

**CONTENTS AND ABSTRACTS****TRANSMISSION AND PROCESSING OF INFORMATION**

*L.A. Demidova, G.N. Myatov, R.V. Tishkin, V.A. Ushenkin.* APPLICATION OF FUZZY MASKS IN THE PROBLEM OF GEOREFERENCING OF IMAGES FROM GEOSTATIONARY SPACE SYSTEMS OF REMOTE SENSING ACCORDING TO ELECTRONIC MAPS

Key words: georeferencing, Earth surface image, electronic map, binary mask, fuzzy mask.

The problem of georeferencing of images from geostationary space systems based on matching of coastline unique fragments, identified in satellite images, and fuzzy masks, formed using electronic maps and taking into account coastline topology as well as brightness features and mutual arrangement of the water surface and land, is considered. ....3

*V.T. Cao, G.V. Ovechkin.* IMPROVING PERFORMANCE OF MULTILEVEL MULTITHRESHOLD DECODER FOR SELF-ORTHOGONAL CODES

Key words: error-correction coding, self-orthogonal code, multithreshold decoder, multilevel multithreshold decoder.

Several cases of multilevel multithreshold decoders (MTD) for self-orthogonal codes and their performance are discussed. New methods for multilevel MTD performance improving at the expense of better usage of decoded bits reliability with decision block are submitted. Recommendation on selecting the best algorithm for decision block and the best parameters for multilevel MTD is given .....10

*T.A. Vityazeva, A.A. Mikheev.* MULTIRATE SIGNAL PROCESSING APPROACH FOR HEART RATE VARIABILITY ANALYSIS

Key words: heart rate variability; multi-rate signal processing; ECG signal; narrow-band filtering.

The paper proposes to use multirate signal processing technique in a task of electrocardiogram signal real time analysis for the detection of slow wave components. The detailed description of a multistage downsampling algorithm is given. The computational costs for the offered approach implementation are estimated .....14

*M.U. Konyshov, V.I. Bliznuk, A.V. Pankratov.* ALGORITHM OF DEMULTIPLEXING OF DIGITAL STREAMS, CONSIDERING STATISTICAL PROPERTIES OF CONDENSED SOURCES OF MESSAGES AND ERROR STREAM

Key words: structure of multiplexed digital stream, Markov chains, metrics.

The model of communication channel with multiplexing, taking into account Markov features of multiplexed message sources and error stream is given. The algorithm of demultiplexing including the procedure of inactive multiplexed channels detection, metrics of binary sequences of active multiplexed channels calculation and procedure of time slots clustering is offered .....21

## RADIO ENGINEERING AND MEASURING SYSTEMS

*S.N. Kirillov, V.A. Revutsky, A.Y. Yashin.* STUDY OF NOISE INFLUENCE ON SPACE RADIO LINES, USING DIFFERENT METHODS OF ERROR-CORRECTING CODING AND MODULATION TYPES

Key words: modulation type, robust code, nuisance, radio line, signal to noise ratio, signal to noise ratio.

Investigation of the influence of some types of intentional interference on the reliability of information transmission in space radio lines using different combinations of modulation types, and error-correcting coding is carried out. It is shown that the most dangerous for different space of links is hindrance on the basis of frequency-modulated noise (WCC) of the carrier. The maximum noise immunity is provided by space communication line with GMSK type of modulation, when using convolutional coding.....29

*S.A. Tikhomirov.* EXPERT SYSTEM ANALYSIS OF TELEMETRY INFORMATION SPACE ROCKET LAUNCHERS

Key words: expert system, telemetry, analysis, development of software, automation, launch vehicle, start-up.

An expert system analysis of space rocket launchers telemetry information to ensure automation of ground electrical tests control during prelaunch and control over onboard systems functioning at the start of space rocket launchers is considered .....33

*S.G. Proskurin, A.Yu. Potlov, S.V. Frolov.* TIME-RESOLVED DIFFUSE OPTICAL TOMOGRAPHY OF BIOLOGICAL TISSUES USING LATE ARRIVING PHOTON

Key words: diffuse optical tomography, highly scattering media, conformal mapping, late arriving photons.

A new method of direct detection of optical inhomogeneity, such as cysts, hematomas, tumors etc. in strongly scattering media with tissue like optical properties is presented. The key feature of the method is a two-stage data acquisition of time point spread function (TPSF), taking into account the absolute value of the intensity of detected signal in entire dynamic range. For quick and reliable inhomogeneity detection, the surfaces obtained from a full set of late arriving photons (LAP) in Cartesian frame are conformally mapped into cylindrical surfaces.....41

*V.A. Belokurov, D.N. Kozlov.* DETECT-TRACK OF A MANEUVERING TARGET FOR LOW SIGNAL-TO-NOISE RATIO

Key words: detection, low signal-to-noise ratio.

This work shows the practicability of a combination of Gaussian particle filter and interactive multi-mode filter for detection and tracking of a small maneuvering target. We propose to use the model with constant velocity, and the other one with constant acceleration. Numerical modelling results demonstrate that the proposed algorithm is capable of detecting manoeuvring target at low signal-to-noise ratio equal to 8 dB .....46

*V.G. Andreyev, T.P. Nguyen.* FAST ADAPTIVE ALGORITHM FOR CLUTTER AND NOISE SUPPRESSION

Key words: adaptive signal processing, clutter and noise, whitening filter, clutter suppression.

We offer a simplified algorithm for estimating the coefficients of FIR suppressing filter to increase the average over Doppler velocities detection probability by 6%...28% compared with the known (non-adaptive) whitening filter. The algorithm does not require inversion of the interferences correlation matrix when the power of uncorrelated interfering components changes, thus reducing the computation cost (number of arithmetic operations) by 1.23...2.84 times as compared with the optimal adaptive algorithm.....50

## COMPUTER ENGINEERING AND APPLIED MATHEMATICS

### *A.K. Rozanov.* VOCABULARY STRUCTURIZATION IN NATURAL LANGUAGE WORD FORM ANALYSIS AND GENERATION SYSTEMS

Key words: natural language processing, string transformations, word form analysis, data structures, hierarchical models.

The article lists basic models of vocabularies in natural language word form analysis and generation systems. The article suggests a special hierarchical vocabulary model and lists its benefits compared to other vocabulary models.....55

### *M.V. Kolmykov, V.N. Ruchkin.* THE APPLICATION OF FRACTAL COMPRESSION ALGORITHM TO MINIMISE MOBILE TRAFFIC

Key words: mobile traffic, fractal algorithm, neuroprocessor.

The approach to optimize mobile internet is given. Improved algorithm of fractal image compression optimized for NM 640X neuroprocessor is proposed. Expediency of using ImCoWeb software-hardware complex for efficient image compression and reduction of mobile traffic is shown.....63

### *L.S. Krupnov.* FORMALIZATION AND ANALYSIS OF COMPUTER SYSTEM PARAMETERS IN APPLICATION TO NETWORK ATTACKS RISK ASSESSMENT

Key words: group method of data handling, network attacks, security, system administration.

This article is dedicated to the analysis of relation between internals of computer system and the state it has after network attacks. Group method of data handling (GMDH) was chosen for this study because it provides the most accurate mathematical model. The experiments confirm the possibility to predict system response to network attacks automatically. The analysis of this relation allows to find weak points in a security system and make recommendations for their improvement .....67

## COMPUTER-AIDED DESIGN

### *A.D. Ivannikov.* PROJECT DEBUGGING BY SIMULATION DECOMPOSITION METHODS FOR COMPLEX DIGITAL CIRCUITS AND MICROSYSTEMS

Key words: complex digital circuits and microsystems model, debugging by computer modeling, designing systems on a chip, logic modeling, logical-time analysis.

The task of complex digital circuits and microsystems project debugging by simulation is formulated on the basis of using family of stationary dynamical systems as a model. Due to the complexity and large dimensions of the task decomposition methods are proposed. The following methods are described and examined: vertical and horizontal structural decomposition, functional decomposition, decomposition based on error types.....73

### *D.V. Lunin, S.V. Skvortsov.* ORGANIZATION OF PARALLEL COMPUTING ON CUDA PLATFORM

Key words: parallel computing, graphics accelerators, CUDA, threads.

Possibilities of parallel computing organization on graphics accelerators are considered. Approach to increase the productivity of general purpose program applications due to their parallelization on the CUDA platform is offered.....77

## ELECTRONICS

*A.V. Ermachikhin, S.A. Kostyukov, D.S. Kusakin, V.G. Litvinov, N.B. Rybin.* LOW FREQUENCY NOISE SPECTROSCOPY OF SCHOTTKY INGAAS/GAAS QW HETEROSTRUCTURES

Key words: low-frequency noise spectroscopy, semiconductor diode structure, spectral power density, quantum well, I-V characteristic, C-V characteristic.

This paper addresses the development and approbation of research methods of semiconductor micro - and nanostructures electrophysical characteristics with the use of low-frequency noise spectroscopy. Comprehensive studies and analysis of current-voltage (I-V) and capacitance-voltage (C-V) characteristics of Schottky diode Au/GaAs/InGaAs/GaAs with quantum well in the temperature range of 20-300 K were executed. These data were used to measure the temperature and field dependence of low-frequency noise spectral power density (SPD) of the diode. Detected temperature and field dependence of SPD type is associated with the presence of quantum-dimensional part in the diode under investigation..... 83

*E.V. Mamontov, V.V. Zhuravlev, V.N. Dvoynin.* FORMING OF TEMPORAL COMPOSITIONS AND SPATIAL-TIME VARIOUS ELECTRIC FIELDS BY DISCRETE ELECTRODES FROM THE VARIETY OF RESISTOR-CAPACITIVE VOLTAGE DIVIDER

Key words: mass spectrometry, ion-optical system, fields superposition, planar discrete electrodes.

The method of forming fields compositions with various spatial-time distributions of potential ion-optical systems with planar electrodes from the plurality of distributed resistor-capacitor voltage divider is considered. The technology of discrete planar electrodes uses dielectric substrates with bilateral metalized coating with special geometry. An example of ion-optics system with planar discrete electrodes to form two-dimensional linear electric field radiofrequency mass reflectron is shown ..... 89

*V.V. Vitukhin, M.Yu. Sudakov.* RESEARCH AND RESONANT MODE OUTPUT PARAMETERS OPTIMIZATION FOR THE IONS OF DIFFERENT MASSES IN LINEAR TRAP WITH T-TRAP TRIANGULAR ELECTRODES

Key words: mass spectrometry, ion trap mass-selective resonant ejection, T-Trap, buffer gas pressure.

This work is a continuation of comprehensive study of T-Trap linear ion trap with simple electrodes consisting of flat segments of triangular shape. Studies have been conducted according to the resolving power of the spectrum obtained on the parameters of ion mass and scanning velocity in mass-selective resonant ejection mode with applied harmonic RF. The next step was the study of how the buffer gas pressure effects the resolution and the search for optimal geometry of the device by the way of resonant ions ejection parameters optimization ..... 94

*V.I. Soloviev, V.A. Korotchenko, Zh.V. Putilina.* INFLUENCE OF OXYGEN ON THE RESISTANCE STABILITY OF REED SWITCH WITHOUT CONTACT PLATING

Key words: reed switch without contact protective coating, sealing of devices, reed switch seasoning autooscillation regime, long-term stability of contact resistance.

The functioning features of MKA-14108 reed switches without aurum-rutenum coatings of contacts are considered. Instability of reed switch contact resistance contacts associated with the presence of oxygen impurities in gas filling when millivolt and microampere signals are switched. The results of comparative evaluation of oxygen effect on the resistance stability for devices with coated and uncoated contact are given..... 99

*A.E. Chizhikov, A.A. Zelenkevich, G.V. Davidov, A.J. Samokhin.* RESEARCH OF MEASUREMENT FEATURES OF MULTILAYERED DIELECTRIC STRUCTURES SPECIFIC SUPERFICIAL RESISTANCE

Key words: superficial resistance, multilayered structure, film oxide magnesium, field distribution.

To measure the resistance in three-layer dielectric structure MgO film - fusible glass - a glass substrate it is offered to use four-electrode system with additional ring electrode which negative potential is equal to potential of voltage electrode instead of 50499-93 three-electrode measuring systems with cylindrical electrodes recommended by GOST P. Direct measurement has shown essential increase in measured resistance of the sample ( $> 7,5 \cdot 10^{17} \text{ Ohm}$ ) in comparison with measurements in accordance with GOST ..... 104

*N.A. Zelentsov, M.U. Prosekin, I.G. Prosekina, V.V. Shirokov.* EFFECT ANALYSIS OF SILICON STANDARDS SURFACE RELIEF DURING CARBON NANOSTRUCTURES SYNTHESIS WITH CATALYTIC PYROLYSIS METHOD

Key words: nanostructures, nanotubes, fullerenes, catalytic pyrolysis, atomic-force microscopy.

Carbon nanostructures synthesis on silicon standards with defined relief has been realized. Scanning of synthesized samples by atomic-force microscopy has been realized, analysis of scans images has been performed. Assumptions of relief effect on carbon nanostructures synthesis have been formulated..... 109

## MANAGEMENT IN SOCIAL AND ECONOMIC SYSTEMS

*M.T. Teryokhin.* MATHEMATICAL MODEL OF MULTIBRANCH ECONOMIC SYSTEM WITH FUNCTIONAL OF COSTS

Key words: linear system of differential equations, volume of funds, investment, fundamental matrix, image, preimage, operator, vector control.

Controllable mathematical model of multibranch economic system development is investigated. The conditions when functioning of the system is possible (or impossible) are defined. The existence of economic system with minimal costs is proved ..... 115

*V.S. Gurov, A.I. Taganov, S.I. Gusev.* PROBLEMS OF ACTIVITY MANAGEMENT OF SPACE TECHNOLOGY SCIENTIFIC AND EDUCATIONAL CENTRE

Key words: scientific and educational center, space technologies, management, training, space branch.

The article considers scientific and methodological problems of management, reflecting the objectives, activities and innovations in creation and development of scientific and educational center of space technology in Ryazan State Radio Engineering University in context of decisions of the Russian Space Innovation Consortium ..... 118

*V.A. Tsvetkov, E.L. Loginov, D.N. Efremov.* DEVELOPMENT OF EFFECTIVE FORMS OF MULTIDISCIPLINARY EDUCATION SYSTEM FUNCTIONING USING EDUCATIONAL, SCIENTIFIC AND INDUSTRIAL NETWORKS TO SUPPORT FUNCTIONAL COMPETENCIES AND MANAGERIAL PERSONNEL

Key words: integration, science, education, manufacturing, organizational model.

This article discusses the formation of intellectual model of optimization processes of communication participants of SNP-based network management organizational model to support functional competencies and managerial skills within distributed data-processing environment ..... 123

## BRIEF REPORTS

*V.K. Klochko, A.N. Usachev, Ch.T. Nguyen.* ALGORITHM TO FORM OBJECT IMAGES BASED ON THE PHASE METHOD OF SPATIAL COORDINATES MEASUREMENT

Key words: 3D images, phase method, coordinates estimation, Doppler filtration.

The algorithm to form object images using Doppler radar based on the phase method of spatial coordinates measurement is offered. Simulation results are given..... 128

*A.G. Ivanov, M.A. Ivanov, V.G. Levashov.* L-BAND POWERFUL TRANSMITTER TECHNOLOGY IN AVIONICS INFORMATION-MEASURING SYSTEMS

Key words: information-measuring system, transmitter, L - range, avionics, temperature effects.

A powerful reference L - range transmitter for informational-measuring systems of avionics is developed. The transmitter provides pulsed signal gain from 3 - 10 mW up to 500 watt in the bandwidth of 1 - 1.55 GHz. Results of transmitter study when it being exposed to extreme temperature conditions are given. Transmitter module simultaneously provides increased power output, broadband, high reliability and stability..... 131

*A.Y. Narbekov.* SPECTRAL ANALYSIS OF SIGNALS WITH VARIABLE DYNAMIC RANGE

Key words: eigenvalues, eigenvectors, Karhunen-Loeve Transform.

A new method for estimating power spectral density of radio signals with varying dynamic range is offered. It does not require a priori information about the eigenvalues of the correlation matrix of a desired signal. Examples of application of this algorithm to the estimation of power spectral density of laser signal are given. The evaluation of method efficiency is made. The evaluation of method efficiency is performed with dispersion  $D = 1000$ , the estimation accuracy is  $1.06 \times 10^{-3}$ ..... 134

CONGRATULATIONS TO HEROES OF ANNIVERSARY ..... 137

INFORMATION ABOUT THE AUTHORS (Russian)..... 139

INFORMATION ABOUT THE AUTHORS (English)..... 141