

CONTENTS AND ABSTRACTS

PHYSICAL ELECTRONICS

M. V. Chirkin, A. V. Molchanov, V. V. Klimakov, V. Yu. Mishin, A. E. Serebryakov, G. V. Davydov. LASER GYROSCOPE MECHANICAL DITHER DIGITAL CONTROL SYSTEM

Key words: laser gyroscope, mechanical dither, ring helium-neon laser, Sagnac phase, FPGA, inertial sensor.

The system for digital control of laser gyroscope mechanical dither making use for its operation of ring laser primary signals has been developed and tested. The digital control system of the mechanical dither of the laser gyroscope includes: a two-stage amplifier, a bipolar adjustable power source and a DAC. Tests of the developed system showed that it provides the regulation of the oscillation amplitude of a ring laser in the range from 1 to 3 arc minutes and its noise according to the normal law in the range from 10 to 30 %. The aim of the work is to construct a digital system to control laser gyro mechanical dither using only primary signals of ring laser as the source of information

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MATHEMATIC AND SOFTWARECOMPUTER SYSTEMS AND COMPUTER NETWORKS

D. A. Perepelkin, I. Yu. Tsyganov. CONCEPT AND PROBLEMS OF NETWORK SLICING IN SOFTWARE DEFINED NETWORKS

Key words: software defined networks, network function virtualization, network slicing, network architecture, software toolkit, SDN Cluster Constructor, quality of service.

Fifth generation networks (5G) have changed the concept of a network as a set of network devices. From the user's point of view, a modern network is considered as a set of services. The underlying technology that allows you to abstract service part of the network from infrastructure and focus on the development of intelligent network services is the technology of software-defined networks (SDN). This technology makes fifth generation networks faster and more flexible, enabling the introduction of services such as enhanced mobile broadband (eMBB), ultra reliable low latency communications (URLLC), and massive machine type communications (mMTC). A convenient mechanism for providing guaranteed quality of network services is the implementation of the concept of network slicing in SDN. Using network slicing network service providers create virtual networks for users with necessary services and quality of service. Network slicing for network service providers opens up the possibility of expanding the range of services offered by leasing several virtual networks based on one physical infrastructure. The aim of the work is a scientific and analytical study of the design features of networks architectures with support for network slicing as well as the development of mathematical and software tools for implementing network slicing in SDN.

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S. A. Lesko, D. O. Zhukov, P. Yu. Pushkin. MODELS AND TECHNOLOGIES OF INTERNET OF THINGS SECURE NETWORK CONSTRUCTION

Key words: Internet of Things (IoT), IoT security threats, security requirements, building a secure architecture, encryption mechanisms, ensuring communication security, cryptographic algorithms.

The widespread adoption of modern Internet of Things (IoT) technologies will largely be based on information security, as well as protecting data privacy. This turns out to be a rather complicated problem in IoT due to the deployment and mobility features. Since IoT allows many persistent things to be tracked and linked, a large amount of personal information can be automatically collected and processed. Protection of privacy in IoT will become more serious than in a traditional network, since the number of vectors of attacks on IoT devices (things) will be knowingly greater. Many of the existing technologies at the moment are available for domestic use, and are not suitable for industrial applications, in which high demands are placed on information security.

The article discusses the mechanisms for implementing attacks in IoT, security requirements, as well as the construction of a secure architecture and the use of key security technologies (encryption mechanisms, communication security and cryptographic algorithms).

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A. K. Kanaev, A. N. Gorbach, E. V. Oparin. SIMULATION OF ATTACK ON SYNCHRONIZATION NETWORK CONTROL SYSTEM

Key words: semi-Markov model, synchronization network, telecommunication system, control system, attack, vulnerability, attacker.

The assessment of control system security of telecommunication system synchronization network from the actions of an organized attacker at the final stage of the attack is carried out. A generalized semi-Markov model of the process is proposed, which reflects the main stages of an organized attacker's attack, highlighting the states characterized by a distinctive set of influences on the control system of synchronization network. Based on the developed semi-Markov model, stationary characteristics synchronization network control system security are calculated.

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O. G. Sherstneva. DEFINITION OF INDICATORS FOR COMMUNICATION NETWORK STRUCTURAL RELIABILITY

Key words: reliability, communication network, structural reliability, mathematical expectation, reliability indicators, failure rate, connectivity probability, availability factor, monitoring system, program.

The article is aimed to define the characteristics of communication network structural reliability according to the statistical data of monitoring system. An algorithm for calculating the mathematical expectation of the number of connections in various structured networks is proposed. The resulting calculation formulas include the main reliability indicators, such as the availability coefficient of a separate network section, idle rate, failure rate, connectivity probability, maximum number of connections in a network. Mathematical models to calculate these indicators according to monitoring and control system of communication network are proposed. Software implementation to calculate these indicated parameters that allows conducting research to find out dependence of main reliability indicators on failure rate, taking into account the characteristics of monitoring and control system in communication network is proposed.

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RADIO ENGINEERING AND RADAR

M. I. Bulgakova, D. A. Gulyaikin, A. A. Brechko. SIGNAL GENERATION ON THE LINE OUTPUT OF VIDEO INTERFACES

Key words: video interface, signal modeling, modulation, manipulation, waveform, harmonic signal, VGA, DVI, RGB.

The article deals with the problem of modeling signals of a given shape using digital-to-analog converter of a personal computer video card. The relevance of the research is the need to support the learning process of theory of electrical communication discipline. The aim of this work is to develop a model of the image displayed on monitor screen for generating signals of a given shape at linear output of video interfaces. The article presents the developed analytical model of the image corresponding to the signals of various forms, including the ones received when performing various types of modulations. Theoretical positions are confirmed by experimental research, in which oscillograms of generated signals are obtained using the developed software at the linear output of VGA video interface. The presented materials can be used in the educational process in the practical study of signals and modulations.

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E. P. Vasilyev. MICROWAVE DEVICES MODELING METHODS ANALYSIS ON THE EXAMPLE OF BAND-PASS FILTER WITH EXTENDED STOPBAND

Key words: electrodynamic and circuit methods, microwave CAD, modeling, microwave devices, band-pass filter with extended stopband.

The article provides a comparative analysis of electrodynamic methods implemented in modern microwave CAD systems. A qualitative assessment to modeling methods in solving various design problems is given. An example of circuitry and electrodynamic modeling methods usage when developing X-band band-pass filter is considered. The aim of the work is to solve by electrodynamic and analytical methods the problem of expanding stopband of a band-pass filter on Hairpin resonators by compensating spurious pass-bands. The technology of X-band band-pass filter research based on modern methods of circuitry and electrodynamic modeling is presented.

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INTELLIGENT INFORMATION SYSTEMS AND TECHNOLOGIES

S. V. Skvortsov, A. A. Kuznetsov, T. S. Skvortsova. ACADEMIC DISCIPLINE PLANNING TASK SOLUTION BASED ON A GREEDY ALGORITHM

Key words: educational process planning, academic discipline model, greedy algorithm, forgetting function, adjacent connectivity criterion.

The problem of educational process planning based on the model that takes into account the structure of the academic discipline and its semantics, presented in terms of concepts and logical dependencies between them is considered. The aim is to develop and study an algorithm for determining the order of study of topics (concepts) of academic discipline based on greedy strategy. Algorithm modifications to obtain solutions according to quality criteria based on forgetting function, allowing evaluating students' knowledge, and adjacent connectivity of the studied concepts, characterizing their logical relationship are proposed. The experimental studies results of the developed algorithm with the aim of analyzing performance and quality of the resulting solutions are presented.

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I. U. Kotciuba, S. A. Kotlizkiy. PROJECT MANAGEMENT APPLICATION USING MIND-MAPS METHODOLOGY

Key words: project management, mind-maps, project life cycle, application, project management automation, methodology, development, mind-maps application.

The article considers the process of project life cycle management with the allocation of management parameters that can be formalized. The aim was to develop a method of using mind maps methodology as the tool that reduces labor intensity of project management process. During the work the advantages and disadvantages of existing software solutions for project management are analyzed. Possibilities of applying mind maps methodology in the process of project management are considered. Also the methodology of practical application of mind maps at different stages of project life cycle has been developed. The requirements to the application for project management using mind-maps methodology are formulated. The results of the application are presented, testing methods are described and examples of its work are given.

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SYSTEM ANALYSIS, MANAGEMENT AND INFORMATION PROCESSING**D. Zh. Satybaldina, G. V. Ovechkin, G. A. Kalymova. STATIC HAND GESTURES RECOGNITION SYSTEM WITH USING DEPTH CAMERA**

Key words: intelligent information systems and technologies, deep learning, depth camera, gesture recognition, convolutional neural network, Keras, OpenCV, Python, TensorFlow, VGG-16.

The aim of the work is to develop a system for static hand gestures recognition based on a convolutional neural network using transfer learning framework. The gesture recognition system consists of a gesture capture device (sensor), preprocessing and image segmentation algorithms, a feature extraction and gestures classification block. This work is performed in Python 3.6 tools. As a sensor, Intel® RealSense™ depth camera D435 is used. Several Python libraries, which provide solid implementations of image processing and segmentation, are used. The subsystem for features extracting and gestures classification is based on the modified VGG-16, being realized with the help of TensorFlow & Keras deep learning frameworks. Experimental results show that the proposed model, trained on the database of 2000 images, provides high recognition accuracy on testing stage.

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A. I. Novikov, N. O. Shamin. INVESTIGATION OF THE REGULARIZATION METHOD FOR RESTORING BLURRED IMAGES

Key words: integral equation, ill-posed problem, equation core, stabilizing functional, Euler equation, parametric family of solutions, optimal solution.

The aim of the work is investigation of regularization method to reconstruct blurred one-dimensional and two-dimensional images with different features in the core and right-hand side of the Fredholm integral equation of the first kind of convolution type. The Euler equation was used as the basis of computational algorithm, which was reduced on a discrete grid to the system of linear algebraic equations with Toeplitz basic SLAE matrix. Studies of one-dimensional and two-dimensional images with inaccurately defined core of the equation and with additive noise superimposed on the blurred signal observed are carried out. The results obtained allow us to develop recommendations for processing blurred images.

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