
Summaries

UDC 004.8

Rudometkina M.N.
**THE DEVELOPMENT OF BINARY
DECOMPOSITION METHOD FOR FUNCTION PREDICATES**

The author analyzed the only sound binary decomposition method of finite predicates, the Descartes decomposition method. For the first time the author developed and substantiated the partial binary decomposition method for the function predicates based on the analysis of dependences; a number of values of the auxiliary variable was minimized. The algorithm of binary decomposition for function predicates was formed based on the proposed method.

UDC 519.872

Nazarova A.A., Semenova I.A.
**ASYMPTOTIC ANALYSIS OF QUEUING SYSTEMS
WITH INFINITE NUMBER OF SERVERS
AND SEMI-MARKOVIAN INPUT FLOW**

The article considers the queuing system with input SM flow and infinite number of servers. The investigation is carried out by the method of sifted flow and asymptotic analysis method at increasing service time. The carried out analysis allows obtaining asymptotic semi-invariants to the third order.

UDC 519.9

Nebaba S.G., Vylegzhanin O.N.
**CONSTRUCTION AND STUDY OF SEARCH ALGORITHM
OF THE FIRST EXTREME SUBSYSTEM FOR A GIVEN
CONSISTENT SYSTEM OF LINEAR INEQUALITIES**

The search algorithm of extreme subsystem for the given linear inequalities system was developed. The range of permitted values for the system was specified and the method for searching the dependent inequalities was suggested. The algorithm includes the accounting of possible equality constrains as well as reduction of initial inequalities matrix to full columns rank. The availability of suggested method was shown on the test case.

UDC 004.94

Pogrebnoy An.V., Pogrebnoy D.V.
**MATRIX ALGORITHM FOR SOLVING
THE PROBLEM OF CUTTING BIPARTITE GRAPHS**

The article introduces the algorithm for solving the problem of cutting the bipartite graphs into prescribed population of minimally connected subgraphs. The algorithm uses matrix representation of bipartite graph and considers its specific character. It allows reducing the cutting problem to the problem of linear mathematical programming. The algorithm may work both with the improved original version of cutting the bipartite graph and with the arbitrarily formed one.

UDC 519.673

Khamukhin A.A.
**ADDRESSABLE CELL OF HOMOGENEOUS COMPUTING
STRUCTURE FOR SOLVING PARTIAL
DIFFERENTIAL EQUATIONS**

The author proposes the addressable cell function diagram of homogeneous computing structure for solving the partial differential equations. The article demonstrates the possibility of solution speedup decreasing the duration of period of data load into cell registers. The article introduces the comparative results of modeling the line of addressable and non-addressable cells by the example of solving the test boundary problem with independent and dependent coefficients.

UDC 004.42

Botygin I.A., Popov V.N., Tartakovskiy V.A.
**ARCHITECTURE OF DISTRIBUTED
COMPUTING SYSTEM FOR TWO-DIMENSIONAL
ANALYSIS OF TREE DISK IMAGE**

The authors developed the architecture and algorithm of implementing the distributed computing system for processing dendroecological data. The article introduces the GPSS-model of the system for estimating the efficiency of its operation. Practical implementation of the system was carried out using the stack of free LAMP software products. The authors illustrated the system operation by such problems of two-dimensional analysis of tree disk image as computing azimuth and mean-square width of maximum increment area as well computing the values of indices of tree ring width increase.

UDC 004.4:004.89

Le Hoai, Tuzovskiy A.F.
USING ONTOLOGY IN ELECTRONIC LIBRARIES

The authors consider the use of ontologies in semantic digital libraries, give their definition and purpose. The types of ontologies in such libraries including knowledge organization systems and structural taxonomy are analyzed. The version of selecting ontologies to develop semantic digital libraries is substantiated.

UDC 681.3.06

Nguyen Ba Ngoc, Tuzovskiy A.F.
**TEXT CLASSIFICATION BASED ON ESTIMATION
OF TERMS SEMANTIC SIMILARITY**

The article considers the method for increasing text classification accuracy by the kNN algorithm applying the estimation of semantic similarity based on terms co-occurrence matrix. The authors propose the method for decreasing the size of co-occurrence matrix filtering terms by pats of speech. The influence of filtration technique on classification accuracy is tested.

UDC 004.931

**Nguyen Toan Thang, Spitsyn V.G.
ALGORITHMS AND SOFTWARE
FOR HAND SHAPE ON-LINE RECOGNITION
USING SURF DESCRIPTORS
AND NEURAL NETWORK**

The authors developed the unique algorithm for hand shape on-line recognition based on SURF descriptors and neural network. A new method of descriptor generation for the neural network was proposed. The software for hand shape on-line recognition was developed based on the proposed algorithm. The numerical experiments on hand shape on-line video sequence recognition at showed that the average accuracy of recognition amounts to 92 %.

UDC 004.932

**Bui Thi Thu Trang, Phan Ngoc Hoang, Spitsyn V.G.
FACE RECOGNITION BASED ON APPLICATION OF
VIOLA-JONES METHOD, WAVELET TRANSFORM
AND PRINCIPAL COMPONENT ANALYSIS**

Based on co-application of Viola-Jones method, wavelet transform and principal component analysis the authors have proposed a new algorithm for face in real time recognition on digital images and video sequences. The algorithm for face recognition is described and software is developed. The article introduces the example of operation and test results of the program. It is shown that the use of the proposed unique algorithm allows recognizing faces efficiently on digital images and video sequences.

UDC 004.932

**Phan Ngoc Hoang, Spitsyn V.G.
ALGORITHMS FOR FINGERPRINT CLASSIFICATION BASED
ON APPLICATION OF GABOR FILTER, WAVELET
TRANSFORM AND MULTILAYER NEURAL NETWORK**

The authors propose the algorithms for fingerprint classification by the types of papillary pictures based on application of Gabor filter, Haar, Daubechies wavelet transform, and multilayer neural network. The numerical experiments are carried out and the proposed algorithms operation results are introduced. It is shown that the use of the algorithm based on co-application of Gabor filter, five-level Daubechies wavelet transform and multilayer neural network allows classifying fingerprints efficiently.

UDC 004.931

**Druki A.A.
ALGORITHMS OF PERSON SELECTION
ON STATIC RGB IMAGES AND IN VIDEO STREAM**

The authors developed the algorithms of person selection on static images and in video stream: algorithm of person detection by color segmentation, algorithm of person selection on static RGB images by deformable elliptical models, the method of static moments for person selection in video stream.

UDC 004.93

**Sidorov D.V., Osokin A.N.
SIMPLE ALGORITHM FOR CONTROLLING BIT
RATE OF JPEG CODER**

The authors developed the algorithm for controlling the compression ratio of half-tone accurate images for JPEG coder differing in software implementation simplicity and low computational complexity. It was tested on the set of half-tone images Calgary Corpus Gray Set 2. The conclusions were made on serviceability of the proposed algorithm in video surveillance and video recording systems at limitation of computational resource and data throughput.

UDC 519.71+004

**Zakharova A.A., Shklyar A.V.
CONSTRUCTION OF MULTICOMPONENT
VISUAL 3D-MODELS USING HETEROGENEOUS
DATA SOURCES BY THE EXAMPLE
OF DEVELOPING GEOLOGICAL MODELS**

The article demonstrates the necessity for developing and improving data visual models, methods of modeling and their using. The authors introduce the approach to construction of multicomponent visual 3D-models allowing testing, interpreting and analyzing spatial information by the example of geological models.

UDC 550.8.053

**Ivanchenkov V.P., Kochegurov A.I., Orlov O.V.
STUDYING THE RESOLVING ABILITY
IN THE TECHNIQUES OF SEISMIC SIGNAL
PHASE-FREQUENCY TRACING**

The article introduces the results of studying the resolving ability in the techniques of seismic signal phase-frequency tracing by the models of wave fields and real data. It is shown that the techniques of phase-frequency tracing of signals with equilibrium and nonequilibrium processing possess high resolving ability and allow selecting weak reflections in a wave field. The results of field material processing prove the conclusions of mathematical modeling and practical effect of the developed techniques.

UDC 681.5

**Pushkarev M.I., Gayvoronskiy S.A.
PARAMETRIC SYNTHESIS OF PI-CONTROLLER
IN LINEAR AUTOMATED CONTROL SYSTEM BASED
ON COEFFICIENT ESTIMATIONS OF STABILITY DEGREE
AND PRESCRIBER Q-FACTOR**

The author developed the technique for selecting the settings of linear proportional-integral controller providing quasi-maximum stability degree and prescribed accuracy of the automated control system in steady static mode. The technique is based on the coefficient estimations of quality indices in stationary systems and sufficient conditions of the prescribed stability degree based on the latter.

UDC 681.5.015

**Rudnitskiy V.A., Alekseev A.S., Kurgankin V.V.
IDENTIFICATION OF CONTROLLED OBJECTS IN THE FORM
OF SAMPLED-DATA TRANSFER FUNCTIONS BASED
ON REAL INTERPOLATION METHOD**

Real interpolation method was used to solve the problem of parametric identification of linearized objects. Based on condition numbers apparatus the authors considered the possibility of increasing accuracy when determining the structure of a model in the form of sampled-data transfer function.

UDC 62-533.65

**Korovikov A.G., Pavlov V.M., Olkhovik D.A.
SYNTHESIS OF MATHEMATICAL
MODEL OF VACUUM CHAMBER HEAT
CONTROL SUBSYSTEM IN KAZAKHSTAN
MATERIAL TESTING TOKAMAK KTM**

The authors studied the vacuum chamber heating in tokamak KTM as the controlled object and developed the mathematical model of the process as the controlled object. The conclusion was made that it is necessary and sufficient to use the control system constructed on the base of PI-controllers to control heating process. The authors determined the coefficient for the controller adjustment parameters for each heat penetration.

UDC 681.516.75

**Pashchenko O.V., Solovyev A.M., Yudakov S.V.
THE CONTROL SYSTEM OF INDUSTRIAL UNIT «KO-MKR»**

The article describes the control system of the industrial unit «KO-MKR». The construction and engineering capabilities of the unit are briefly disclosed in the paper. The authors substantiate the selection of control system structure and master controller. The article describes the principle of constructing the controller supervisory program and discloses the control system constructional features.

UDC 51-73

**Krivtsov P.Yu., Pavlov V.M.
USE OF SIMULATION COMPLEX FOR CHECKING
THE CONTROL SYSTEM OF SODIUM PROCESS**

The paper demonstrates the possibility of using the techniques of half-sized simulation modeling for checking the control system of inflammable and explosive sodium coolant process. The authors introduce the structure of the simulation complex, mathematical model of the process, program simulator; determine control system performance being subject to checking at simulation complex. The testing results of the control system are introduced.

UDC 004.75

**Muravyev S.V., Tarakanov E.V.
DATA TRANSMISSION IN WIRELESS SENSOR NETWORKS
WITH PRIORITIES BASED ON PREFERENCE AGGREGATION**

The authors propose the method of controlling data transmission in a wireless sensor network based on application of consensus relation for prioritization to the data transmitted. The article describes the statistical analytical model for analyzing the behavior of the proposed transfer protocol at limited network capacity. The model allows supporting the quality of measuring data transfer on the desired level.

UDC 621.398.725:621.317.727.1

**Zarevich A.I., Muravyev S.V., Bedareva E.V., Velichko O.N.
DIGITAL PULSE SIGNAL PROCESSING FOR DETERMINING
FREQUENCY RESPONSE OF CURRENT TRANSDUCERS**

The authors propose the method for determining amplitude- and phase-frequency characteristics of linear current transducers based on digital co-processing of input transducer impulse action and response to it. Frequency dependence of shunt transmission coefficient is computed by the components of complex spectral transformations of voltage from the output of the test and reference current transducers. The authors propose the ways of increasing the method accuracy based on ensemble averaging of signal spectral components.

UDC 519.688;004.93'12

**Parubets V.V., Berestneva O.G., Devyatykh D.V.
APPLICATION OF CUDA TECHNOLOGY
FOR COMPUTATIONAL SPEEDUP
IN NEURAL NETWORKS**

The authors consider the application of artificial neural networks in medical diagnostic. The article describes the possibility of computational speedup in the networks with NVIDIA CUDA technology for implementing parallel computing in learning and image recognition by the network. The network speeding is shown.

UDC 004.652.3

**Volovodenko V.A., Berestneva O.G.,
Nemerov E.V., Osadchaya I.A.
IMAGING APPLICATION IN STUDYING
THE STRUCTURE OF EXPERIMENTAL
MULTIDIMENSIONAL DATA**

The article considers the methods of multidimensional data structural analysis and introduces different approaches to visualization of the experimental research results. The authors give the examples of solving the applied problems using NovoSparkVisualizer.

UDC 004.9

**Tarkov M.S., Tikhonov N.V., Polovinkin V.G.
ESTIMATION OF CELL PREPARATION IMAGE
FOR MEDICAL-BIOLOGICAL RESEARCH**

The authors propose the technique for estimating image based on application of half-tone erosion and dilatation, «hat top» transformations and following threshold segmentation. The technique is implemented as a software product and used within the method of time-lapse (slow-motion) computer video shooting of microscopic objects developed for studying barrier properties of plant cell membranes. It allows estimating the relative area of the objects under observation in the image and may be used in various applications when the decay rate of cell structure is required to be determined.

UDC 004.942:338.27:504.062

**Zatonskiy A.V.
THE ADVANTAGES OF DIFFERENTIAL MODELS
IN ECOLOGICAL-ECONOMIC MODELING**

It is shown that it is more preferable to use ecological-economic models in the form of ordinary differential equations in the problems of predicting the controlled systems development than polynomial models and time tends in terms of adequacy and decrease of probable spread in predictions required for decision support.