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RADIOENGINEERING, RADIOLOCATION AND COMMUNICATION SYSTEMS

<i>S.N. Kirillov, I.V. Lukashin.</i> ANALYSIS OF IEEE 802.15.4a CSS PROFILE EFFICIENCY IN THE ACTION OF INTERFERING FACTORS	
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Key words: IEEE 802.15.4a, CSS profile, LFM pulse, biorthogonal mapping, multipath, Doppler shift, model JTC94.

Analysis of the IEEE 802.15.4 standard CSS profile efficiency in communication channel with multipath and the Doppler shift is made. JTC94 was used to analyze the effects of multipath. It is shown that the CSS profile possesses low performance when functioning in communication channel with the multipath and increased stability to the Doppler shift. For example, the velocity of network node with the speed up to 200 km/h requires 0.05 dB increase in the signal-noise ratio having bit error probability equal to 10^{-4}

<i>S.I. Gusev.</i> ESTIMATION OF SIGNAL PARAMETERS BY MAXIMUM LIKELIHOOD METHOD WITH SEQUENTIAL SAMPLING OF OBSERVED DATA	
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Key words: spatio-temporal signal processing, statistical estimation, optimal spatial structures, sequential samples.

The paper investigates the problem of determining parameters of radio system spatial structure viewed as the problem of statistical estimation together with the detection of desired signal based on the data obtained as a result of sequential sampling of observed field

<i>A.V. Levitin.</i> PRINCIPAL COMPONENT METHOD IN THE PROBLEM OF LINEAR SELECTION SIGNAL ON THE BACKGROUND OF INTERFERENCE AND NOISE	
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Key words: signal selection, principal component analysis.

The method describing how to build linear operators producing quasideterministic useful signals from their mixture with additive quasideterministic interferences and broadband noise based on the formation of signal and interference subspaces by means of principal component analysis is given. Illustrative example in which during the transition from maximum likelihood estimates calculated by simplex search to the linear estimates the relative energy error selection signal increases from 1.01% to 1.24% while the computation time is reduced more than 10 000 times is considered.....

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Key words: MIMO channel, channel matrix, UAV, measurable error, channel capacity.

The simulation of data channel from unmanned aerial vehicle to ground control station is

performed. The dependence of channel capacity from the length of training sequence for different values of signal-to-noise ratio, velocity of unmanned aerial vehicle and the number of transmitting and receiving antennas is obtained22

A.A. Potapov. FRACTAL RADAR

Key words: fractal, scaling, fractional operator, dynamical chaos, radio system, radar.

The selected results of application of the theory of fractals, dynamical chaos, scaling effects and fractional operators in fundamental problems of radiolocation, radio physics, radio engineering and antennas theory are presented in the paper. The author has been investigating these issues for 35 years exactly. The fractal radio systems conception, sampling topology, global fractal-scaling approach and the fractal paradigm underlies the scientific direction established by the author in Russia and in the world for the first time. The results of big practical and scientific importance obtained by the author were published in four summary reports of the Presidium of the Russian academy of science (2008, 2010, 2012, and 2013) and in the report for the Government of the Russian Federation (2012).....28

P.A. Polushin, D.A. Martyshchenskaya, I. Julani. METHOD OF COMPENSATION OF INTERSYMBOL INTERFERENCE IN DIVERSED COMMUNICATION SYSTEMS

Key words: intersymbol interference, method of compensation, diversified communication.

Method of compensation of intersymbol interference of digital signals in diversified communication systems is proposed and described. The efficiency of proposed method and the method of optimal combining was compared. Results of computer modeling of the proposed method were described and its efficiency in various conditions was shown.42

P.S. Pokrovsky. PROCEDURE OF RADIO SIGNALS WITH CONTROLLED COMMUNICATION SYNTHESIS BETWEEN INPHASE AND QUADRATURE COMPONENTS BY TWO CRITERIA

Key words: deep space communication, bandwidth-efficient radio signals, multicriterion synthesis, combined criterion, energy efficiency.

The synthesis of radio signals with controlled relationship between inphase and quadrature components (RSCRIQ) is implemented. It is based on combined criterion including two parts, which are indirectly linked with bandwidth and crest factor. It is shown that the resulted signals allow to variate bandwidth in the range more than 28 per cent, and variate crest factor in the range more than 1.9 dB. The two-stage procedure of RSCRIQ synthesis is vindicated. It allows to form radio signals with given characteristics of spectral and energy efficiency. The ensemble of RSCRIQ is vindicated. These sets allow to take the signals with spectral efficiency from 0.66 to 1.1 Hz/bps and noise-immunity from 6.8 to 7.4 dB.49

COMPUTER ENGINEERING, INFORMATION SYSTEMS AND TECHNOLOGIES

S.V. Gavrilov, D.I. Ryzhova. ALGORITHM OF PEAK CURRENT ESTIMATION AT THE LOGIC LEVEL OF VLSI DESIGN BASED ON THE ANALYSIS OF LOGIC CORRELATIONS PROPAGATION IN THE CIRCUIT

Key words: static timing analysis (STA), intellectual property block (IP-block), logic correlations, analysis of peak current.

With technology scaling, the peak current analysis in the power buses is required for solving such problems as IR-drop problem and width of power bus problem. The existing approaches for the peak current estimation does not provide a sufficiently accurate solution of the problem. This article presents methods that provide improving accuracy of peak current estimation compared with other known approaches. These methods are based on analysis of logic constraints

(correlations) propagation in the CMOS circuit. The proposed method based on the analysis of correlations in circuit jointly considers real-valued intervals of propagation delays with Boolean intervals of input vectors for which the delay is achievable, and enhances the reliability of the maximum current due to the analysis of the logical compatibility for switching gates.56

A.Yu. Romanov, S.R. Tumkovsky, G.A. Ivanova. SIMULATION OF NETWORKS-ON-CHIP BASED ON REGULAR AND QUASI-OPTIMAL TOPOLOGIES BY USING THE OCNS SIMULATOR

Key words: network-on-chip (NoC), NoC simulation, NoCs based on quasi-optimal topologies, NoCs based on regular topologies, OSI model.

The review of the networks-on-chip modeling methods is given. A high-level model of networks-on-chip based on the programming language Java which helps to accelerate the modeling process by several orders compared to HDL-models is developed. The results of simulation of networks-on-chip based on regular and quasi-optimal topologies with the number64

A.N. Pylkin, S.V. Filatkin. MODELING AND PERFORMANCE EVALUATION PROTOCOL FOR TRANSMITTING REAL-TIME DATA IN CASE COMMUNICATION CHANNELS WITH A LARGE TIME SPREAD OF THE SIGNAL ARE USED

Key words: distributed systems, satellite communication channels, data transmission protocols, communication channels with large propagation time of the signal.

A number of management tasks (or control) of complex technical systems provides reception from control objects the information about their current state. In cases where the objects of control are Ugro-SHL security, control points can be on the remote distance from them, the absence of terrestrial communication channels may require SL use of satellite communication channels with large propagation time of the signal.

Modern standard protocols can inefficiently use the capacity of such channels of communication, especially with low reliability. By improving the efficiency of data transmission in real time, the use of specialized protocols focused on the use of the channels due to the large propagation time of the signal may be the solution. The use of the described protocol can provide the necessary reliability-the ability to send highly sensitive operational state data of control object.69

I.Yu. Kashirin, O.I. Kashirina. PROGRAMMING TOOLS FORMAL RESEARCH SURVEY

Key words: program analysis, algorithmic algebras, programming tools.

In the article the survey of the most known ways to research programming tools is proposed, its distinctive features which determine its applicability to solve different classes of problems of formal research are considered.....74

U.V. Petrov. GENERATOR OF PSEUDO-RANDOM NUMBERS OF THE SPECIFIED DIMENSION SEQUENCES WITH ALMOST UNIFORM DISTRIBUTION

Key words: pseudo-random numbers, uniform probability density, histogram, discrete random variable, conditional probability.

Method and simulation program sequences of pseudo-random uniformly distributed numbers of given dimension is offered. The main point of the method is the formation of pseudo-random numbers using not unconditional probability (as in a standard pseudorandom number generator), but the conditional probability. This allows to receive practically uniform density distribution of generated random numbers, the modeling of which in each step is limited by two stages: modeling of discrete random value with conditional probability (interval selection) as well as direct random number formation which is uniformly distributed inside the given interval.....83

SYSTEM ANALYSIS, INFORMATION PROCESSING AND CONTROL

N.N. Astakhova, L.A. Demidova. APPROACH TO FORECASTING OF TIME SERIES GROUPS WITH APPLICATION OF CLUSTER ANALYSIS TECHNOLOGIES

Key words: time series, forecasting, clustering, strictly binary tree, modified clonal selection algorithm.

Approach to forecasting of time series groups with application of cluster analysis technologies is offered. The description of time series – clusters centroid with use of forecasting models on the base of strictly binary trees and modified algorithm of clonal selection is realized. Application prospects of general forecasting models for time series', entering in one cluster, is shown89

A.I. Bobikov, D.M. Grushin. THE TOOLS FOR SYNTHESIS OF FINITE-HORIZON STATE DEPENDENT RICCATI EQUATION SDRE CONTROLLER IN MATLAB (GUI)

Key words: problem of tracking, finite-horizon SDRE controller, finite-horizon SDRE observer.

This article focuses on task which purpose is to develop tools for synthesis of nonlinear control systems represented by "input-state-output" model. The method based on the solution of finite-horizon state-dependent Riccati equation (SDRE) is applied for controller design. The application of SDRE controller allows to solve the problem of tracking. The application allows to design the control system with observer status, which is based on the solution of SDRE for finite time horizon.....97

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Key words: DC motor, non-linearities, PID-controller, adaptive controller, neural network controller.

A new algorithm for controlling the speed of a DC motor using neural network controller, which eliminates effect of non-linearities of the motor at its output is offered. As an example a nonlinear model of the DC motor, built using Simulink tool in the application package MATLAB is considered. The advantage of the new method of control setting over the classical methods is shown105

S.S. Luksha. ALGORITHM OF MAP BUILDING AND TRANSLATION ELTIMATION OF MOBILE ROBOT IN REAL TIME

Key words: laser scanner, navigation, localization, mobile robot, digital map, parallel computing.

The modification of iterative algorithm for closest points optimized for using on graphics processing units allowing translation estimation in real time is considered. Comparative characteristics of temporary indicators which show the stages of iterative algorithm of closest points optimised to be used on central and graphic processors is given.....112

O.A. Kozelkov. LOCAL AND GENERALIZED ESTIMATIONS OF NEW TECHNIQUE PRODUCTION PROJECT REALIZABILITY

Key words: estimation of realizability, innovative project, factors of production, displacing, integral index.

Major principles of evaluation of enterprise innovative plans realizability are examined. The system concept where the attention is given to structural-functional approach with hierarchical structure of indexes is found the most important. The method to receive generalized estimations of innovative project realizability is offered on the basis of local indexes of functioning and development of enterprise. The structure of local and generalized estimations of new technology

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INSTRUMENT ENGINEERING AND INFORMATION-MEASURING SYSTEMS

A.I. Kalinkin, I.S. Kholopov. PULSE ULTRASONIC RANGE METER ERROR COMPENSATION CONSIDERING TEMPERATURE, BAROMETRIC PRESSURE AND RELATIVE HUMIDITY

Key words: ultrasonic range meter, speed of sound, temperature sensor, atmospheric pressure sensor, humidity sensor.

The formulas for the compensation of measurement errors of sound speed in the air while changing the basic meteorological characteristics of the atmosphere is considered. Results of experiments with ultrasonic transceiver HC-SR04 showed that the use of the resulting formulas for estimating the speed of sound provides the root mean square error of measurement less than 3.2 millimeters in the range of 4 – 250 cm and relative error of measurement less than 1.2 % in the range of 30 – 250 cm 125

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Key words: transfer functions, linear circuits, topological modelling.

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D.M. Batukhtin, V.L. Ryzhkov, N.N. Mitrakova, Y.A. Furman. DAMAGE DEGREE OF STOMACH TISSUE ESTIMATE ON ENDOSCOPIC NBI IMAGES BY MULTIVARIATE STATISTICAL ANALYSIS

Key words: endoscopy, NBI, multivariate statistical analysis, classification, image processing, stomach pathology, intestinal metaplasia, stomach diagnostic map.

This paper proposes the method for quantitative evaluation of precancerous changes in the gastric mucosa, based on multivariate statistical analysis. To segment tissues in endoscopic NBI images a classifier allowing to obtain objective information about changes in the tissues is developed. The classifier makes the decision by comparing diagnosed images from the image model built for healthy and diseased tissue 138

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Key words: fuzzy clustering, system of decision making support, medical purpose system, medical technological process.

The paper considers the use of an improved clustering algorithm based on fuzzy equivalence relations arising from the properties of the investigated data in medical technological processing. Fuzzy evaluation function of clustering quality in order to build medical purposes systems is obtained. The method of fuzzy clustering using the evaluation function for clustering on the basis of which the assessment of risk factors influencing the evaluation of treatment results of patients with pulmonary tuberculosis is carried out 144

ELECTRONICS AND NANOELECTRONICS

V.S. Gurov, M.V. Dubkov, M.A. Burobin, I.A. Kharlanov. OPTIMIZATION OF TWO-SECTION MONOPOLE MASS ANALYZER TRANSITION REGION

Key words: monopole mass analyzer, resolution, electrode system.

Investigation of electric field in the transition region between sections of two-section monopole mass analyzer with rotated 180° electrode section is completed. Numerical modeling and experimental research of the proposed design of the monopole mass analyzer electrode system is done. The part of spectrums at different electrode systems of monopole mass analyzer configuration is demonstrated. It is shown that applying of the diaphragm with zero potential between the electrode sections allows to increase resolution in 1.6 times and to reduce sensitivity losses 150

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Key words: adsorptive sensors, mathematical model of surface reactions, nanocomposites, fractal structure.

A mathematical model of surface reactions for the development of highly selective sensors is proposed. The experimental data and simulation results of the temperature dependence of the conductivity on the basis of the nanocomposite system SiO₂-SnO₂ in dry air are presented. The existence and uniqueness of solutions of differential equations describing the kinetics of filling of surface states are demonstrated. A model of sensor response of nanocomposites based on mixed oxides with fractal structure is developed. 155

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Key words: ionization energy, deep trap, semiconductors structure.

The physical mechanism of charge of defects with deep levels - deep traps (DT) with uniform distribution of their concentration in the base of diode-like structure and with the concentration profile of small doped impurities is discussed. The expression for calculating DT ionization energy in semiconductor barrier structures based on measurements of two spectra of deep-level transient spectroscopy (DLTS) registered at the same relaxation time constant for different impulses of reverse bias voltage is obtained..... 163

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Key words: atomic force microscopy, conductive probe sensor, electrical resistance, contact resistance.

The mathematical relationships describing electrical properties atomic force microscope point probe contact are presented. Various physical models describing electrical properties of point contacts and their mechanical properties are analyzed. Applying mathematical relations given in the work as well as physical parameters of atom-power microscope probe and the surface investigated it is possible to calculate electrical resistance of corresponding point probe contact. 168

P.G. Vorobyov, V.S. Zorkin, A.A. Kondrakhin, E.G. Chulyaeva, G.V. Melnichuk. RESEARCH OF DIGITAL SYSTEM OF FREQUENCY STABILIZATION OF ZEEMAN HE – NE LASERS

Key words: He – Ne laser, difference frequency, LGN-212-1M, Zeeman effect, steepness, discriminatory curve.

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BRIEF REPORTS*I.V. Belokonov, S.I. Gusev, A.I. Taganov.* RESULTS AND DECISIONS OF THE FIRST RUSSIAN NANO-SATELLITE SYMPOSIUM

Key words: Russian nano-satellite symposium, problems of creating ultra-small spacecrafts, application of nano-satellites.

The paper considers the work results and decisions of the First Russian nano-satellite symposium with international participation, which was held from June 2 to 4 2015 in Samara, on the basis of the Samara State Aerospace University (SSAU) named after academician Korolev (National Research University), with the participation of Ryazan State Radio Engineering University in sections of "Scientific equipment and onboard nano-satellites systems", "Nano-satellites missions and projects" 179

A.I. Bakulin. REGARDING CERTAIN PROPERTIES OF FUNCTION WITH THE BOUNDED SPECTRUM

Key words: spectrum, probability density.

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