## DEVELOPMENT OF AUTOMATED INFORMATION SYSTEMS DIAGNOSIS AND CHOICE OF TREATMENT ENDOMETRIAL HYPERPLASIA

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The article deals with the construction of the automated information system of diagnosis and the type of treatment of endometrial hyperplastic processes based on statistical and neural network modeling. To build mathematical models of diagnosis and choice of treatment were used statistical data on 230 patients with endometrial hyperplasia: endometrial hyperplasia, endometrial polyp and the polyp of the cervical canal. To improve the efficiency of diagnostics of hyperplastic processes of the endometrium and assessment of the significance of clinical signs in the first stage of the study it is proposed to use a method of constructing a decision tree. The result was built several decision trees: full binary, complete with many descendants in the node a compact (binary), compact with many descendants in the node. The analysis of the obtained results was selected a complete binary tree of solutions". Testing of the constructed model was performed on the test sample, where the accuracy of diagnosis by the method of "decision trees" is 77.5 %. In the next phase of the study were obtained classification Fisher's function to supply the preliminary diagnosis for each type of endometrial pathology. The analysis and testing of classification models, it was found that the accuracy of diagnostic models based on discriminant analysis is of 85.5 %. For specification of the diagnosis in the second stage of the study built a neural network model, where it was used the neural network in the form of multilayer perceptron where the input sensor layer serves the values of the 12 signs of illness, and the output resultant layer obtained data on the type of hyperplastic process of the endometrium. Based on testing of the control group patients it was found that the accuracy of diagnosis based on neural network modeling is 93.9 %. The resulting model-based method build a decision tree, discriminant analysis and neroserial simulation are used in the automated information system, which contribute to improve the diagnosis and choice of treatment of endometrial hyperplastic processes

Key words: information systems, diagnosis, treatment, gynecology

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## THE MANAGED INERTIAL NAVIGATION MULTISYSTEM

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The analysis of a condition and prospects of development of inertial sensors allows to draw a conclusion that their development is now at such stage when the existing inertial sensors do not meet requirements for cost and accuracy any more. A perspective method of increase of accuracy of any measuring systems is the method of functional multiplexing by spatial control of measuring instruments of vector sizes. For its implementation two blocks of sensitive elements which include in the structure on three one sedate gyroscope and the accelerometer are used. By means of a control unit blocks of sensitive elements are located in space so that their vectors of errors of measurement were opposite directed. This method of management of vectors of errors theoretically allows to increase the accuracy of measurement of vector parameters of a multisystem from three component measuring instruments by 2,5 – 3,5 times in comparison with regular averaging of indications of sensitive elements. The developed management program, allows to create the working signals providing movement to the minimum value of an output mistake. In this case the amount of modules of vectors of errors will be minimum and dispersion of an error of navigation measurements considerably will decrease. The algorithm of functioning of the managed inertial navigation multisystem allows to compensate not only the main errors of sensitive elements, but also errors of determination of orientation of the block of sensitive elements

Key words: inertial navigation system, block of sensitive elements, flight and navigation complex

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## DIGITAL SIMULATION OF DIRECT TORQUE CONTROL SYSTEM BASED ON MULTI-LAYER PERCEPTRON NEURAL NETWORK IN SIMULINK

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Modified direct torque control (DTC) method, proposed in the paper, is based on artificial neural network (ANN) concept , where fast torque response with low ripple in the torque of induction motor can be achieved. The Takahashi switching table of the conventional DTC is replaced by the multi-layer perceptron neural network. Artificial neural network having inputs the torque error, the stator flux error and position of stator flux, and as output the voltage space vector. Levenberg-Marquardt back propagation technique has been used to train the neural network. Matlab/Simulink based numerical simulations have been carried out to compare drive performances with conventional control structure and proposed neural network based structure. The simulation results clearly depict, that the torque ripple has been reduced, when artificial neural network based control structure has been used

Key words: Artificial Neural Network (ANN); direct torque control (DTC); switching table

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## MULTIALTERNATIVE CONTROL OF THE EXPERIMENT USING THE MODELS OF CONJUGATED SYSTEMS

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In this article we examined general patterns of the control experiment when using accurate estimates of the gradient using models of conjugated systems. The proposed model scheme implementations for the most common formulation of the experiment, including measurements, indirect estimates, observability over the entire time trajectory or its end ( terminal) state, the presence of the researcher models of static of dynamic type. The obtained systems of modules forms the basis of mathematical software in the framework generated by the automated systems of scientific research using the concept of multi-alternativeness. In future, possible inclusion in the system of modules for space-time optimization based on the models with distributed parameters on the graph

Key words: control of the experiment, conjugated systems, model modules, multi-alternativeness

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## *Machine Building and Engineering*

### THE PLANNING OF COMBINED PROCESSES OF SURFACE LAYER MODIFICATION IN STANDARD COMPONENTS

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The article considers typical examples of the application of processing methods to achieve the required operating characteristics of key components, working in heavy-duty sites of products under adverse impact of aggressive environments, thermal flows or impulse loads. The criteria have been presented for assessing the results obtained through development and implementation of combined methods of surface layer modification.

The studies, conducted during the last decades, have shown that the investigation of the problem is being carried on in the following main areas:

- the modification of properties without stock removal in conjunction with focused combined impact upon the surface layer. First of all, it implies thermal, mechanical and chemical processes, as well as electromagnetic impacts, the composition of which within a combined technology permits to impart higher operating characteristics to components. In process of modification, nanofilms can be formed with a thickness which does not affect the change in product dimensions;

- removing the portion of the product's surface layer until the material having required operating characteristics is obtained;

- growing layers of materials with special properties, having a monolithic structure, in which the operating characteristics are achieved by imparting the required product characteristics (wear resistance, heat resistance, etc.) to components (including those made of other materials) via the parameters of coating deposited. The typical example of such technology is electro-spark alloying, which, in recent years, has become widely used as a technology of part geometry restoration and incremental layering, with each layer exceeding 1 mm in thickness. This gives reasons to claim that such a process is becoming a part of prototyping technology. Here, a fundamentally new result is achieved, eliminating the major flaw of the prototyping process, i.e. the volatility of strength characteristics, since coating deposition does not modify the properties of key components, while the layer strength is provided by the use of adaptive combined processes, usually with applying an electric field;

- depositing layers, which comprise pellets, made of conductive and insulating materials (e.g. ceramics, abrasive, etc.). This provides greater opportunities for developers in creating modern equipment, which is also essential, especially for leading domains of domestic machine construction, i.e. manufacturing aircraft and space equipment, repair of vehicles, etc.

Key words: combined processes, technology, surface layer formation, modification, operating characteristics

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## FEATURE TECHNOLOGY SHAPING METAL HONEYCOMB FOR A CASING OF A TURBOJET

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This article describes the process of manufacturing cellular panels of metal mate-rials. It revealed the possible appearance of rejection symptoms occurring in forming the panel. When is led springing-payment for parts made of titanium alloys and stainless steels. A variant of adjustment of the punch universal design by the amount of springback. The theoretical dependence, which are confirmed by experimental studies. Revealed limitations of the process of forming a flexible stretch panels in which the perforated support layer of the outer OT4-1 is due to low plasticity.

Depending ≈ 3% on the limit of the outer layer of the panel deformation values of the variants of the process of forming the panel with advanced flexible with stretching, followed by calibration and shaping in a die in UVN furnace. It provides the use of a stamp with a variable loading force which increases in the course of the punch that eliminates rejection symptoms, the appearance of which may point to the original panel molding.

In order to improve the characteristics of the resource panel, we recommend carrying out the diffusion annealing.

Results materials and geometrical dimensions of casings and filler used for manufacturing cellular panels.

When the preliminary tensile force shaping panel achieves in bearing layers in the flow-stress σт. Depending on panel loading and P-I, P-I-P must consider the strength of the co-compound layers connection plates with crushed layers panel.

Key words: Trim, punch, airplane, close-fitting, shaping.

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# *Radio engineering and communications*

## PARALLEL NON-BINARY LDPC-DECODING ON THE GRAPHICS PROCESSOR

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In this paper we propose a massively parallel implementation of the non-binary LDPC decoder based on the gras-Graphical processor (GPU) to achieve greater flexibility and scalability. Implementation displays algo-rhythm Min-Max decoding GPU parallel architecture. It describes the methodology of separating the decoding task on a heterogeneous platform consisting of a CPU and graphically gras-processor. Experimental results show that the decoder implementation based graphics processor achieves high throughput while providing more flexibility and scalability. The proposed architecture was implemented using OpenCL. This implementation is flexible and can be easily adjusted by adjusting the parameters to support different types of code, code length. Used half (620; 310) (3; 6) - regular GF (32) LDPC code, which is widely used in related research, and shows good performance error correction. Pre-representation method takes full advantage of graphics processors to speed up the processing power of non-binary LDPC decoding algorithms. The experimental results show that the proposition-adjoint non-binary low-density decoder based on the implementation of the graphics processor ustroytvo can achieve high performance, flexibility and scalability.

Key words: non-binary LDPC decoder decoding algorithm Min-Max, parallel architecture

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# METHODS OF ASSESSMENT OF THE NEAR ELECTROMAGNETIC FIELD BY THE METHOD OF EQUIVALENT MODELS

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At present, the problem of electromagnetic compatibility plays an important role in the development of electronic equipment. Most developers are trying to miniaturize electronic components, due to which the increase in the chances of failures of electronic tools. To save production time and money, it is logical and appropriate to identify problem areas of the PCB in the early stages of development. Since the article is a description of the developed method of detection of near electromagnetic field, which allows without a high cost of tests to determine the noise emitted by the circuit board in the near field. The method is based – to replace sources of PCB emissions equivalent to a variety of sources, dipoles. Procedure described in simplification dipoles matrix which includes operations such as "delete" and "association."

Key words: near-field dipole equivalent mod

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## A FULLY PARALLEL NOBINARY LDPC DECODER WITH DYNAMIC CHANGE OF SAMPLING FREQUENCY

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The article discusses the 1.22 Gbit / s in a fully parallel decoder GF (64) (160, 80), regular (2, 4) NB-LDPC code in the 90 nm CMOS. Is based on algebraic properties of the binary image functions with low degrees of check nodes (CN) and variable nodes (VN), thus, complexity and VN CN mo-Jette kept low. 960 bits of the codeword 160 are grouped into 6-bit GF (64) characters. Factor graph code comprises 160 VNs and 80 CVs. The fully parallel decoder is a direct mapping of the factor graph. Implemented a dynamic change in the frequency of sampling at the site level to the majority of the processing units have been closed long before reaching the limit number of iterations. Throughput is further improved by the design of a single-stage check node, which increases the clock frequency to 700 MHz, and the alternating variable node operations and CHECK-term node shortens one iteration of decoding up to 47 cycles. When all the processing units were strobe Rowan, the decoder stops working and moves to the next entry in order to increase the capacity up to 1.22 Gb / s

Key words: full parallel architecture, architecture the variable node, architecture the check node, non-binary LDPC decoder

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## *Physics*

## ELECTRICAL PROPERTIES OF BILAYER THIN-FILM STRUCTURES ZnO/ZnO-Fe

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Bilayer thin film structure ZnO / ZnO-Fe samples with different percentages of Fe obtained by ion beam sputtering. Temperature dependence of electrical resistivity of ZnO and ZnO-Fe layers and thermovoltaic effect of the bilayer structure ZnO thin film / ZnO-Fe samples with different percentages of Fe in the range 300 - 700 K were investigated.

Temperature dependencies of athermovoltaic effect for structures with content5 and 10 at. % Fe monotonically increase in the range 300 - 700 K. This may be due to the increase in the mobility of the charge carriers. Temperature dependence of a thermovoltaic response for a structure with a Fe content of 19 at. % in the range 300 - 600 K is a positive sign and passes through a maximum at 500 K, and at T ~ 600 K changes its sign to negative.

Analysis of dependencies, into coordinates lnU = f (1 / T), has shown that the temperature dependence thermovoltaic effect in the system is described by the Arrhenius law with an activation energy of 0.14 ± 0,01 eV

Key words: oxides semiconductors, electrical resistivity, thermovoltaic effect, thermopower

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## THE RESEARCH FACILITY FOR MEASURING OF COMPLEX MAGNETIC PERMEABILITY OF HIGH-TEMPERATURE SUPERCONDUCTORS

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The research facility for measuring the real and imaginary parts of the complex magnetic permeability of the superconductors at 77 K has been created. Its work is based on the inductive method. Inductive method is based on register the magnetic flux density changes inside the superconductor by coils which placed within the scope of the two magnetic fields - constant and variable small amplitude. Research facility allows measurements in the permanent magnetic fields of 0,15 Tesla and alternating magnetic fields with the peak value of strength $10^{-4} \div 3 \cdot 10^{-1}$ mT and a frequency of 100 Hz to 100 kHz. The experimental data is automatically registrating by universal digital voltmeter V7-78 / 1, which is controlled by specially designed software. The software reads data from V7-78/1, then implements its primary processing, and outputs results to the graphics and in the file. Experiments on samples of high-temperature superconductors $Y_1Ba_2Cu_3O_{7-\delta}$, made possible to determine the effect of the amplitude and frequency of the alternating magnetic field to the depth of its penetration into the sample and the amount of energy dissipated in this case. It was found that an increase of both amplitude and frequency of the alternating magnetic field leads to an increase in the real and imaginary parts of the complex magnetic permeability

Key words: research facility, superconductor, complex magnetic permeability, the inductive method

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## DEPENDENCE OF THE RATE OF WHISKER GROWTH, LIMITED TYPE OF HETEROGENEOUS CHEMICAL REACTIONS, THE COMPOSITION OF THE GAS PHASE AT A GREATER CONCENTRATION OF SILICON TETRACHLORIDE

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An analysis of the known experimental results on the growth of whiskers allows you to select as a defining stage of their growth, diffusion and chemical processes deliver the crystallizing substance to the liquid-gas interface. The growth system where the allocation of the crystallizing substance is accompanied by chemical transformations, we can talk about the decisive role of heterogeneous chemical reactions release crystallizing substance in the process of growth of a whisker. For silicon whiskers grown in flowing hydrogen chloride system, the dependence of the growth rate of silicon tetrachloride concentration in the gas phase. At low concentrations of silicon tetrachloride, experimental data agree with the theoretical dependence obtained in the model of whisker growth-limited heterogeneous chemical reaction. With increasing concentration of silicon tetrachloride discrepancy between the experimental and theoretical curves increasing with the degree of divergence increases. To apply silicon tetrachloride in the reactor was used the principle of bubbling hydrogen through the liquid $SiCl_4$. To calculate the concentration of silicon tetrachloride in the gas phase during the experiment used a formula, which takes into account, not change the concentration of $SiCl_4$ saturated steam during the bubbling. The experimental results are explained the changes in the concentration of silicon tetrachloride in the gas phase in the evaporator. As the flow of hydrogen through silicon tetrachloride borbater concentration in an evaporator, and its temperature decreases. Allowance for reduction of silicon tetrachloride concentration in the gas mixture provides a satisfactory agreement between theoretical and experimental results in the whole concentration range.

Key words: mechanism of vapor-liquid-solid growth, whisker, a heterogeneous chemical reaction, the concentration, the molar ratio of silicon tetrachloride to hydrogen, borbater, growth rate

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# MODELLING OF TECHNOLOGICAL PROCESSES OF CRYOGENIC LIQUID SUPERCOOLING

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In the paper was researched the industrial methods of cryogenic liquid supercooling. A mathematical model of cryogenic liquid supercooling in containers under vacuum ejector vapor space was developed. The resulting system of equations describes the thermal processes occurring during subcooling of cryogenic liquid, allowing to obtain values fluid mass, pressure, temperature, liquid phase, and the pressure and temperature of the gas phase to the selected time

To perform the automatic calculation it has been developed an algorithm based on the model that allows for given initial conditions to calculate the parameters of the cryogenic liquid in each time of ejection process with some desired accuracy. The proposed algorithm was used to writing software, which graphically displays the results in the form of tables and graphs. The time dependence of temperature, pressure, mass of liquid oxygen at the supercooling in a cryogenic tank obtained using the developed model are attached. At the checking the validity of the developed model to determine ejection process parameters generated by the model were compared according to the experimental obtained for subcooled liquid oxygen on the test bench AO IK KBHA. It was found that the calculation results have a good agreement with experiment

Key words: ejecting, cryoagent, modeling, algorithm

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## THE ADHESION STRENGTH OF THE COMPOSITE COATINGS BASED IRON

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Has been invistigated the adhesion strength of the composite coating $Fe_x(Al_2O_3)_{100-x}$ и $(Fe_{45}Co_{45}Zr_{10})_x(Al_2O_3)_{100-x}$, obtained by ion-beam sputtering, supported on steel substrate (12X18H10T). Composite metal-ceramics coating capable of providing the material in one combination of properties possessed by the ceramics and metal individually. In real operating conditions beyond the basic strength properties of the important role played by the adhesive strength of the coating to the surface to be protected. This article describes in detail methods of adhesion test for metallic coatings hardening and surface coatings describes failure mechanisms during tests with different concentrations of the metallic phase in coatings. Established, that coatings $Fe_x(Al_2O_3)_{100-x}$ и $(Fe_{45}Co_{45}Zr_{10})_x(Al_2O_3)_{100-x}$ with different concentrations of the metallic phase in scratching erased, but not peeled, that is destroyed by cohesive mechanism, associated with plastic deformation and formation of fatigue cracks in the coating material

Key words: adhesive strength, thin-film nanocomposite

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## PROSPECTS FOR DEVELOPMENT OF ALTERNATIVE SOURCES OF ENERGY: HYDROGEN IN METALS AND ALLOYS, OBTAINEDBYTHEELECTROCRYSTALLISATIONMETHOD

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Potential possibilities for hydrogen storage by using some electrochemical systems (aluminum, chromium, nickel, nickel-boron), are considered. The possibilities of formation of hydrides of metals at their catholic restoration at parallel reactions of a cation of $Me^{n+}$ и $H^+$ are discussed in this paper. It is established, that such interaction is caused by a possibility of introduction of atom of hydrogen and by its localization in structure of metal, and by ability of formation of hydrides on defects of structure of metal. It is shown that the energetic of processes of interaction of metal with hydrogen in technologies of metallurgy and electrodepositing are different therefore we discussed some of the mechanisms of interaction of hydrogen with the electrolytic metals and alloys. The exclusive role of defects of structure on which formation of Me – H communications is possible is noted. It is established that steady defects can be used for the accumulation of hydrogen in the form of hydrides

Key words: metal hydride, structural defects, internal friction, hydrogen reduction potential, electrochemical systems, ion-implanted deuterium

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## CALCULATION COMPARISON OF VARIANTS FOR PROFILING CENTRIFUGAL PUMP IMPELLER

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The comparsion of several versions of impeller of the centrifugal pump is carried out in this article. Considered Three different variants of form profiling of the impeller blade, determined by the installation angles on an inlet and at the outlet. The first option is based on the circle arch usage for definition of the blade mean line. The case of parabola applications is considered in the second option. In the third case the method of paddle profiling on points was used. The dependence of smooth changing of blade installation angle cotangent from the distance to the axis rotation has been given as the spiral equation In this specific case the meridional profile of the impeller remained invariable. Geometry of inlet and volute remained constant for all numerical solutions

Key words: centrifugal pump, impeller, ANSYS, hydrodynamic processes

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## SYSTEM OF SAFE-SEPARATION STORE FROM COMPARTMENT OF AIRCRAFT BASED ON ATTITUDE CONTROL MOTORS

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This article is dedicated to solving the problems of separation of store from compartments of the aircraft using attitude control motors. The article provides a method of creating a system of gas-dynamic control separation of store from compartment of the aircraft, which provides a guaranteed absence of a collision store with an aircraft interior components, as well as ensuring the stabilization of the cargo prior to disclosure control surfaces. For the numerical analysis of the safety separation of store and the efficiency of gas-dynamic control system established model of the movement of store from compartments of the aircraft from

the moment of rupture of rigid connection with the aircraft until disclosure control surfaces. This model makes it possible to obtain all the necessary parameters, which allows to evaluate the safety separation of store at various flight conditions of the aircraft.

In order to confirm efficiency of gas-dynamic control separation of store in the article presents the results of this system for various flight conditions of the aircraft

Key words: safe-separation, gas-dynamic stabilization, aircraft compartment, control separation, attitude control motors

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