MATHEMATICAL MODELING — APPLIED ASPECTS

STABILITY OF A MULTI-STEP RECOVERY PROCESS WHEN CATASTROPHE VARYING INTENSITY

page 4–5

The actual problem of simulating the operation of the «Man — Machine — Environment» system, that is the process of the object recovery after the environmental disaster is considered, provided the recovery is made by one of its sub-systems, that include humans. The model differs significantly from the classical theory of reliability. The work is devoted to modeling of multi-step restoration process of an arbitrary nature object with non-stationary Poisson stream of events (accidents) and exponential intensity of recovery process. It passes a fixed finite sequence of phases — the states and is described by the Kolmogorov probabilities for these states. The cases of ergodic and absorbing chains with continuous time are considered. Some of the states in the chain indicate the efficiency of the operator in elimination the accident. It is assumed that the efficiency of the operator cannot recover during the process of eliminating accidents. According to the verbal descriptions of the object, graphs of states are drawn, and in accordance to them — the Kolmogorov equations and their stationary solutions. The resulting figures of numerical solutions allow us to determine the time of the process stabilization. For actual input data the following resulting probabilities are obtained: for trouble-free operation of the facility, for a fatal accident and for disaster recovery.

Keywords: Markov chain, Kolmogorov equations, maximum entropy.

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MATHEMATICAL MODEL OF CHAOS, CAUSED BY INTERNATIONAL TRADE

page 6–7

The basic effects and patterns that characterize the Keynesian model of business cycle have been modeled using the system of linear differential equations. The solutions of the system, which describes the interaction of two or three states are found, and stability of this system was investigated. The majority of economic processes proceed in time. Owing to this, corresponding mathematical models are basically dynamic and nonlinear. The similar phenomena were observed in 4 dimensional models for economies of two states. Thus the required combination of parameters has been found, and the hypothesis of chaos as a result of globalization has been proved to be true, even for the elementary models.

Keywords: Keynesian model, stability problem, phase space, attractor, chaos.

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CHLORINE AND HYDROGEN CHLORIDE GAS EMISSIONS CLEANING IN VINYLCHLORIDE PRODUCTION

page 8–10

The paper gives the data on mathematical modeling of simultaneous absorption of chlorine and hydrogen chloride by alkaline solutions. The mathematical model of the process includes the system of differential equations of component-wise material balance and the system of kinetic equations. The system of material balance equations describes the change in concentrations of components along the column height. For its solving it is necessary to know the numerical values of chemisorption acceleration coefficients. They are determined from the system of equations describing the kinetics of chemisorption. The gradients of components concentrations create various conditions of mass transfer processes along the height of the column. This leads to the fact that in one unit there can be various zones of chemisorption process along the height of the packed layer. Each zone is characterized by its reaction order for absorbing component and its kinetic constants. Various zones of the course of binary absorption with chemical reaction were considered. Taking into account the zones, the mathematical model of chemisorption was designed for the countercurrent packed absorber. The peculiarity of the developed mathematical model is the lack of iterative algorithm for calculation. The use of band mathematical model of chemisorption of two gases allows calculation of similar columns at the stages of design and research of industrial processes. The results can be used for calculation and optimization of existing columns of gas emission neutralization in organochlorine production.

Keywords: band model, absorption, chemisorption, chlorine, hydrogen chloride.

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THE USE OF B*-TREES TO CREATE AND CALCULATE OLAP CUBES USING A COMBINATORIAL ALGORITHM

page 10–12

The paper considers the approach to building a multidimensional OLAP cube in the form of B*-tree structure, and the algorithm of its creation, using a combinatorial approach to the calculation of aggregate values of the cube. The main objective of research is to develop the methods of effective materialization of OLAP-cubes for further integration with the models and methods of Data Mining. The proposed storage structure of multidimensional data allows solving the problem of data irrelevance; it is suitable for both dense and sparse cubes, and the proposed algorithm allows efficient calculation of aggregate values of the OLAP-cube. The research results can be applied in various fields, which use database management systems, as well as in decision support systems, using the methods of business intelligence.

Keywords: OLAP, multidimensional cube, fact table, dimension table, B*-tree, level of detail, combination, aggregation.

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TEMPERATURE FIELD MODELLING WITH DEPENDENCE OF PHYSICAL CHARACTERISTICS ON TEMPERATURE

page 12–15

The model of a metal plate heating by laser beam, taking into account the dependence of density, heat capacity and heat conduction of material on the temperature, is considered in the paper. For describing the temperature distribution, three-dimensional nonlinear unsteady heat conduction equation is used. For its solution the coordinate-wise splitting method was used, which reduces the three-dimensional problem to a sequence of one-dimensional. At each time step, a system of nonlinear algebraic equations is formed, for its solving the Newton's method was used. The system of linear algebraic equations with a tridiagonal matrix is formed at each irteration. For reducing the dimensionality of generating systems, the method for constructing adaptive difference grids was used, in which nodes are concentrated in the areas of large solution gradients. The model can be applied to compare the results obtained with regard to the dependence of physical characteristics of material on the temperature and without it.

Keywords: three-dimensional unsteady nonlinear heat conduction equation, coordinate-wise splitting method.

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MODELING EXTRACTION PROCESS USING ALGEBRAIC PROPERTIES OF DIFFERENTIAL SPECTRA

page 15–17

The following article is an example of modeling the one-dimensional diffusion process, which describes the extraction process, with the use of the method based on the algebraic properties of the differential spectra. The goal of the research was the modeling of an unsteady physical process to reduce the error from the modeling over a long period of time. Application of physical modeling of non-stationary processes in the area of differential images with the limited amount of discret in the differential spectrum, foresees imposition of the condition under which a modeling step is determined from the expression of estimation from above design errors according to Lagrange. We compared the results according to the known methods and found out that this process allowed the reduction of the calculable complication and the increase of the precision of the physical process design to the set level. The research results can be useful during the design stage of the extraction apparatuses for increasing the modeling process's efficiency to optimize the extraction, formulation

and solution of the production intensification problem. The usage of the method based on the algebraic properties of the differential spectra allows can more accurate reproduce the characteristics of the physical processes of extraction and the complexity of the relationship between their parameters.

Keywords: extraction, diffusion, differential transform, algebraic properties, boundary value problem, the accuracy of modeling.

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SYSTEMS ANALYSIS IN PREDICTION OF INTERRELATED RANDOM PROCESSES

page 18—19

The paper draws attention to the need for applying systems analysis in the prediction of interrelated random processes, the need for focusing on the creation of systems methodologies in the prediction problems. For studying and analyzing the problem of structural identification in creating mathematical models of prediction there is a need to involve the experts with various fundamental knowledge and practical experience in the implementation of projects in their respective areas. In researches on the problems of structural identification of mathematical models of prediction, special attention should be paid to the human factor. Owing to the development of computers and modeling techniques, among which various decomposition methods and models get a widespread use, the systems studies of the problem of structural identification of predictive models are needed for the prediction of interrelated random processes.

Keywords: processes prediction, structural identification, systems approach, systems methodology, systems analysis.

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ENERGY APPROACH IN MODELING POPULATION DYNAMICS

page 20—21

To understand the functioning mechanisms and problem solutions of the use of populations, information about their structure is of great importance. The study of regularities of animals population dynamics is needed to create a scientific basis of the rational use of pest destroying animals and pest control. Herewith, mathematical methods, in particular modeling, are used. Among the population dynamics models, the Verhulst's logistic function (1838) is the most widespread in mathematical ecology. It is used to describe both the behavior of populations and their interaction, for example, in the Lotka-Volterra equations. Recent studies have shown the impossibility of using the logistic models in predicting the development dynamics of objects of different nature. The methodology for constructing mathematical models of population dynamics is proposed in the paper. It is fair for mathematical description of objects of different nature. Systematology is the theoretical basis for the construction of mathematical models.

Keywords: logistic model, population dynamics, systems theory, energy approach.

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TECHNOLOGY OF ORGANIC AND INORGANIC SUBSTANCES

INFLUENCE OF PROCESSING TIME ON ETHANOL DEHYDRATION

The paper gives the analysis of ethanol dehydration by using a solid adsorbent, which is capable of forming crystalline hydrates by means of chemical bonding of water molecules with its further formation. The main objective of the research was to study the process of crystalline hydrates formation, as well as another type of interaction with water — hydrolysis.

Ethanol, almost free from water, was obtained using one of the salts of phosphoric acid — sodium hydrogen phosphate, containing one hydrogen atom and two atoms of sodium. Thus, the selection of sodium hydrogen phosphate as a salt was due to its ability to form crystalline hydrates of several compositions. To confirm this phenomenon, the volume fraction of ethanol depending on the time was analyzed.

As expected, the results showed gradual formation of crystalline hydrates of various compositions. The volume fraction of water was measured during the study by Karl Fisher titration.

The research results can be used primarily in the manufacture of biofuel for transport vehicles. Thus, the use of solid-phase adsorbents can provide dehydration of ethanol to almost dewatered state. Herewith, there is no need to use sophisticated equipment (e.g. to shift the azeotropic point) for water distillation, or to shift the azeotropic point of water, for example, by introducing a third component — benzol.

The analysis of ethanol dehydration allows selecting the most effective length of time for dehydration.

Keywords: adsorbent, ethanol, crystalline hydrate, water, processing.

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DEPENDENCE OF ANODIC TITANIUM (IV) OXIDE PROPERTIES ON ACTIVATOR COMPOSITION

The process of obtaining a secondary carrier of catalytically active substance for its application in catalysis was considered and some results of our research in this field were given. The main objective of the study is to examine the dependence of properties of titanium (IV) oxide, obtained by anodization method, on the activator composition.

Porous titanium (IV) oxide layer was obtained by titanium plate anodizing in electrolyte consisting of aqueous solutions of sulfuric acid and activator. By changing the activator composition its effect on the properties of secondary carrier and optimal anodizing time was studied.

The presented method allows estimating the dependence of thickness and porosity of the obtained secondary carrier and optimal anodization time on the activator composition.

The results of the study can be used in electrochemistry and catalysis for improving the process of obtaining secondary carrier for catalytically active substances.

We propose to improve the process of getting secondary carrier for catalytically active substances on the surface of titanium plate using more efficient activator.

Keywords: titanium anodizing, activator, ionic radius, titanium (IV) oxide layer, thickness, porosity.

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OBESITY IS THE ILLNESS OF XXI CENTURY

The research shows the problem of overweight, in particular, obesity as the epidemic of modernity. The causes and factors leading to overweight, obesity and their consequences were analyzed. The main objective of the study is to analyze and promote information about various methods to combat overweight, review medical knowledge obtained from different sources and spheres of activity, develop products for overweight people. The obesity may be caused by poor nutrition, heredity, hormonal failure, etc. As a result, it leads to various human diseases: diabetes; hyperlipidemia; cardiovascular diseases (ischemic heart disease, arrhythmia, myocardial infarction, atherosclerosis, hypertension, stroke); cancer; thromboembolic diseases; increasing the concentration of hemoglobin; various skin diseases, psychosocial disability; varicose veins; indigestion. It was found that the main methods for overweight and obesity treatment are homeopathic, medical and surgical treatment. It is possible to prevent the disease with the help of a diet with a high content of fiber, vitamins and other biologically active components and limited eating of easily digestible carbohydrates, as well as physical activity. It was determined that the efficiency of weight-loss drugs on the market of Ukraine mostly does not correspond to the advertisement promises.

Keywords: overweight, obesity, problem, weight-loss drugs.

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BIOCIDAL ACTION OF COMBINED AGENTS BASED ON POLYHEXAMETHYLENE GUANIDINE

The paper gives the comparative evaluation of the effectiveness of the use of disinfectants of different chemical groups. It is noted that one of the most promising groups of disinfectants is polyhexamethylene guanidine (PHMG). To increase the effectiveness of its action it was proposed to create new combined biocidal agents based on PHMG with $(NH_4)_2S_2O_8$ and H_2O_2 and investigate their antimicrobial properties. Antimicrobial action of disinfectants based on polyhexamethylene guanidine salts in combination with hydrogen peroxide and ammonium persulphate was determined in relation to the test-cultures of microorganisms (Escherichia coli IEM-1, Bacillus subtilis TU-2, Staphylococcus aureus BMS-1, Candida albicans D-6, Aspergillus niger R-3). A comparative evaluation of combined biocides based on PHMG, $(NH_4)_2S_2O_8$ and H_2O_2 on bacterial, fungal microflora was conducted and minimum inhibitory and biocidal concentrations of these drugs were determined. This will allow the improvement of the efficiency of sanitization by combined disinfectants.

Keywords: polyhexamethylene guanidine, disinfectant, combined biocide, microorganism, antimicrobial action.

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ENVIRONMENTAL COMPONENT OF PRODUCT LIFE CYCLE ASSESSMENT

The methods of environmental assessment of products were analyzed in the paper. The basic stages of the product life cycle assessment were given. The index method was proposed to assess the ecological impact of the product on the environment throughout its life cycle. The index method involves obtaining the estimates in the form of dimensionless parameters by simplified mathematical dependences for easy implementation and use of these estimates by relevant regulatory authorities and provision of product information to the consumer. According to the algorithm it is proposed to evaluate the impact of the product throughout its life cycle on the environment using four index indicators, namely the unitary index of surface waters pollution, unitary index of air pollution, unitary index of soil pollution and unitary index of waste formation. Based on these indexes, the unitary index of effects on the environment is formed, which allows making conclusions on the adverse impact of the product on the environment during all stages of its life cycle.

Keywords: life cycle assessment, index assessment, environmental assessment of the product, environmental impact.

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PRECISION AFFINAGE OF COPPER FROM CROW-BAR AND WASTES

The model of the deep copper refining from the secondary raw materials using methods of physical and chemical analysis was considered. The theoretical and experimental results of copper refining from the secondary raw materials using phosphide Cu_3P were proposed. The copper phosphide Cu_3P was added into melting during fire refining. The copper phosphide Cu_3P influence on the refining level was estimated on the tin, lead, zink and antimony impurities. Reactions analysis showed that the Cu_3P addition helps to form stable oxidiger P_2O_5 and copper oxides recoverability. It was determined that the reaction, of conversion the remaining impurities into slag place at the first stage by P_2O_5 formation and was followed by phosphates of lead, zinc and tin impurities formation.

Keywords: melting, fusion, five refining, impurities, copper phosphide Cu_3P.

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INFLUENCE OF HUMIDITY ON REMOVAL OF $TiCl_2$ FROM MOLTEN SALT AT THE ELECTROLYSIS OF $MgCl_2$

The results of the study of the effect of titanium chloride during the electrolysis of molten magnesium chloride after reduction of titanium chloride are given. It was found that the humidity of molten chlorides has a significant effect on the removal of titanium from the melt. The results of processing the results of experiments allowed the building of regression equation. It is shown that moisture in the salt has a significant effect on cleaning the electrolyte from titanium impurities. Analysis of the results of experiments of the content of magnesium oxide showed that it does not exceed 0.05% by weight that is an indirect proof of reactions between magnesium oxide and titanium compounds. To effectively remove the titanium compounds from the molten salt it is proposed to load the moistened salt in the head unit of production line or in a separate working electrolyzer during the filling of the next portion of magnesium chloride.

Keywords: electrolysis of magnesium, production line, lower titanium chlorides, factorial experiment, humidity.

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IMPROVING THE EFFICIENCY OF COMPLEX STEEL DEOXIDATION

The mechanism of carbon removal at the initial stage of processing the chromium steel scrap was considered. The results of thermodynamic analysis of the processes of decarbonization and deoxidation of steel were given. For improving the deoxidation efficiency, physical-chemical analysis of combinations of metals and their interactions with the dissolved in the melt oxygen was made. Complex deoxidizers based on aluminum with silicon and barium are quite effective. Thus, the possibility to increase the efficiency of the complex based on metal with lower affinity for oxygen from the metals with higher affinity for oxygen of a series of affinities was established. Explanation of the obtained results based on the model which takes into account the equilibrium of reactions between the metal-deoxidizer and dissolved oxygen was proposed. The use of complex deoxidizer improves the kinetics of deoxidation and reduces the number of non-metallic inclusions.

Keywords: steel, carbon, deoxidation, physical-chemical analysis, oxygen, affinity for oxygen, equilibrium of chemical reactions.

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STUDY OF VESICULATION IN INTUMESCENT MATERIAL

The patterns of vesiculation in hydrosilicates are considered in the paper. The main objective is obtaining overall dependencies of vesiculation in the intumescent material based on silica to develop a strategy of production of heat-insulating materials with a structure close to optimal. General regularities of porous structure formation in foam mass with various chemical components are given. General conclusions on the influence of impurities in the initial mass on the process of material intumescence are made. It was also concluded that the change in the local moisture content does not affect the overall vesiculation process, since the rate of moisture diffusion in the material exceeds the vesiculation rate. In addition, a series of experiments on the effect of aluminium on the vesiculation of alumina material was carried out. Small additives of aluminium increase the strength characteristics and porosity in siliceous mass with small amounts of impurities.

The results can be of interest to scientists and engineers dealing with the production of refractory materials.

Keywords: porosity, material structure, heat-insulating material, intumescense.

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THE THEORETICAL APPROACH TO THE DESCRIPTION OF THE EXTRTUSION PROCESS OF THE COMPOSITE ORGANIC RAW MATERIALS

Currently the usage of screw extruders for the processing of organic composite materials (WPCs, fuel briquettes, extrusion feed and food products, biodegradable plastic products, organic-mineral fertilizers) becomes a relevant question in the chemical industry. The actuality of the extruder's research confirms large number of publications and patents, many of which are focused on the practical aspects of the usage of the extruders and material's transformation processes in the extruder.

The aim of this work is the developing of theoretical approach to the study of the extruder's pre-matrix zone during processing of

the organic composite materials. Within the theoretical approach the movement of raw materials in the pre-matrix zone is considered as the fluid motion in a coaxial confusor that needs to be supplemented by information on the rheological characteristics of the raw materials, taking into account the thermal effects.

Further theoretical and practical studies should determine the rheological properties of the concrete types of raw materials, the real boundary conditions of flow and ensure the accounting of thermal effects.

Keywords: composite organic raw materials, before the matrix zone, coaxial confusor, single screw extruder.

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ANALYSIS OF UTILIZATION OF WASTE

page 43—45

Based on the results of environmental monitoring established in Ukraine, a substantial amount of waste wood that is not used and only pollutes the environment. Developed and proposed acquisition of pellets that can be used as fuel. Determined the optimal ratio of waste wood and binde , which acts as waste paper mill. Based on the proposed method to obtain pellets, which can be used as fuel. This will reduce the use of the basic fuels. The analysis showed that the pellets produced by extrusion with the addition of a binder according to indicators such as the dynamic and static power, heating value, and efforts to form them, match those of the granules obtained using a pellet press, and in some cases even exceeded them.

Keywords: environmental monitoring, the extrusion method, pellets, wood waste, the calorific value.

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ANALYSIS OF THE IMPACT OF MAGNETIC FIELD ON THE PROCESS OF SEPARATION IN THE HYDROCYCLONE

page 45—47

The analysis of field distribution in magnetic hydrocyclones of different configurations was conducted. Technical solutions of magnetic hydrocyclones were demonstrated based on the hypotheses of magnetic field impact on the separation of particles in the working chamber. The effect of magnetic force and coagulation forces that influence on the particles in the working zone of inertia-type apparatus was showed. By the calculation of centrifugal and magnetic forces for various particle diameters during the change of magnetic field intensity (40 kA/m, 0,1 MA/m and 0,4 MA/m) it was proved that coagulation is the determining factor in increasing the efficiency of hydrocyclone operation. It was calculated that the force of magnetic adhesion of the particle to the pole of electromagnetic system is by the orders of magnitude smaller than the centrifugal force. The results can be used in the design and development of new devices for viscous media cleaning from mechanical impurities for less material and energy expenditures.

Keywords: hydrocyclone, magnetic field, coagulation, floccula, centrifugal force.

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PROBLEM OF ECOLOGICAL SAFETY OF AQUATIC ENVIRONMENT IN CONDITIONS OF ANTHROPOGENIC EUTROPHICATION

The state of any aquatic ecosystem, its trophic level, pollution degree and other constituents of environmental monitoring are reliably characterized by means of studying and monitoring the species composition and the number of planktonic algae. The most typical negative anthropogenic impact on the aquatic environment is drastic propagation of phytoplankton, called «algal bloom». It is caused mainly by the flow of nutrients into the water, which stimulate the intensive propagation of algae. Another factor that influences phytoplankton propagation is temperature. In this regard, the important question is the effect of temperature on the dynamics of phytoplankton expansion in aquatic ecosystems.

The correlation analysis of algae propagation depending on the water temperature in a water intake (for example, the reservoir of the Teteriv River, a tributary of the Dnieper River) was made in the paper. The analysis indicated a significant influence of the temperature on algae propagation that allowed using trigonometric series in mathematical description of the dynamics of their propagation.

According to the studies, an adequate mathematical model describing the dynamics of phytoplankton expansion in aquatic ecosystems was developed and its adequacy (model relative error) was estimated. The analysis of the relative error shows that the developed mathematical model adequately describes the dynamics of phytoplankton expansion in aquatic ecosystems. It should be noted that the proposed model can be simplified. However, this will increase the relative error, and, therefore, the model will not adequately correspond to the original.

Keywords: phytoplankton, seasonal changes, anthropogenic eutrophication, «algal bloom», mathematical model.

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THE ANALYSIS OF SANITARY QUALITY OF OUTPLANT DRINKING WATER

Sanitary state of drinking water quality is important because pathogens of many infectious diseases are transmitted through water. Ground water as a source of decentralized water supply is also affected by microbiological contamination. Microorganisms that have reached the groundwater are long stored and hard to remove from aquifers. The main objective of the study is to assess the sanitary state of drinking water of decentralized water supply.

High concentration of sanitary indicator microorganisms, namely Escherichia coli, indicates the contamination of water and possibility of content of pathogens and viruses. Therefore, E. coli was determined in water during the study.

The analysis of the sanitary state of drinking water of decentralized water supply showed unsatisfactory state of groundwater and, therefore, it may cause infectious and noninfectious human diseases. The growth of the coli-index and total microbial count depends on seasonal changes, so the wells in the studied areas should be monitored by microbiological indicators, especially in spring and autumn. For cleaning and restoring the wells, disinfection should be held, especially in spring.

Keywords: ground water, total microbial count, coli index, epidemiological indicator, decentralized water supply.

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THE INFLUENCE OF ORGANIC ACIDS AND FUNGICIDES ON SCOTCH PINE AND PENDUCULATE OAK IN FOREST NURSERIES

page 51–54

Recently, the problem of increasing the productivity of forests is solved not only by selection and genetic methods and fertilization, but also by using the phyto-pharmacological plant protection products — natural or synthetic compounds, which at low concentrations can lead to significant changes in the growth and development of plants.

When growing the standard seedlings of Scotch pine in nursery conditions, they are massively affected by the pathogens of Fusarium spp., Alternaria spp., Botrytis spp. One of effective ways of increasing the resistance of plant material to these pathogens is treatment of seeds and seedlings with solutions of anthranilic and acetylsalicylic acids.

The seedlings treated with the fungicides «Derozal», «Altosuper» and «Falcon» have maximum resistance to root rot pathogens, lodging of seedlings, powdery mildew, fusariose of scotch pine (Pinus silvestris) and pedunculate oak (Quércus róbur) in Ukrainian Polissia.

The treatment of plants with the fungicides «Derozal», «Altosuper» and «Falcon» by reducing the degree of exposure by fusariose and downy mildew increases the productivity of photosynthetic active surface, leading to an increase in plant productivity.

Keywords: pathogens, acetylsalicylic acid, anthranilic acid, fungicides.

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MECHANICAL ENGINEERING TECHNOLOGY

REGULATORY SUPPORT OF CALCULATION OF DIMENSIONAL CHAINS IN ASSEMBLING WITH THERMAL INFLUENCE

page 55–57

The article deals with regulatory support of assembling accuracy with thermal influence of multi-element junctions due to the calculation of dimensional accuracy at the stage of technological preparation of production with regard to temperature gaps formed during heating and assembling of product elements. The analysis of processes that take place under the influence of temperature in the contact zone of mounting surface of parts of multi-element junctions was conducted in the paper, as well as mathematical modeling of the thermal state of the product was carried out and the regularities of the temperature gap change were determined through the use of existing systems of computer-aided engineering analysis. Based on the analysis, an improved formula for calculating the dimensional accuracy of the assembly was obtained and classification of the «bush» type parts with models of determining the temperature gaps, which are included in this calculation, was proposed.

Keywords: regulatory support, assembling quality, dimensional accuracy, thermal influence, temperature gap.

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METHODS OF RESTORATION AND HARDENING OF AGRICULTURAL MACHINERY PARTS

page 57–59

The paper deals with the methods of restoration and hardening of agricultural machinery parts both in our country and in several foreign countries. The main objective of the study is to examine the changes in the structure of working surface of parts during the ordinary and vibration deformation for further use in the manufacturing process of restoring the worn parts by vibration hardening of their working surfaces.

The paper considers some methods of restoration of working parts of agricultural machinery, which because of complex manufacturing processes, expensive processing equipment, high costs have not yet found wide application in the agricultural repair production.

The mechanism of hardening the surface layer material of parts under vibratory loading was revealed. It was shown that the hardening of material is related to the formation of barriers for moving dislocations, which contributes to the greater compaction (hardening) of the surface. The parameters influencing the rate and degree of deformation were defined.

Keywords: plastic deformation, vibration hardening, dislocations, durability, manufacturing process.

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VIBRATION PROCESSING IN THE MANUFACTURE AND RESTORATION OF DETAILS

page 60–61

The issues of using the vibration oscillations in manufacturing processes in various areas of national economy, contributing to the intensification of processing methods, improvement of mechanization and automation level of many labor-intensive technologies were considered in the paper. The objective of the study was to develop a method of restoring ploughshare discs of grain seeders by vibration deformation.

The paper considered some methods of vibration treatment of parts of agricultural machinery, which because of insufficient study, complex processing equipment have not yet found a widespread use in the agricultural repair production, particularly in the restoration of ploughshare discs of grain seeders.

The dependence of the depth of hardening the working surface of parts on such factors as: the oscillation amplitude of processing tool, frequency of oscillations, time of hardening was shown. The optimum values when restoring the ploughshare discs or their manufacture in engineering were defined.

The obtained data will be used in developing the technology for hardening certain nomenclature of parts both in engineering during the manufacture and agricultural repair production.

The obtained data allow using them in the development of technology of hardening of agricultural machinery parts by vibration deformation.

Keywords: vibration oscillations, manufacturing process, hardening, reliability, microstructure.

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