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# Summaries

UDC 519.2

**Rozhkova S.V., Rozhkova O.V.**  
**INFORMATION ASPECT IN A JOIN TASK  
OF A DISCRETE-CONTINUOUS FILTERING  
AND INTERPOLATION. ANALYSIS**

The authors studied the properties of Shannon information amount in a joint task of filtering and interpolation of stochastic processes by continuous-discrete observations. They concern information efficiency of the observations with a memory relative to a lag observation. The direct determination of Shannon combined information amount in a joint task of filtering and interpolation was obtained.

UDC 519.2

**Rozhkova S.V., Rozhkova O.V.**  
**INFORMATION ANALYSIS IN A JOINT TASK  
OF FILTERING AND GENERALIZED  
EXTRAPOLATION. ANALYSIS**

The authors studied the properties of Shannon information amount in a joint task of filtering and generalized extrapolation of stochastic processes by continuous-discrete observations with a memory. They concern the information efficiency of the observations with a memory relative to the memoryless ones.

UDC 621-52+511.92

**Avetisyan A.G.**  
**MULTIDIMENSIONAL DIFFERENTIAL ANALOG  
OF D.K. FADEEV METHOD**

The author proposed the method for determining the coefficient-functions of proper polynomials and inverse matrices of polyvalent matrices based on D.K. Fadeev method and G.E. Petukhov multidimensional differential transformations. The model pattern and the procedure of finding the coefficient-functions of a characteristic polynomial and the inverse matrix were introduced.

UDC 519.24

**Skripin S.V.**  
**STATISTICAL ESTIMATE OF WEIGHTING FACTOR  
IN A COMBINED REGRESSION MODEL**

The author introduces the versions of a weighting factor statistical estimate in the combined regression model. The latter uses the estimates of the designed models: parametric and non-parametric ones (in tasks of regression or discrimination). The version of the modified statistical estimate of weighting factor allows obtaining the regression estimates in a set point close to the optimal ones by a standard deviation minimum criterion. The statistical simulation results at finite samples show that the combined regression estimate with the weighting factor statistical estimate is more preferable than each of those for the designed models.

UDC 65.012.122

**Samochnova L.I., Petrov E.S.**  
**OPTIMIZATION OF QUEUEING SYSTEM  
WITH A HYSTERESIS CONTROL STRATEGY  
BY A UNIFORM BACKUP DEVICE**

Queueing system with a hysteresis control strategy was examined by a uniform backup device controlled by the current time of waiting for the request being the first in the queue. The system was optimized considering wait and depreciation losses.

UDC 004.94

**Pogrebnoy A.I.V.**  
**DETERMINATION OF COMPACTNESS ESTIMATE LOWER  
LIMIT FOR TOPOLOGICAL PARTITIONS**

The author introduced the notion of compact set for the distributed system objects and proposed the efficient algorithm of forming such sets. Two methods for determining a lower limit of estimating the topological partition compactness were proposed based on the compact sets. The author gave the example of the software implementing the algorithm of determining the lower limit of partition.

UDC 66.012-52

**Kozin K.A., Goryunov A.G., Sachkov S.A.**  
**ADAPTIVE CONTROL DESIGN  
OF NON-STATIONARY SYSTEM – SIEMENS REACTOR  
FOR POLYSILICON PRODUCTION**

The article considers the issue of automated control over compound objects of chemical production by the example of Siemens-reactor for obtaining polycrystalline silicon. The authors show the synthesis stages of control system using the adaptive principle with the identification method of regulator parameter adjustment. The computer modeling method is used for proving considerable decrease of «human factor» influence and quality increase of process controlling using the developed control system.

УДК 681.5

**Kurgankin V.V., Zamyatin S.V., Alekseev A.S.**  
**APPLICATION OF THE EMBEDDED CONTROL SYSTEMS  
FOR SOLVING THE IDENTIFICATION TASK**

The authors consider the application of the identification approach based on the real interpolation method for designing the embedded control system. The article describes the mathematical and algorithmic facilities to identify control objects in a digital form. The hardware of the embedded control system is selected. The results of the natural experiments are introduced.

UDC 519.688:552.578.2.061.4

**Anikanov A.S., Kemerova P.A., Sergeev V.L.**  
**ADAPTIVE IDENTIFICATION AND INTERPRETATION  
OF NON-STEADY HYDRODYNAMIC STUDY RESULTS  
CONSIDERING PRODUCT FLOW INTO A WELL**

Models and algorithms for adaptive interpreting the results of oil well non-steady hydrodynamic analysis were examined by the pressure recovery curve at their plotting considering product flow in a well bore and by additional a-priori information on well pool parameters. The authors give the examples of interpreting the well study results of a uniform porous well pool by the pressure recovery curve.

UDC 519.688:552.578.2.061.4

**Kemerova P.A., Sergeev V.L., Anikanov A.S.**  
**INTERPRETATION OF THE OIL WELL NON-STEADY  
HYDRODYNAMIC ANALYSIS BY THE ADAPTIVE METHOD  
OF THE DETERMINED PRESSURE MOMENTS**

The authors examine the issue of interpreting oil well non-steady hydrodynamic analysis results based on the adaptive method of the determined pressure moments considering the additional information on reservoir pressure. The article illustrates the examples of the results

processing of uniform and fractured-porous oil pool wells analysis by the pressure recovery curves.

UDC 004.9:533.9:087.4

**Mezentsev A.A., Sharnin A.V., Pavlov V.M., Ovchinnikov A.V. DAQViewer. THE COMPUTER PROGRAM OF VISUALIZATION AND ANALYSIS OF TOKAMAK KTM EXPERIMENTAL DATA**

The authors developed the program DAQViewer intended for loading the experimental data of Kazakhstan testing Tokamak from data base and visual analysis. The data base access functions were tested at the model stand of the Tokamak information-measuring system. The experimental data of the Tokamak T10 were used as the model ones. The article described the DAQViewer interaction process with the experiment automatization system at the Tokamak. The authors introduced the main opportunities of mathematical model describing plasma probing implemented in DAQModeling utility as well as DAQViewer and DAQModeling interaction process.

UDC 550.8.053:519.2

**Kochegurov A.I., Kochegurova E.I. THE ANALYSIS OF APPLYING PHASE-FREQUENCY ALGORITHMS OF SIGNAL TRACKING FOR LIQUID LEVEL MEASURING IN OIL PRODUCERS**

The article analyses the application of phase-frequency acoustic signal tracking algorithms for liquid level measuring in oil producers. Using the statistical modeling it was shown that the phase-frequency algorithm use at the stage of determining temporary situation of multipulse signals allows obtaining reliable estimates of liquid level under the intensity noise.

UDC 681.3.06

**Sonkin M.A., Grachev V.V., Kuzmin A.L., Yatsenko M.A. THE FORMATION OF COMPUTATIONAL RESOURCE OPTIMAL DISTRIBUTION OVER THE PROCESSING SOFTWARE**

The article described simulation of the information pipeline system operation allowing increasing the efficiency of its performance. The processing software pseudo-optimal distribution was formed by computational modules of the information pipeline system.

UDC 004.75:614.84

**Sonkin M.A., Shkuratov A.V. ON-BOARD COMPLEX SOFTWARE AND ALGORITHMIC SUPPORT FOR MONITORING FIRE SITUATION IN THE FOREST**

The authors propose the software structure for monitoring fire situation in the forest. It is used for automation of air forest conservation service based on the original algorithms of information forming, processing and transmitting. This structure allows increasing the operability and adequacy of the transmitted navigation and industrial data. The article introduces the results of filtration algorithm verification for navigation data which confirmed the efficiency of the proposed approach.

UDC 004.62

**Veyber V.V., Kudinov A.V., Markov N.G. THE ISSUE OF GATHERING AND TRANSMITTING MANUFACTURING INFORMATION OF THE DISTRIBUTED ENTERPRISE**

The authors considered the tasks of gathering manufacturing information of an enterprise and its transmitting to the control and decision making level. They analyzed the issues of using OPC standards for solving the tasks specified and proposed the original architecture and functions of the developed package for gathering primary manufacturing data based on SOA principles. The results of studying the proposed solution efficiency in comparison with the analogues were given in the article as well.

UDC 004.62:004.42

**Veyber V.V., Kudinov A.V., Markov N.G. THE ALGORITHM OF DATA SCHEME MATCHING IN INFORMATION SYSTEMS OF OIL-AND-GAS PRODUCTION ENTERPRISE**

The authors proposed the original algorithm of automatic matching for XML scheme – PSM. It was carried out within the frames of developing the platform of industrial data integration at the oil-and-gas production enterprise. The experiment outcome confirming the algorithm efficiency was proposed.

UDC 004.942:66.011

**Ivashkina E.N., Dolganov I.M., Ivanchina E.D., Kirgina M.V., Faleev S.A., Kravtsov A.V. INTELLECTUALIZATION OF OIL-REFINING PROCESSES USING COMPUTER MODELING SYSTEMS**

The intelligent computer complex was developed and software implemented in programming object oriented environment Delphi 7. It was integrated with a unified subject data mart of the oil refinery plant. The software allows monitoring constantly and predicting the main data of dehydrogenation, hydrogenation, alkylation processes. SQL-requests of process parameters and processed raw material hydrocarbon composition are implemented using a factory data base. The system allows computing different versions of the existing device reconstruction as well as analyzing the process technique-economic indices.

UDC 004.942:66.011

**Ivashkina E.N., Dolganov I.M., Romanovsky R.V., Chekantsev N.V., Ivanchina E.D., Dolganova I.O., Kirgina M.V., Semakin S.V. THE DEVELOPMENT AND APPLICATION OF COMPUTER SIMULATORS FOR PROFESSIONAL ADVANCEMENT OF ENGINEERING STAFF AT OIL-REFINING ENTERPRISES**

The computer program for testing engineers at oil-refining enterprises was developed and software implemented in programming environment Delphi 7.0. The testing system includes the process questions and interacts with data bases of local and network purpose. The software product may be used for monitoring and engineering staff professional advancement. The key feature of the proposed system for testing and diagnostics of deviations from a device standard operating procedure is the functionality with the mathematical model for manufacturing linear alkylbenzenes. It gives the opportunity of the optimized parameter quantitative estimate.

UDC 004.422.8:004.043

**Lavrov V.V., Spirin N.A., Burykin A.A., Rybolovlev V.Yu., Krasnobaev A.V. THE USE OF CONTROLLED SOFTWARE CODE ON THE.NET Framework PLATFORM WHEN DEVELOPING THE AUTOMATED INFORMATION SYSTEM FOR ANALYZING AND PREDICTING THE BLAST FURNACE OPERATION**

The article reflects the features of applying the controlled software code when developing the modern information systems on NET Framework (CLR) platform. The authors introduce the versions of forming architectures of the automated information system for analyzing and predicting the manufacturing situation in the blast furnace shop at the «Magnitogorsk metallurgical plant».

UDC 002.53:004.89

**Zagorulko Yu.A. SIMULATION OF A VOICE SIGNAL CONTROL ROBOT**

The author proposed the approach to the development of a voice signal control robot simulator. The latter was implemented by means of the software environment Semp-TAO which supports a flexible integrated technique for developing the intelligent systems. The simulator is easily adjusted to the knowledge domain and has a scalable command system.

UDC 004.931

**Tkhi Tkhu Chang Bui, Ngoc Hoang Fan, Spitsyn V.G.  
SOFTWARE AND ALGORITHMIC SUPPORT  
FOR DIGITAL IMAGE CLASSIFICATION BY THE HAAR  
WAVELET TRANSFORM AND NEURAL NETWORKS**

A new algorithm is proposed to classify digital images by their color information, form and texture. The program for digital image classification is developed and implemented in object oriented programming language C# using the Haar wavelet transform and a multilayer neural network. The authors make a conclusion on a possibility of using the coefficients of the direct Haar wavelet transform as the input data for the neural network to classify digital images. The article illustrates the use of the proposed original algorithm based on the Haar wavelet transform and neural network which makes possible the efficient classification of digital images.

UDC 681.3

**Nemirovsky V.B., Stoyanov A.K.  
IMAGE PRE-PROCESSING  
BY ONE-DIMENSIONAL POINT MAP**

The authors examine the opportunity of applying one-dimensional point map for image pre-processing before lossless compression. It is shown that brightness values maps serve for decreasing image information redundancy. The calculation technique for mapping parameters is proposed. The experimental test results of the proposed image pre-processing method are introduced.

UDC 519.688:53.083.98

**Volkov Yu.V., Tartakovsky V.A.  
THE ALGORITHM OF ANALYZING TREE-RING AREAS**

The authors examine the algorithm for recognizing tree-ring boundaries and computing annual zone areas imaged in the pattern of a tree stem cross section. This algorithm is based on the grouping method. The article introduces the results of the proposed algorithm computational investigation and the results of its application to sample analysis.

UDC 004.42

**Botygin I.A., Popov V.N., Tartakovsky V.A.  
MATHEMATICAL MODELS IN THE TASKS OF PROCESSING  
DENDROECOLOGICAL DATA. P. I**

The authors introduce the mathematical models and their software implementation (computer models) for analyzing tree-ring images to determine the changes in environment parameters reflected in a tree accretion. Tree-ring modeling is based on the fundamental properties of radial tree growth. They are the growth time and space monotony and its rate limitation. Wood density changes are considered as time-space oscillating process.

UDC 004.42

**Botygin I.A., Popov V.N., Tartakovsky V.A.  
MATHEMATICAL MODELS IN THE TASKS OF PROCESSING  
DENDROECOLOGICAL DATA. P. II**

The authors introduce the mathematical models and their software implementation (computer models) for analyzing tree-ring images to determine the changes in environment parameters reflect-

ed in a tree accretion. Tree-ring modeling is based on the fundamental properties of radial tree growth. They are the growth time and space monotony and its rate limitation. Wood density changes are considered as time-space oscillating process.

UDC 004.925.8:616.441-002

**Kochegurov V.A., Konstantinova L.I., Marchenko V.V.  
USE OF EEG PHASE DISPLAY FOR CONTROLLING HEALTH  
STATE OF THYROID-PATHOLOGY PATIENTS**

The article considers a possibility of ellipse approximation of the electroencephalogram phase reflect. It shows the dependence of the enclosing ellipse parameters on a patient nosology form. For the first time the electroencephalogram phase reflection is proposed to control health state of thyroid patients.

UDC 519.688

**Makarov M.A., Konstantinova L.I.  
THE DEVELOPMENT OF THE ALGORITHM FOR ESTIMATING  
A NERVE LIMB INJURY SEVERITY BY A SIGNAL  
OF GENERATED MAGNETIC RESPONSE**

The authors obtained the description of the difference of the generated magnetic response signal using wavelet-transform. They determined the informative values of the wavelet-transform coefficients which can help in defining the nerve limb injury severity. The confidence intervals were plotted. They illustrate the severity of injury conformity to a certain coefficient. The algorithm for estimating a nerve limb injury severity by a signal of generated magnetic response was developed on the basis of the confidence interval boundaries.

UDC 621.396.946

**Voroshilin E.P., Rogozhnikov E.V., Vershinin A.S.  
THE METHOD FOR IMPROVING THE ACCURACY  
OF ESTIMATING A TRANSFER FUNCTION IN RADIO-WAVE  
PROPAGATION CHANNEL**

The article is devoted to the development of the method for estimating a transfer function in radio-wave propagation channel. It is used the a-priori data on the channel parameters for improving accuracy. The work is based on the wide spread methods for estimating the channel transfer function: the least-squares methods, Kalman filter, Wiener filter. The statistic modeling of the methods was carried out. The mean-square error in the channel transfer function estimation was calculated depending on signal/noise ratio. The developed method allows increasing considerably the accuracy of estimating transfer function in radio-wave propagation channel due to accounting a number of displayed signals on real paths.

UDC 519.688;004.92

**Parubets V.V., Berestneva O.G.  
APPLICATION OF THE PARALLEL COMPUTING  
TECHNIQUE TO OPTIMIZE THE GLOBAL LIGHTING MODEL**

A mathematical model of illumination built in the basis of spherical harmonics for three-dimensional scene is covered. It proposes parallelized version of the preliminary calculation of expansion coefficients of the basis for points of the scene using nVidia CUDA technology. A performance comparison between central and graphics processors is given.