RESEARCH TRACKING SYSTEM IN MATLAB

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For the industrial robot manipulator actuators the important performance improvement ranges from 2 to 3 times while the smooth movement of a gripper device (memory) should be maintained at the same level. Smoothness of its movement is provided by the memory, which receives the aperiodic second order transient response. The drive links of the similar robot manipulator are set up as multi-circuit automatic systems with a subordinate regulation. There are several ways to provide specific dynamic indicators of the regulation quality. The most commonly used are corrective devices (CD), PI controllers and the most promising in the recent years – the so called modal controller (MC). The possibilities to apply modern approaches to the automatic feedback systems design are not entirely investigated as of yet. A comparative analysis of the methods to improve performance with their varied parameters revealed acceptable limits of time regulation variations and the possibility to overshoot the transient response should its form is maintained. The use of PI controllers to obtain the desired quality of regulation is limited to the mutual inter-dependence between the control time, and the overshoot interval. An arbitrary variation of the coefficients modality regulator (MR) revealed a non-linear functional inter-dependence of the control time and overshoot interval based on their actual values. When comparing the sensitivity of the quality parameters of the controlling based on the transient response to 50% change of time constants (CD) and 50% change the coefficients of the (MR) – the time of regulation and the overshoot interval of the latter does not change. 50% change of time of T constant in the transfer function affects the overshoot interval and the transient process becomes oscillatory. The performance of ACS when the overshoot is not more than (0.04-0.05) % increases MR by 3 times, and the performance of ACS itself is increases by 1.8 times.

Based on the above survey results it is possible to conclude that the use of modality regulators provides the highest speed performance of the tracking (servo) system and of the management quality indicators applied. As oppose to the classical regulators, the use of MR does not bring additional inertia into the tracking (servo) system. Nevertheless, some scientific resources describe certain disadvantages of using MR, which may limit its practical application. The purpose of the present study is to find ways of eliminating these drawbacks and subsequently provide for the follow-up research on the MR application

Key words: Electromechanical tracking (servo) system block diagram of a modal controller, transient response

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MODELING OF FLOODS’ CONSEQUENCES ON THE BASIS OF FORRESTER’S CAUSE-AND-EFFECT SYSTEMS AND SYSTEM DYNAMICS APPROACH

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On the basis of system dynamics, which takes into account the causal relationships between the modeled variables, a mathematical model is developed to forecast the characteristics of floods. The graph of cause-effect relations that exist between the modeled characteristics and presented system of nonlinear differential equations was constructed. Functional inter-dependencies of the right-hand parts of the system of equations were determined on the basis of the of the existing experience of specialists. They are also reviewed as a polynomials derivative. Numerical solution of the system of equations was obtained using the Runge-Kutta method. Computational experiments, allowing for different time intervals to determine the modeled characteristics were conducted. The comparison of the characteristics of different representations of the right-hand side of the system of differential equations calculated using the model, with their real values of the Primorski Krai's floods, which erupted in August 2001, confirms the adequacy of the mathematical model applied. The results of the model can be used in the development of the information forecasting systems of the flood effects for operating and dispatching personnel of the EMERCOM

Key words: mathematical model, system dynamics, forecasting of floods' consequences

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ANALYSIS OF NEURAL NETWORK AND THERMODYNAMIC MODELS FOR FORECASTING ACCIDENT SITUATIONS

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The results comparison of the neural networking and thermodynamic models forecast within the framework of the general concept of accident-free control of potentially dangerous technological processes is the problem statement of the paper. A kind of obscure logic is applied to create a neural networking model that approximates artificial prediction procedures to the reactions of a living organism. Learning is conducted using the method of back propagation of errors using the LM algorithm. The training sample is generated randomly. The input variables in the thermodynamic model are the observations of the process, represented as Brownian functions. To assess the performance of the thermodynamic model, the Hurst index is used. The results of the comparative analysis of the neural networking and thermodynamic models of the prediction of accident situations are presented. Alongside, the function of the proximity to the accident situation of the neural networking model and the state function of the process of the thermodynamic model are compared on one graph. In the quantitative assessment of predictive properties of models, the time is compared when the function of the proximity to the accident situation approaches the value equal to unity, and the time when the Hurst index reaches the level of 0.5. The relative error of the predicted time of occurrence of an accident situation for models is 0.645%. The research presumes the possibility of using both the neural networking and thermodynamic models as part of the composite model for accident situations forecasting

Key words: neural network, thermodynamic model, forecasting, accident situations

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SELECTING SERVER RESOURCES FOR VIRTUAL DESKTOP INFRASTRUCTURE DEPLOYMENT

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Virtualization as a technological base of Cloud Computing technology provides significant economic and social advantages for educational institutions. While using server virtualization and centralized management of desktop computers server resources consolidation combined with desktop virtualization facilitates the transition to a new level of IT service delivery. Both server virtualization and desktop virtualization raise the problem of resource usage optimization.

The problem of hardware selection for Virtual Desktop Infrastructure deployment is reviewed in the article. The possibility of applying methods of integer mathematical programming to the problem of virtual machines placement on heterogeneous hardware platforms is thoroughly analyzed. A mathematical model of server platform and RAM selecting

for placement of predetermined number of virtual machines with specified RAM requirements, objective functions and constrains are suggested.

Problem solution for the proposed range of hardware server models and different numbers of hosted virtual machines are introduced

Key words: Virtual Desktop Infrastructure, integer mathematical programming, linear programming; equipment costs

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SYSTEMATIC APPROACH TO DECISION-MAKING AND SPEECH PROCESSING USING "OBSCURE PHONETIC CODING METHOD"

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The article reviews methodology of system analysis in speech recognition for autonomous information systems with a voice interface. Based on the information-theoretic approach, a new computationally effective algorithm for decision-making and processing of speech information with obscure phonetic coding was developed. Unlike traditional approaches, which involve the construction of separate acoustic models for each type of minimal speech units such as individual phonemes, it is suggested to consider the interrelations between different phonemes.

The presented algorithm is applied to the information system of intellectual support of speech information processing. Its functional scheme is also provided in the article. To increase the efficiency and reliability of the voice interface in the preliminary stage, it is suggested to conduct special trainings for system operators in order to enable them to pronounce each of the phonemes adequately. The results of experimental study of the accuracy and speed of the developed algorithm used for recognizing isolated words of the Russian language as compared to the methods based on hidden Markov models and deep neural networks are also presented. The proposed approach significantly exceeds the traditional methods of speech recognition not only in accuracy, but also in terms of recognition time and memory costs for storing the acoustic model

Key words: system analysis, speech processing, obscure phonetic coding, theoretic information approach

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MULTIAGENT SYSTEM FOR OPTIMIZATION OF COMPLEX SERVICE COMPLEXES FUNCTIONING

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The subject matter of this study in this paper are complex multistage systems with several service centers and mutual inter-dependence between tasks, the duration of which is of random value. The goal of the study is to optimize the operations of such systems by creating a schedule for their functioning. The criterion that makes it possible to use the resources rationally time-wise was chosen as a criterion of optimality. The paper formulated an optimization task that takes into account the existence of several service centers, mutual dependence between tasks, their random execution time and resource constraints. Analysis of different possible approaches to the above task showed the expediency of using multi-agent technologies. Taking into account the peculiarities of the problem, the special structure of the multi-agent system was proposed. It includes a pre-planning agent, performing the preparatory stage of forming of the schedule, intelligent agents who execute a schedule for the service center assigned to them, and the coordination agent. The paper outlines the main functions for agents of all categories. Particular attention is paid to the specific features of their interaction.

Thus, the optimization approach to the functioning of multi-stage service complexes by scheduling their work, based on the use of interacting intellectual agents and the possibility to make a sub-optimal decision within acceptable time limits was developed

Key words: multi-agent system, optimization task, scheduling

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Energetics

HEAT-ENERGY CHARACTERISTICS AND FIRE RISKS ASSESSMENT OF OIL POLYMER RESIN PRODUCTION

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Thermal energy characteristics of the basic technological production method of petroleum resin are reviewed in the paper. Paper also emphasizes the need to reduce partial vapor pressure of petroleum resin to improve the quality of the products obtained as a result of the processing. The authors suggest possible solutions of this problem, such as evacuation of technological devices or dilution of the "gas phase" with superheated steam. Various other solutions for the placement of unreacted components during the production of petroleum resin inside the device itself are also proposed.

The technique for the experimental identification of the vapor saturation pressure of petroleum polymer resin, which closely correlates with the temperature, is also introduced. The results of the experimental study of the equilibrium pressure for petroleum polymer resin depending on the temperature are presented. The analytical dependence of the equilibrium pressure and the temperature is obtained.

Fire risks assessment of production is provided. The volumetric concentrations of the vapor of petroleum resin "Pyroplast-2K", corresponding to the upper and lower limits of ignition concentration, are identified. A functional inter-dependence of the equilibrium vapor pressure and the temperature of environ, is outlined. The interval of partial pressures and temperatures, in which the ignition of the processed fluid is possible is confirmed experimentally. It is also confirmed that the greatest risk of ignition of technological raw materials appears at the stage when it is heated to the level of the operating temperature. In the basic mode of volatile components distillation, the concentration of vapors exceeds the upper concentration limit of ignition, which makes the ignition of the product unlikely

Key words: fire safety, concentration limits of ignition, distillation, saturated vapor pressure, petroleum polymer resins

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TO THE QUESTION WHETHER THE USE OF THE DIFFERENT TEMPERATURE CONDENSATION FILTER FOR PURIFICATION OF GAS STREAMS

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Paper provides comparative analysis of the prominent acting gas purification plants and justifies the expediency of using universal multi-temperature filter, which is able to purify high-temperature flows of large expenditures. Special facility which helps to purify air from aerosol particles based on a condensation filter is represented. The possibility to use the heat-base regularities in the development of industrial multi-temperature condensation filters for the purification of gaseous emissions is proved experimentally. The required inter-dependencies were determined on the basis of the observed change of the temperature difference between the working surfaces of the gas path of the filter, the varying flow rate of the contaminated gas flow through the facility and the pressure in the working channel. The high efficiency is achieved by the differentiation of the temperatures within the temperature area of the filter. The filter under investigation has a high degree of purification, low hydraulic resistance and low energy intensity. The proposed "condensational purification method" provides significant economic effects as applied to metallurgical industry, trapping out valuable products in a finely

dispersed state, removing particulate matter, heavy hydrocarbon condensate and water vapor in the oil and gas industry. Overall ten author's certificates for this particular method of cleaning as well as for the plant design were received by the author

Key words: filter, supersaturation, condensation, gas stream

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ON THE POSSIBILITY OF DEFINITION OF LOCAL MICROBONDENOUSES IN MULTILAYER POLYMERIC AIRCRAFT VEHICLES BY SINGLE-DEPTH THERMAL SCANNING

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On the basis of the nonstationary heat equation in the 2D format, a model for determining the presence of cavern bundles in the fairings of aircraft is proposed, assuming that there is no temperature gradient in the unbound region except for the convective heat input zone and the insignificant thermal conductivity coefficient of the cavern environment. Using this model, the effectiveness of thermal scanning on the example of the nose fairing MIG-29 is justified. A detailed picture of the temperature field is obtained for a short duration of heating by numerical integration of the model equations with mixed boundary conditions of the second kind on non-heated surfaces of the scanning region and of the third kind on a surface convection heated by the finite element method using an adaptive grid on the FlexPDE6 platform. The presence of an acceptable temperature contrast on the surface of the fairing for registration even by low-sensitivity thermal imagers is confirmed. The advantage of the synthesized mathematical model is the one-parameter of the Bio number, which makes it possible to invariantly apply such an approach for various geometric and thermophysical characteristics for analysis and identification of local micro-bundles of multilayer polymeric fairings of aircraft for various purposes. With the help of computational experiments, the hypothesis of a non-diffusible heating zone over the alleged site of stratification of multilayer polymeric structures is confirmed. It is shown that the model can be reduced to the 1D format by introducing an "effective" Bio number, meaning more intense heating in the zone above the peeling cavern

Key words: thermal scanning, multilayer polymer layer, stratification, cavern, thermal conductivity

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Radio engineering and communication

PROBABILITY CHARACTERISTICS OF THE ABSOLUTE MAXIMUM OF GAUSSIAN RANDOM PROCESS

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In this paper, methods are described for obtaining general expressions for absolute maximum distribution functions of nonstationary Gaussian process. Differentiable and nondifferentiable random processes are considered. It is shown that the form of the distribution law depends on the analytical properties of the process, namely, on the existence of its continuous derivative. On the basis of the results obtained, formulas are written for the probabilities of non-exceeding the threshold by stationary differentiable and nondifferentiable Gaussian random processes. As a result of solution of the Fokker-Planck-Kolmogorov equation, the statistical characteristics of Gaussian Markov or locally Markov random process are obtained. It is established that in a number of particular cases the proposed asymptotic approximations describe satisfactorily the true distributions over a wide range of values of the parameters of the random process. The obtained results are confirmed by the methods of statistical modeling; with their help the boundaries of applicability of the obtained estimates of statistical characteristics are established. The proposed approaches, with appropriate generalization, can be used to determine the limiting characteristics of non-Gaussian random processes.

Key words: Gaussian random process, distribution function of the absolute maximum, probability of barrier crossing, outliers of random process, Fokker-Planck-Kolmogorov equation.

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ALGORITHMS OF PERIMETRIC DETECTION AIDS SELECTION

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The urgency of the system solution of problems and tasks of security activity has increased greatly in recent years, which is due to many factors. Security practice shows the need in a scientifically based approach to solving problems and tasks of different objects protection.

Individual perimeter security systems can not completely solve the problem of detecting an intruder. To cover all the possible ways of an intruder's movement in practice, several systems are used. However, different systems have different values of probability of detection and probability of false alarm, and this has to be taken into account.

In this paper, we consider an algorithm for processing signals from individual perimeter protection systems. This algorithm has a simpler form and is more convenient for practical implementation than the algorithm of combinations ordering by the ratio $\Delta P_j/\Delta\overline{P}_j$. Moreover, it is always optimal, i.e. with the given probability of detection, it provides the minimum possible probability of a false alarm. At the same time, with a given probability of false alarms, the maximum possible probability of detection is ensured

Key words: perimeter protection systems, combined detection aids, signal processing

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DIFFERENTIAL BIOELECTRIC-POTENTIAL AMPLIFIER WITH ORGANIZATION OF POWER SERVO FEEDBACK

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Active suppression of noise arising during registration of biopotentials is possible with circuitry methods for constructing analog input junctions, and also by special processing of the already digitized signal inside the microprocessor. In this article, attention is given only to circuitry methods of controlling noise.

The principles of functioning of the main "core" of a biopotential amplifier - bipolar circuit- are described. Study of the basic physical operation principles of a bipolar circuit amplifying element has made it possible to identify the ways of increasing the common-mode signal suppression coefficient by the entire amplification circuit.

The variants of constructing a biopotentials amplifier with organization of power bipolar servo feedback are investigated. Advantages and disadvantages of the scheme are described.

Development of a method for organizing a power single-pole servo feedback of a biopotential amplifier is made, which makes it possible to eliminate the drawbacks of a bipolar scheme. The analysis of the principles of operation of the bipolar circuit made it possible to determine the dependence of the change in the unbalance of the supply voltage (and, correspondingly, the shift of the bias voltage) on the magnitude of the suppression of the. It is proved that when the common-mode signal appears at the input of the biopotential amplifier, a displacement of the bias voltage will occur in the bipolar circuit of its operational amplifier. This phenomenon could be compensated for by means of an additional feedback on the power of the amplifier. Due to the fact that the potential of a real power source can be modulated by the output current of an operational amplifier and the presence of internal resistance in it, a technique for constructing a biopotential amplifier has been developed, which makes it possible to increase the common-mode suppression factor due to the organization of a power single-pole servo feedback.

Simulation of seven different circuits for the construction of amplifiers was carried out. Based on the results of the simulation, it has been established that the circuit constructed using the developed technique has the largest signals coefficient. The results of simulation are verified experimentally

Key words: common-mode noise, feedback, bipolar circuit, bioelectric-potential amplifier, suppression factor

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COMPACT ACOUSTIC SYSTEMS ON THE BASIS OF ACOUSTIC LABYRINTH

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An original method for calculating an acoustic transmission line (acoustic labyrinth) is proposed, based on the method of electromechanical analogies and the representation of a transmission line in the form of its electrical analogue - a long line with an arbitrary load. It is shown that the optimal length of a transmission line is equal to a quarter of the wavelength radiated by the dynamic speaker at the frequency of its resonance in air, and the cross-sectional area is the effective area of the loudspeaker diaphragm. In this case, the input resistance of the transmission line is maximal and has a purely active character, like a parallel oscillatory circuit tuned to resonance. At this frequency, the output of the acoustic labyrinth emits energy intensively into the surrounding space, while the amplitude of the oscillations of the loudspeaker diaphragm is minimal, so that the distortions in the low-frequency range are significantly reduced. Unwanted resonances at frequencies above the main resonance are suppressed by sound absorbing material on the inner walls of the labyrinth. The design of double-band compact acoustic systems in the form of "acoustic labyrinth" with an increased level of characteristic sensitivity, calculated by the proposed method is presented. Their main parameters and characteristics are given. The design uses first-order separation filters in the low- and mid-frequency ranges and third-order in the high-frequency range, the separation frequency is 2.4 kHz. The analysis of the measurement results shows a high stability of the frequency dependence of the impedance module over the entire range of reproduced frequencies, which simplifies greatly the selection of the low-frequency amplifier. The frequency response of the developed acoustic systems has good uniformity; a slight increase in the unevenness (± 4 dB) at frequencies above 1.5 kHz is noted. Further work on selecting a high-frequency radiator, selecting the frequency of separation and the order of the separation filters will allow to improve the frequency response in this frequency range

Key words: acoustic systems, transmission lines, acoustic labyrinth

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PASSIVE RECEIVING ANTENNA DEVELOPMENT AND EFFECTIVENESS

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Direction finding devices have a number of requirements, such as range, noise immunity, reliability, efficiency, but the most important and problematic requirements are high accuracy of signal reception and sensitivity. Accuracy and sensitivity of direction finding predetermine technical capabilities of direction finding equipment. These two parameters are interrelated, the higher the direction finder sensitivity, the higher the bearing accuracy.

To improve the accuracy of direction finding it is proposed to use a passive receiving antenna in the complex, which has high parameters for sensitivity, linearity and dynamic range. In addition, using such an antenna provides a directional radio reception from a source of radio emission.

The article presents the development of a receiving antenna, which is part of the direction-finding system. Simulation of the antenna under study is carried out. During the calculations, the operating frequencies are changed and the efficiency indexes of the antenna itself are considered, such as the active and reactive components of the antenna input impedance

Key words: finding system, antenna design, feeder, antenna impedance

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METHODOLOGY FOR SCANNING DATA ANALYSIS OF NEAR ELECTROMAGNETIC FIELD

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Methodology for analyzing near-electromagnetic field scanning data is proposed, which is used to process data from a near electromagnetic field scanning hardware and software complex and allows to provide graphic interpretation of the electric and magnetic components of the near electromagnetic field, which facilitates the search for local areas in which there can be potential problems in terms of providing intra-instrument electromagnetic compatibility. In the course of the work, the creation and modeling of the object of research in specialized software was performed, which represents a modified structure of a dipole antenna on a printed circuit board. Information for processing was obtained using the hardware-software complex for scanning near electromagnetic field, the spectrum analyzer and the previously developed program designed to work as part of the hardware-software control and data acquisition complex. Information on the intensity of the electromagnetic field in the near-field radiation zone of the device under test is processed according to the proposed methodology and gradient charts of distribution of the electric and magnetic components of the near electromagnetic field are comprised. The results of computer simulation of the distribution of the near electromagnetic field and data from the full-scale experiment are compared, confirming the adequacy of the proposed methodology

Key words: electromagnetic compatibility, near electromagnetic field, near electromagnetic field scanner

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AUTOMATIC CALIBRATION OF DAC IN CURRENT SOURCES

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A digital-to-analog converter (DAC) is a device for converting a digital code into an analog signal. At present, for devices of wireline and wireless broadband communication systems, radar and satellite subsystems, high-speed and sufficiently accurate digital-to-analog converters with a small nonlinearity are required. To obtain the necessary characteristics of DACs, production calibration is performed; but calibration of the weights of multi-bit DACs in production does not solve the problem of their non-linearity, since in the further operation their accuracy deteriorates. As a result, automatic calibration has become an integral part of DACs, which is subject to increased requirements for speed and resolution. Shortcomings of production calibration do not allow, in the current conditions of CMOS technology development, to obtain a DAC with a high conversion frequency and a bit capacity of more than 16 bits. The article presents a method for automatic calibration of DAC linearity, taking into account the drawbacks of existing methods. The method under consideration is based on the use of a subchannel region of a p-channel transistor acting as a current source, as a second gate finger. The proposed solution improves the linearity of DACs by increasing the accuracy of current sources with a consistent comparison of its weights

Key words: CMOS, current-steering DAC, self-calibration, linearity

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DESIGN AUTOMATIZATION OF B19K RESISTANCE BLOCK SPICE-MODELS FROM THE POSITION OF TEMPERATURE STABILITY

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Development and improvement of methods for designing and modeling of on-board space radio equipment requires the existing nomenclature of electronic products to be electronic models or SPICE-models. Resistor blocks with planar terminals of the B19K series are quite common in the nomenclature of electronic products allowed for use in the on-board space radio equipment. The article deals with the automation of the process of forming B19K resistor block SPICE-models. It is shown that the series of resistors B19K differs not only in variety of electrical circuits, but also in individual character of the temperature dependences of resistances of the resistive elements. Explanations are given with references to the previous studies explaining the reasons for negative effect of the parameters of the resistor blocks on the stability. These reasons lead to a number of specific implementations of SPICE-models. The authors propose a methodology for creating resistor block SPICE-models, based on grouping the temperature dependences by the criterion of analogy and similarity. To generate resistor block SPICE-models, the authors developed the program "B19K", implemented in high-level TCL / Tk scripting language. The TCL / Tk Scripting procedure provides unlimited possibilities for interaction with both the user interface of the OrCAD Capture schematic editor and the database of projects in OrCAD. A test comparative analysis of the "prototype-model" has been carried out with one of the samples of the resistor block B19K

Key words: temperature stability, temperature resistance coefficient, resistor block, SPICE model, OrCAD

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Mechanical engineering and science of machines

INFLUENCE OF OPERATING CONDITIONS IN ANODIC DISSOLUTION PROCESS ON QUALITY ASSURANCE OF ELECTROCHEMICAL SHAPING

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Efficiency of electrochemical shaping is determined by its output technological parameters: productivity, accuracy of processing, quality of the treated surface. Electrochemical machinability is considered as a function of the properties of the metal of a workpiece, electrolyte, and the regime parameters of the anodic dissolution process. The influence of regime parameters of anodic dissolution on the main parameters of the process is considered in the article.

Productivity of the process or the rate of anodic dissolution of a metal is ultimately determined by the values of the anode current density and the anode current output. The ways of increasing the intensification of the process productivity are shown: vibration of the electrodes, superposition of ultrasonic field on the electrodes, application of abrasive-bearing electrolyte, combination of various processing methods, correct choice of the electrolyte composition and the main technological parameters of the process.

The accuracy of electrochemical shaping is determined by the localizing ability of the metal-electrolyte system, which depends on the composition of the electrolyte, the size of the interelectrode gap, the electrode-tool design, and the electrolysis regime. The localization capacity of the system can be increased by using a gas-liquid mixture or oxygen-containing electrolytes as a working medium, isolating the non-working areas of the electrode-tool surface, maintaining small interelectrode gaps, and using a pulsed current.

The surface roughness decreases with a decrease in the interelectrode gap size, with an increase in the feed rate of the tool electrode, with an increase in the passivating action of the electrolyte, and with an increase in the degree of localization of the anodic dissolution of the metal. When processing by impulse current, the surface roughness decreases with an increase of the amplitude current density. When the most electrochemical shaping operations are performed, the surface roughness is in the range of R_a = 2.5-0.32 μm

Key words: electrochemical treatment, modes, technological indicators

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DEVELOPMENT AND IMPLEMENTATION OF QUALITY MANAGEMENT OF LOGISTICS PROCESSES AT A MACHINE-BUILDING ENTERPRISE

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The article considers a methodological approach to the formation of a quality management mechanism for logistics processes, taking into account the recommendations of the international system of standards for quality management. The results of research into the content of the activity on quality management of logistics processes are reflected, the classification of functional logistics processes is given and a process-oriented scheme for implementing documented procedures for quality management of logistics processes is formed. Taking into account the content of the logistic activity of the enterprise, the functional structure of the mechanism for managing the quality of logistics processes has been developed, the content of the principal provisions and stages of work necessary for the development and operation of the mechanism has been disclosed. The matrix for identifying the responsibility for ensuring the quality of logistics processes has been formed. Taking into account the principle of the process approach, a process-oriented structure of the quality management mechanism for the logistics processes is built. The expediency of integrating the functional processes realized within the production management system and the quality management mechanism of the logistics processes is justified. To ensure the functioning of the mechanism, a scheme is proposed for monitoring the logistics processes with a view to timely identifying and eliminating the causes of deviations in the processes. The content of documented procedures used in monitoring logistics processes is described in the context of the content of logistics activities. The necessity in organizing a multifunctional team for quality management of logistics processes, which includes representatives of each division of the logistics service of the enterprise, is substantiated. It is substantiated that the rigid identification of responsibility between employees in the composition of a multifunctional team for ensuring the quality of the logistics processes will ensure the quality of the transferred resources by the production stages and the quality of the final result of the enterprise

Key words: management, quality, monitoring, process-oriented structure

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IMPACT TOUGHNESS OF TITANIUM WELDED JOINTS WITH OXIDE FILMS

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In this paper, the effect of oxide films formed during annealing in the temperature range 350-650 ° C on the impact toughness of welded joints of sheet titanium alloys is estimated. The initial sheet blanks had regulated gas-saturated sublayers of various microhardness. Butt welds on the sheet blanks for the purpose of excluding the edge difference factor were imitated by the automatic through penetration with a non-consumable electrode without an additive with argon local protection. After welding, pieces for impact toughness testing (KCU) were cut from the blanks according to GOST 6996-66. The center of the notch Ø2 mm was located at the distance of 1 mm from the weld line. Finally, the samples were subjected to a one-hour air finish annealing. It is shown that the oxide film formed after low-temperature annealing contributes to the growth of the impact toughness of technical titanium VT1-0. An increase in the finishing annealing temperature reduces the KCU values of technical titanium to the initial state without annealing. For a high-strength alloy VT6ch, a beneficial effect of the surface state after annealing at 650 ° C was noted. The prevailing influence on the nature of the dependence of the toughness on the annealing temperature is due to internal structural changes that occur during annealing, not the surface state

Key words: titanium alloys, annealing, oxide films

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CALCULATION OF JET PARAMETERS IN COMBINED HYDROABRASIVE PROCESSING

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The paper presents the analysis of a possible trajectory of the jet movement in combination with anodic dissolution of the surface layer during the final hydroabrasive treatment of geometrically complex surfaces, for example, aircraft engine

blades. To do this, a volumetric model of a blade airfoil and transition areas of jet blades, turbo-pump units of rocket engines and other types of turbomachines is used. The analysis has shown that the proposed combined process is most effective for parts with limited access to the tool working area where the developed jet machining method has significant advantages.

A mathematical apparatus for automated control of the jet was developed for complex sections processing, which made it possible to form trajectories circumscribing smooth bends given by the table method (by points).

The analysis of the possibilities of finishing jet machining is performed taking into account the influence of the assumptions made when developing the software product on the accuracy of the profile. It is shown that with the use of modern equipment for combined jet hydroabrasive processing, it is possible to provide high accuracy, to accelerate the process of technological preparation of production, and to expand the area of effective application of combined hydroabrasive processing onto science-intensive products of modern technology

Key words: jet, waterjet combined processing, software, mathematical apparatus, trajectory.

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Physics

MEASURING TEMPERATURE ON THE TOP OF THE CONE WHISKER AT THE POINT OF TRANSITION TO CYLINDRICAL GROWTH

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The growth of whiskers is a multi-stage process, accompanied by a heterogeneous chemical reaction. The temperature effects on their growth process can be significant. Filamentous crystals grow as conical structures. Normally, their taper comprises 10^{-3} to 10^{-4}. The geometry of the crystal must be taken into account when calculating the temperature of the melt at its apex. Proposed is the model for the heat transfer of a long conical whisker in the case of its steady growth, provided that the taper is small and its diameter can be neglected. The heat balance equation includes: heat fluxes due to phase transitions at the gas-liquid and liquid-crystal boundaries, the thermal effect of the chemical reaction, and the convective heat sink from the lateral surface. It is assumed that the temperature in the radial direction of the whisker is constant, since its transverse dimension is less than 100 μm. The model of the thermal balance of a long conical filamentary crystal makes it possible to estimate the temperature dependence at its vertex from the radius of the crystal and the temperature distribution along its length. As the radius of the crystal decreases, the temperature at its apex drops, approaching zero, as a result of an increase in the proportion of the lateral surface. With an increase of the whisker taper, the temperature at its apex decreases as a result of the heat sink increase in the surface and in facilitating thermal conductivity with an increase in its cross section from top to bottom. For a single, long, conical, nanoscale filamentary crystal, the effect of thermal effects on the temperature of the vertex is not significant

Key words: whisker, heterogeneous reversible chemical reaction, whisker taper, heat flux, heat balance

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CRYSTAL OSCILLATIONS CAUSED BY THE PIERLS STRESS

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Based on self-consistent dynamical theory of small oscillations of a dislocation clusters the “Lagrangian specifications” definition is extended to “the cluster of continuously distributed dislocations” in the paper presented. As a sample of this cluster the construction of the wave equation of the “Peierls Stress” (PS) is considered by the authors.

In the framework of the Peierls model the distribution of dislocations in a slip plane is determined by the energy mismatch insertion into the Lagrangian. As we convert it into quadratic in the dynamic variables of the form and then use the principle of stationary action it makes it possible to obtain the equation of oscillations of a crystal, which for a straight dislocation is converted to an integral equation of oscillations of a dislocation. For sinusoidal approximation of Peierls’ relief it is possible to reduce this equation it to a differential equation of the second order. The function, which appears in this case is the same as the extended inverse susceptibility of a duplex border.

Based on the numerical solution of equation spectra of oscillations in PS was investigated. Hence, it was discovered that for an edge dislocation within the limits of the high frequency limit the phase velocity of the oscillations approaches the speed of transverse sound, and the oscillations themselves obtain the anti-phase features, i.e. the PS edges fluctuate in anti-phase with its central part. Similar results were obtained for a local frequency of a screw dislocation, but in this case, the phase velocity slightly decreases. The calculation results for intermediate (mixed) dislocations show that in the long-wave asymptotics the PS gets shifted as a whole. Analysis of the dependence of the phase velocity from the changes in the share components shows an increase in phase velocity with increasing wave number.

The explicit expression of the extended susceptibility of PS in the long wavelength approximation is determined. The results obtained correlate well with the similar expression for a linear dislocation, however their correct definition of the parameter corresponding to the radius of the nucleus and form a high-frequency dependencies of the arguments of the logarithmic multipliers are different

Key words: Peierls Stress (PS), generalized susceptibility

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ELECTRICAL EXERTION FEATURES IN Ni-MgO AND $(In_2O_3/ZnO)_{83}$ HETEROGENEOUS SYSTEMS DISPLAYED AT LOW TEMPERATURES

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Paper studies the electrical features of the Ni_x $(MgO)_{100-x}$ granular composites and the $(In_2O_3$ / $ZnO)_{83}$ multilayer system displayed at low temperatures. In samples of Ni_x $(MgO)_{100-x}$ the resistance increases with decreasing temperature in the range of 77-280 K up to the percolation limit , which is typical for granular metal-dielectric systems. As nickel concentration reaches sufficient level to form a percolation cluster based on the temperature inter-dependence of the resistance at ~ 190 K, the following discrepancy is observed - temperature coefficient of resistance changes due to the effect of quantum corrections based on the conductivity (the effect of weak localization). The resistance of the samples of the $(In_2O_3/ZnO)_{83}$ multilayer system reduces with decreasing temperature throughout the interval 280-77 K. Considering that the effect of weak localization is observed in amorphous In_2O_3 films at 110 K, the same result is also anticipated in $(In_2O_3/$ $ZnO)_{83}$ samples. It occurs at 280 K temperature, so the increase in resistance during cooling is due to this effect as well. A significant increase in the temperature of the weak localization effect in comparison with the values characteristic of amorphous In_2O_3 films is observed due to the presence of a large number of electron scattering centers at the In_2O_3 - ZnO interface. In this case, the electronic transportation in the samples $(In_2O3$ $ZnO)_{83}$ is carried out mainly by In_2O_3 layers

Key words: weak localization, composite, electrical conductivity, multilayer system

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INFLUENCE OF THICKNESS OF WATER FILMS ON THE STRUCTURE OF COMPOSITE BUILDING MATERIAL BASED ON PHOSPHOGYPSUM

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There are various ways of phosphogypsum processing nowadays. At present, the authors of this article are developing the technology of unfired cement-free building materials based on phosphogypsum. That requires adjustments to start the production of wall partitions in industrial volumes. The advantage of the developed technology is lower labor, energy, and time costs, as well as lower cost of the final material due to the use of cheap components of the mixture. The analysis of phosphogypsum processing technology with the use of firing, boiling in gypsum boilers and autoclaving is carried out. These studies did not lead to widespread use of phosphogypsum. The waste of phosphogypsum continues storing in dumps, which requires a large amount of land and is an environmental problem. The technology of unfired cement-free building materials based on phosphogypsum, developed by the authors of this article, is based on the mechanism of influence of the thickness of water films on the processes of structure formation between nano- and micro-sized particles of the building composite. The data of differential scanning calorimetry, X-ray phase, and microscopic analysis confirm the hypothesis that the thickness of water films influences the formation of nano- and microstructures for quartz surfaces at temperatures of 60 - 65 °C and works well in any hydrated hydrophilic systems

Key words: technology, unfired cement-free effective building materials, phosphogypsum, structure

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