

## **ELECTRONIC STRUCTURE AND ADSORPTION OF GRAPHENE ON POLAR MnO SURFACE**

**V.V. Ilyasov, I.G. Popova, I.V. Ershov**

Simulation of single-layer graphene adsorption on (111) oxygen-terminated polar MnO surface was performed within DFT framework. Surface oxygen atoms were completely passivated by hydrogen. Local atomic reconstructions of graphene-MnO(111) interface and its thermodynamic and electronic properties were studied. The effects of force and electric fields on electronic spectrum of the graphene/H:MnO(111) interface were studied for the first time. The effective charges on carbon and immediate neighborhood atoms were found. The charge transfer from the surface to graphene was determined which leads to n-doping of graphene electron spectrum. The latter provides the opportunity of creation of graphene n-type FET. The work demonstrates the effects of external transversal force and electric fields on the band gap opening in graphene

Key words: graphene, adsorption, graphene/H:MnO(111), atomic and electronic structure, force and electric fields

## **EFFECT OF CHEMICAL COMPOSITION ON THE MICROSTRUCTURE AND PHASE COMPOSITION OF LOW-CARBON WHITE CAST IRON**

**L.S. Pechenkina**

The results of studies of the effect of alloying elements on structure air-hardening white irons

Key words: white iron, chromium, vanadium, alloying, composite structure

## **THE EFFECT OF BORON CONCENTRATION ON FINELY-CRISTALLINITY OF ELECTROCHEMICAL NI-B-H COMPOSITES**

**A.V. Zvyagintseva**

The experimental results of the behavior of hydrogen in alloys of Nickel in its alloying by boron atoms are presented. Investigation of the structure of electron microscopic method showed that the doping of the Nickel coatings with boron up to 1% leads to an increase in the dispersity of the resulting structures and to the formation of finely-crystalline structure. The interdependence of the structure, hydrogenation and kinetic data that characterize electrocrystallization, depending on the boron content in the composite Ni-B-H, is shown

Key words: composite Ni-B-H, hydrogen, histogram, microstructure, structural defects, partial current density, grain size, the content of boron

## **ELECTRICAL PROPERTIES METAL OXIDE FILMS OF SnO<sub>2</sub>, PREPARED WITH SOL-GEL TECHNOLOGY**

**S.A. Belousov, A.A. Nosov, T.G. Menshikova, S.I. Rembeza**

The article describes the method of making thin metal-oxide films SnO<sub>2</sub> with sol-gel technology. The choice of the optimal time of maturation of the solution to produce films with the best characteristics argued. The parameters SnO<sub>2</sub> films investigated to assess the feasibility of their use as structural elements of a transparent thin film field effect transistor

Key words: metaloxides, sol-gel process, thin films, transparency, electrical properties

## **THE PROBLEM OF OPTIMIZATION OF DIFFERENTIAL SYSTEMS USING THE CONJUGATE STATES**

**S.L. Podvalniy, V.V. Provotorov**

Presents a study of the optimization problem from the point of view of the analysis of States of the original and conjugate systems. The necessary and sufficient conditions for the existence and uniqueness of the solution to the problem of finding the optimum. The results are illustrated with examples from practice

Key words: optimization of associated systems, necessary and sufficient conditions for the existence of the optimum

### **ABOUT APPLICATION OF THE UNIFORM LAW OF CONTROL OF THE BLOCK OF SENSITIVE ELEMENTS FOR THE INERTIAL NAVIGATION SYSTEM WITH AUTOCOMPENSATION OF ERRORS**

**S.V. Slesarenok, I.P. Shepet, A.V. Zakharin, V.I. Rubinov**

Presented Results of research of possible ways of increase of accuracy of the autonomous mode of functioning of the inertial navigation system by the operated rotation are presented by the block of sensitive elements. An object of research is the uniform law of control of the block of sensitive elements. Results of research of precision characteristics of the inertial navigation system with program rotation of the block of sensitive elements are presented. Requirements are imposed to inertial sensors

Key words: inertial navigation system; inertial measurement units; integrated flight and navigation system

### **EXPOSITION OF OBJECTS OF THE IMAGE OVER METHODS OF NUMERICAL DYNAMICS**

**E.A. Gantseva, V.A. Kaladze, A.V. Shulyaev**

The numerical analysis of images of vascular systems of an eye bottom with an estimation of their morphological indications allows to raise essentially quality of diagnostics in ophthalmology and to ensure an automatic estimation of a condition of vascular systems. Researches of a picture of an eye bottom in work are spent on the monochromatic image, that considerably reduces labour input of a numerical solution of a problem of allocation of system of blood vessels which is based on application of the developed dynamic model of vascular system in an image phase space

Key words: grey tone, phase trajectories, adaptation

### **STATISTICAL ANALYSIS OF CHOICE OF TACTICS OF TREATMENT OF CHRONIC HEART FAILURE IN PATIENTS WITH ACQUIRED DEFECTS OPERATED HEART**

**A.S. Trukhachev, E.N. Korovin**

The article discloses the use of cluster analysis and principal component analysis to streamline the process of selecting the tactics pathogenetic treatment of patients with chronic heart failure (CHF) operated acquired heart defects

Key words: Chronic heart failure (CHF), classification, principal component analysis, treatment

### **DEVELOPMENT OF THE AUTOMATED SOCIO-MEDICAL CARD OF THE CHILD FOR INFORMATIONAL SUPPORT FOR REHABILITATION PROCESS OF CHILDREN AND TEENAGERS WITH LIMITED HEALTH ABILITIES**

**T.A. Khorosheva, M.A. Novoseltseva**

The paper describes process of infological modeling and realization of the "Socio-medical card of the child" database with graphic user interface for the process of socio-medical rehabilitation of children and teenagers with limited health abilities and disabled people. The database is designed for specialists of rehabilitation centers and provides informational support for individual programs of rehabilitation

Key words: database, rehabilitation center, graphic user interface, socio-medical card of the child, individual program of rehabilitation

## **UNIVERSAL THERMODYNAMICS CYCLE AXIAL-PISTON MOTOR**

**E.L. Topalov**

The article discusses the thermodynamic cycle of the axial-piston combustion engine, equipped with turbo-supercharged engines with high power and efficiency stable with a negative fuel consumption

Key words: axial-piston motor, thermodynamics cycle

## **HARDWARE IMPLEMENTATION OF DIGITAL DEMODULATOR "AS A WHOLE" PHASE-SHIFT KEYED SIGNALS**

**A. N. Glushkov, V.P. Litvinenko, A.A. Shaforostova**

Hardware implementation of digital demodulator "as a whole" PSK signals on the basis of field-programmable gate array (FPGA)

Key words: phase-shift keying, digital demodulation, noiseless coding, FPGA, VHDL

## **RING PACKAGED GYROSCOPE WITH A SEMICONDUCTOR LASER DIODE: FEATURES OF CONSTRUCTIVE AND TECHNOLOGICAL SOLUTIONS**

**N.A. Us, S.P. Zadorozhny**

The article presents the results of a study of possible ways to create a new group optic sensors laser gyro strapdown inertial navigation systems. The subject of research are the features of constructive and technological solutions of monoblock ring gyroscope with a semiconductor laser diode that implements the Sagnac effect. Substantiated the requirements to the parts of the device gyroscope structural and technological plan. Presents comparative estimates of the parameters of the new sensor and its analog – gas ring laser gyroscope

Key words: Sagnac effect, the optical gyro, design, technology, laser diode

## **AUTO-CALIBRATION TECHNIQUE FOR MULTIBIT CMOS-SOI-DAC WITH CURRENT SOURCES**

**V.S. Kononov**

Disadvantages of factory calibration of CMOS-DAC parameters are considered. Limited abilities of known auto-calibration techniques are shown. A new auto-calibration technique is offered, based on usage of input clock signal to provide set of binary-weighted voltage references

Key words: CMOS, DAC, source, calibration

## **DESIGNING OF A CONTROL LOGIC OF 8-BIT, 75 MS/s SAR ADC BY CADENCE EDA**

**A.V. Strogonov, S.V. Zhigulsky, V.S. Pozhidaev**

A 8 bit, 75 MS/s control logic for successive approximation analog-to-digital converter (ADC) synthesized from Verilog HDL code by Cadence EDA tools is presented in this paper

Key words: control logic, ADC, hardware description language Verilog, Cadence

## **DIGITAL INTERPOLATING FILTER FOR HIGH SPEED DIGITAL TO ANALOG CONVERTER**

**S.V. Kalinichenko, V.P. Litvinenko, V.P. Dubykin**

The method of interpolation of discrete signals using multistage FIR filter is examined. The example of interpolating filter design on FPGA is realized and simulated in Matlab

Key words: interpolation, DAC, digital filtering, FPGA, Matlab

## **RING MONOBLOCK GYRO WITH SEMICONDUCTOR LASER DIODE: FEATURES OF THE RETRIEVAL SYSTEM OUTPUT INFORMATION**

**N.A. Us, S.P. Zadorozhny, A.A. Avershin**

Presents the results of research into the formation of dynamic interference pattern at the output of the laser gyro with a triangular optical system that implements the Sagnac effect. The research is original constructive and technological scheme of the optical interference mixer. Justified requirements for the construction of the mixer. Presents comparative estimates of the parameters of the new sensor and its analog – gas ring laser gyroscope

Key words: Sagnac effect, the optical gyro, mixer interference

## **SPECTRAL-EFFICIENT SIGNAL WITH THE CONTINUOUS PHASE**

**S.V. Dvornikov, S.S. Dvornikov, S.S. Manaenko, A.V. Pshenichnicov**

The paper presents the materials to study signals of gradual phase change for the transmission of digital information. Settle the procedure for synthesis such signals. We consider their spectral efficiency, and analyzes the results of the computer simulation

Key words: phase modulation, spectral efficiency, the transfer of digital data

## **DPSK SIGNALS DIGITAL DEMODULATOR**

**A.N. Glushkov, B.N. Kolbov, V.P. Litvinenko**

DPSK signals digital demodulator hardware implementation on programmable logic integrated circuits (FPGA)

Key words: phase modulation, digital demodulation, FPGA, verilog

## **MODEL OF ATMOSPHERIC OPTICAL COMMUNICATION SYSTEM WITH THE SPATIAL-FREQUENCY DIVERSITY**

**R.P. Krasnov**

In this article the of atmospheric optical communication system with spatial-frequency diversity based on carbon dioxide and semiconductor laser transmitters is considered. Dependences of receiver's bit error rate in relation to signal-to-noise ratio are received. The analysis of optimum number of diverse channels on each working wavelengths is given

Key words: FSO, laser, diversity

## **ACHIEVEMENT OF REQUIRED MICROSURFACE BY DIMENSIONAL ELECTROCHEMICAL AND MIXED MACHINING**

**V.P. Smolentsev, V.V. Zolotarev, I.T. Koptev**

Mechanism of surface layer formation by contactless electrochemical machining is viewed. Was demonstrated that roughness height of details depends on machining modes, dimensions of alloy structure. Roughness and micropits have the same cause of appearance. Their dimensions depend on proportions permanent for every material. Recommendations for choosing of instruments for measuring of roughness, depth of micropits without metallographical observations are described. These recommendations make it possible to explain choose of allowances for final operations and explain usability of different technological methods for getting details with high resistance by cyclic loadings. Mixed machining methods, their possibilities to form surfaces with required quality and calculation methods of machining modes are viewed

Key words: formation of microsurface, quality evaluation, ways to improve quality of details

## **HIGH-TEMPERATURE CREEP OF TITANIUM WHEN TESTED IN AN ENVIRONMENT CONTAINING NITROGEN**

**V.V. Peshkov, A.B. Bulkov, I.B. Korchagin**

The process of high temperature deformation of thin-walled titanium billet with a globular microstructure in argon and a mixture of argon and nitrogen. It is shown that by using a mixture of argon and nitrogen samples deformation quantity is greatly reduced due to the formation on the surface of the nitride layers. By approximating the results of calculation expressions are obtained to assess the kinetics of deformation and creep speed samples. Established range of the welding parameters, in which it is advisable to use an argon-nitrogen mixture to reduce accumulated deformation of thin-walled structures with diffusion welding

Key words: titanium alloys, thin-walled structures, argon-nitrogen mixture, deformation, hardening

## **FEATURES DESIGN AND MANUFACTURE PULLING PUNCHES FOR FORMING AIRCRAFT SKINS**

**M.V. Molod ,V.I. Maksimenkov**

This article presents the results of the design Pulling punch, providing high quality manufacturing to aircraft skins Pulling presses

Key words: boarding, punch, airplane, close-fitting, shaping

## **EXPERIMENTAL RESEARCH OF OPERATING MODES OF TURRET FEED WITH ACCUMULATOR OF MECHANICAL ENERGY**

**V.S. Semenzhenkov, M.V. Semenzhenkov**

Description of the methodology of experimental research of turret feed sheet-stamping machine and the test results had been adduced. The effectiveness of the developed design turret feed with accumulator energy was shown

Key words: feed, sensor, calibration, velocity, acceleration, power

## **AN OCCURRENCE OF A SELF-OSCILLATION IN SIMPLE CUTTING SYSTEM**

**V.S. Bykador, G.Ju. Kostenko, T.S. Babenko**

Conditions of an appearance of a self-oscillations in simple cutting system were considered in the paper. Two competing factors are delay of a cutting force and nonlinear characteristic of contact clearance face of a tool and workpiece are making the self-oscillations. We also got a self-oscillations region for two non-controlled parameters

Key words: a self-oscillations, dynamics, cutting process, a delay

## **FOR THE KINETICS OF DEVELOPMENT OF PHYSICAL CONTACT WHEN DIFFUSION BONDING OF TITANIUM**

**V.V. Peshkov, A.B. Bulkov, M.V. Semenzhenkov, S.A. Arsenov**

According to the results of experimental studies carried out on samples of titanium alloy VT14 and OT4 microprojection with model simulating the roughness of real surfaces, set the height of the microprojections influence on the kinetics of physical contact with the diffusion bonding. It is shown that an increase in the height of the microprojections decreases the speed of the physical contact, which is associated with deformation hardening of metal in the contact zone, due to localized stresses and strains in the tops of the microprojections

Key words: diffusion bonding, temperature, pressure, microprojection, physical contact