable one for being used in this work. This is the very technique which allows separating hidden components from any periodic signals but not only from harmonic ones. The technique was studied at model signals. The dependence of the technique relative inaccuracy on the number of hidden periods and sample interval was shown.

UDC 528.854.2

**Zamyatin A.V., Afanasyev A.A.
PARALLEL COMPUTING IN THE PROBLEM
OF LAND COVER CHANGES 3D MODELING**

The task of land cover changes modeling based on application of Markov chains and cellular automata apparatus is discussed. The increased performance of the task is achieved by application of different variants of parallel processing when modeling. The article introduces the results of numerical experiments on estimation of various types of parallel processing, obtained when using the expensive supercomputing cluster and cluster from low-cost PC in local network including the estimation of parallel speed up, parallel efficiency and cluster overall performance.

UDC 519.673

**Khamukhin A.A.
APPLICATION OF HOMOGENEOUS STRUCTURE CELL WHEN
DETECTING NOISE HYDROACOUSTIC SIGNALS BASED ON
INTEGRATED WAVELET SPECTRUM**

When detecting noise hydroacoustic signals based on integrated wavelet spectrum the computation of continuous wavelet transform takes the significant time that results in detection delay. The author has proposed the modified scheme of homogeneous computing structure

for computation paralleling and speed up. The article introduces the results of computer modeling of test task of detecting noise hydroacoustic signals based on integrated wavelet spectrum by means of homogeneous structure cells.

UDC 621.312/313: 621.317.31

**Bedareva E.V., Kostin E.V.
THE RESEARCH OF COAXIAL SHUNT
TEMPERATURE FIELD IN ANSYS**

The distribution of coaxial shunt temperature field has been analyzed in ANSYS. It has been ascertained that temperature field of coaxial shunt is of a nonuniform character owing to material heat capacity and natural convection. The impingement cooling system of the shunt is proposed to be used. It allows decreasing the internal mechanical stress of the resistance element and improving shunt metrological characteristics as the whole.

UDC 533.9.08

**Merkulov S.V., Golobokov Yu.N.,
Baystrukov K.I., Pavlov V.M., Kachkin A.G.,
Mezentsev A.A., Li A.M., Khokhryakov V.S.
THE SYSTEM FOR ACQUISITION AND LOGGING
THE RESULTS OF MEASURING MAGNETIC PARAMETERS
OF ELECTROPHYSICAL UNIT**

The authors have proposed the structure of the system for acquisition and logging the results of measuring magnetic parameters of KTM unit. The algorithms and protocols of measurement results transfer from measuring transducers into data logging units were developed. The units for data recording from measuring transducers were implemented on the basis of modules with programmable logic. The algorithms of acquisition, logging and primary processing of the results of electromagnetic parameters measurements were developed.

UDC 681.5

**Krivtsov P.Yu., Pavlov V.M.
THE DEVELOPMENT OF CONTROL SYSTEM
FOR SODIUM COOLANT PROCESSING**

The paper introduces the general algorithm of controlling sodium processing unit; the principle functions of the system and circuits for controlling process conditions depending on the unit current operation mode have been determined. The control system development is shown by the example of sodium supply system. The authors describe the software configuration and introduce the structure of processing displays of operator interface.

UDC 62-533.65

**Korovikov A.G., Pavlov V.M., Olkhovik D.A.
SOFTWARE MODULE OF SAFETY ALARM, EMERGENCY
PROTECTION AND AID TO THE OPERATOR
OF VACUUM SYSTEM OF TOKAMAK TKM**

The authors have studied the pre-vacuum pumping system of tokamak KTM vacuum unit on using the model implemented by Petri nets. The model qualitative characteristics have been determined. Based on the model data the module of safety alarm, emergency protection and aid to the operator was programmed.

UDC 681.5.015+004.428

**Filipas A.A., Mikolaenko S.N., Kladiyev S.N.
SOFTWARE SYSTEM FOR SIMULATION OF INDUSTRIAL
MECHANISM LOAD TORQUE**

A software system for referencing the load torque of industrial mechanisms is developed under MATLAB Simulink environment; it has all the peculiarities of the base software package. Simulation models of the typical industrial mechanisms are grouped in a library and made of the standard program blocks. The models interfaces allow adjusting parameters of the industrial mechanism.

UDC 004.822:004.89

Zagorulko Yu.A.
**THE CONCEPT OF KNOWLEDGE REPRESENTATION
 INTEGRATED MODEL**

The article considers the concept of integrated model which combine mutually complementary methods and knowledge presentation tools. On the basis of the model the language of knowledge representation and processing as well as the tools providing to the full extent the known needs for developing knowledge data base of the applied intelligence systems are set up.

UDC 004.942

Beshta A.A., Kirpo M.A.
**CONSTRUCTION OF OBJECT TRUST MODEL
 IN THE AUTOMATED INFORMATION SYSTEM
 FOR PREVENTING DESTRUCTIVE INFLUENCE
 ON THE SYSTEM**

A formal model of destructive influence on the system has been described; the main possible destructive effects are singled out. The authors have proposed the object trust model of the automated information system on the basis of object operation monitoring. The paper introduces the service oriented concept of delivering information safety service and multiagent distributed architecture implementing the concept.

UDC 550.8.053

Ivanchenkov V.P., Kochegurov A.I., Cherkasova M.A.
**THE ANALYSIS OF INFORMATION FEATURES OF MUTUAL
 PHASE SPECTRA OF REFLECTED SEISMIC WAVES**

Based on the accepted model of layered absorbing media the authors have considered the features of mutual phase spectra of seismic waves reflected from the top and the bottom of the depth; the main prerequisites of their application for forecasting geologic profile were determined.

UDC 004.056.5, 004.89

Atkina V.S.
THE ANALYSIS SYSTEM OF DISASTER TOLERANCE

The article describes the problem of developing disaster tolerant information systems and their importance for information security. The author has assumed that the current rates of disaster tolerant system should be analyzed and the efficiency of disaster tolerant solutions should be estimated for development and management of disaster tolerant information systems. The analysis system of disaster tolerance formed on the basis of artificial immune system was proposed and described formally. The possibility of applying the solution proposed as a tool for decision support was shown by the example of the results of carried out experiments.

UDC 004.931

Druki A.A.
**RECOGNITION OF STRUCTURED SYMBOLS
 ON IMAGES USING HISTOGRAM OF AVERAGE INTENSITY
 AND CONVOLUTION NEURAL NETWORK**

The algorithm of selecting a region of character pitch on a complex background and the algorithm of symbol selection on the basis of average intensity histogram have been developed and introduced. The convolution neural network was developed and introduced to solve the problem of symbol recognition.

UDC 004.021

Belousov A.A., Spitsyn V.G.
**APPLICATION OF 3D METHODS
 OF VIDEO IMAGE ENHANCEMENT**

The authors have studied the applicability of image processing methods on the basis of Illuminance-Reflectance model and histogram equalization for video data processing. The indicated methods

were modified for being applied in real time mode. Their application allows improving considerably such frame criteria in video sequences as quantity and intensity of edge pixel and the level of brightness adaptation to human vision.

UDC 004.89:004.4

Rudometkina M.N., Spitsyn V.G., Ettl V.A.
**DEVELOPMENT OF RELATIONAL MEANS
 OF PREDICATE DECOMPOSITION**

The article is devoted to the development of new means for predicate decomposition on the basis of statements on dependences from relational normalization. The precise definition to decomposition in respect to relationals and predicates has been given. The paper considers the statements on dependences which allow decomposing the relationals; introduces their generalizations. Based on the connection between the relation algebra and predicate algebra the authors have stated the statements on dependences converted into the new means of predicate decomposition.

UDC 004.415

Hoang Van Kuet, Tuzovsky A.F.
**CONTROL METHOD OF DIRECT ACCESS
 TO SEMANTIC DATA BASE**

The paper introduces the main notions, methods for determining and developing security labels of semantic data triplets. The authors have developed the algorithms for forming the security cover of semantic data and safety control of user direct access to data bases.

UDC 004.912 519.689.3

Sidorova E.A.
**THE DEVELOPMENT OF LINGUISTIC SUPPORT
 OF INFORMATION SYSTEMS ON THE BASIS
 OF KNOWLEDGE ONTOLOGICAL MODELS**

The article describes knowledge ontological model focused on automatic analysis of texts in concrete subject area. The author considers the linguistic resources and tools required for developing the linguistic support of information systems.

UDC 004.415

Hoang Van Kuet, Tuzovsky A.F.
**METHODS FOR DETERMINING SECURITY
 LEVELS OF ONTOLOGY ELEMENTS**

The paper considers the principle problems of multilevel security in semantic data. The principles of assigning the security levels of notions, properties and individuals of the ontology have been described. The authors have proposed the algorithms which allow defining the security levels for the main elements of ontology and inferences obtained in logical rules.

UDC 004.8; 004.4'2

Zaikin I.A.
THE METHOD OF OWL 2 ONTOLOGY THREE-WAY MERGE

The authors have proposed the algorithm of ontology three-way merge at multiuser editing by pair-wise comparison of ontologies based on detection of coinciding and conflicting changes. The algorithm software implementation was developed.

UDC 004.02:004.82

Le Hoai, Tuzovsky A.F.
**DOCUMENT SEMANTIC ANNOTATION
 IN DIGITAL LIBRARIES**

The paper considers the task of document annotation in digital libraries applying semantic technologies. The reasons and advantages of such annotation application are described. The authors have proposed a new technique for semi-automatic annotation; the results of testing its software implementation are shown.

UDC 004.942, 004.652.5

Vichugova A.A., Vichugov V.N., Tsapko G.P.
FORMAL MODEL OF A STRUCTURE OF DIFFERENT DESIGN OBJECTS RELATIONSHIPS

Within the development of the existing theoretical and practical states of information support techniques of product life cycle the authors have set the problem of developing the method which allows structuring the entities formed at high-technology product design by the example of radio electronics. The set-theoretic models are formed. The latter describe the composition and relationship of different design objects: product, its information models, electron structure and design documents. Using the object-oriented approach the authors have carried out the conceptual design of data base: a set of attributes describing life cycle of the design objects was determined and the formal information model of their relationship structure was proposed in the form of UML-class diagram.

UDC 681.3.06

Mytsko E.A., Malchukov A.N.
THE RESEARCH OF SOFTWARE IMPLEMENTATION OF CRC COMPUTING ALGORITHMS COMPATIBLE WITH PKZIP, WINRAR, ETHERNET

The paper introduces the numerical results of computer experiment for determining speed of software implementation of CRC32 computing algorithms. It was shown that the fast four byte matrix-driven algorithm should be applied in embedded systems and data transfer industrial systems.

UDC 004.62

Sharabayko M.P., Markov N.G.
THE EFFICIENCY OF BLOCK INTRA PREDICTION MODES IN MODERN STANDARDS OF VIDEO COMPRESSION

In 2013 the final version of H.265/HEVC video compression standard is going to appear. Its implementation is supposed to start the mass shift to super resolution systems. The paper introduces the results of analysis of block intra prediction methods efficiency of H.265/HEVC standard from the point of view of their influence on key frame compression degree in digital video. Besides, the results of comparison of key frame compression efficiency in H.265/HEVC and H.264/AVC standards are given.

UDC 681.3.06

Mytsko E.A., Malchukov A.N.
THE RESEARCH OF HARDWARE IMPLEMENTATION OF TABLE- AND MATRIX-DRIVEN ALGORITHMS OF COMPUTING CRC32

The paper introduces the description of hardware implementation of matrix- and table-driven algorithms for computing CRC32 check sum on Altera programmed integrated logic circuits Cyclone of SDK-6.1 layout. The hardware implementation features are shown by the example of CRC32 valuator description; the designed units availability is demonstrated in a specific context. The algorithms have been studied by CRC32 valuator comparison in occupied logic cells and time delays.

UDC 004.9

Tarkov M.S., Osipov M.I.
ESTIMATION OF CELL NUMBER ON IMAGES OF CYTOLOGICAL HERBAL PREPARATIONS

The authors have proposed the algorithm for calculating vacuoles (plant cells) on the image. The algorithm allows selecting cell outlines

in arrays of cells binding together by image brightness range partition into layers with further application half-tone erosion and dilatation, «hat top» transformation and liminal segmentation in each layer. When calculating cells the approximation of their outlines by ellipses is used. The algorithm may be used in various applications, for example when determining cell structure disintegration rate over a set of patterns.

UDC 519.175.1

Pogrebnoy V.K.
THE TASK OF ESTIMATING THE SIMILARITY OF TWO GRAPHS STRUCTURES ON THE BASIS OF GENERAL PARTS DEFINITION

The author has proposed the algorithm for solving the problem of estimating the similarity structures represented by ordinary graphs on the basis of their general parts definition in the form of isomorphic and partial graphs. The algorithm functions in the class of graphs with similar vectors of initial descriptors.

UDC 519.175.1

Pogrebnoy An.V., Pogrebnoy V.K.
INVARIANT OF A GRAPH BASED ON DENSE SUBGRAPHS AND THE ALGORITHM OF ITS COMPUTATION

The paper introduces the estimation of subgraph density for weighted ordinary graphs. On the basis of this estimation the authors have determined a number of invariants characterizing graph structure considering edge nonuniformity of weight values. Special attention is given to the notion of dense subgraph. The authors have proposed the algorithm of dense subgraph selection and computation of invariants on their base. The significant property of the dense subgraphs is the ability to reflect the isolation effect of vertex subset with high density estimation.

UDC 681.3.06(076.5)

Kositsyn V.S., Galchenko V.G., Gladkova T.A.
SOFTWARE AND DATAWARE FOR ANALYZING MICROWAVE PULSE PARAMETERS

The estimation of microwave pulse parameters is the significant task in the experimental researches. The existing programs for plotting microwave pulse graphs and estimation of their parameters have been implemented in MathCad. The programs possess significant disadvantages as the majority of the parameters of the environment where microwave pulses travel should be entered immediately in the program. The paper describes the software of estimating microwave pulse parameters implemented in Qt 4.5 C++.

UDC 519.681.3

Anureev I.S.
ONTOLOGICAL TRANSITION SYSTEMS AND THEIR APPLICATION TO COMPUTER LANGUAGE SEMANTICS

Operational ontological approach to a formal specification of computer languages has been developed by the author as a methodology of forming operational semantics of computer language on the basis of its ontology, known as operational ontological semantics. The author proposes formalism for describing operational ontological semantics of computer languages, ontological transition systems; ontological description of computer languages is compared with the traditional grammatical one.