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SYSTEM ANALYSIS, CONTROL AND INFORMATION PROCESSING

The article deals with the issues of increasing the degree of reliability of modeling and predicting the deformation processes of polymeric textile materials, which are proposed to be carried out on the basis of the corresponding integral criteria for the adequacy of modeling the viscoelasticity of these materials. The criteria represent an estimate of the magnitude of the deviations of the values of the integral convolutions of the nuclei of relaxation and creep of polymeric textile materials from the theoretically substantiated single value. The less the value of the specified integral convolution differs from a single value, the more adequate the developed models of relaxation and creep, and, therefore, the corresponding numerical prediction of viscoelastic-plastic processes of the studied polymeric textile materials will be more accurate.
Keywords: degree of certainty, mathematical modeling, forecasting, textile materials, polymers, viscoelastic-plastic processes.

The article discusses the methods of system analysis of the operational properties of aramid textile materials. Knowledge of the viscoelastic characteristics of aramid textile materials allows for the best choice of materials with the ability to deform properties. To determine the deformation characteristics of aramid textile materials, computer methods for the system analysis of their deformation properties are being developed.
Keywords: system analysis, mathematical modeling, textile materials, operational properties, aramids.

The article deals with the issues of predicting relaxation and deformation modes of operation of polymer textile materials. The basis of mathematical models of relaxation and deformation processes of the studied materials is the spectral-temporal theory of viscoelasticity. The practical use of methods for confident prediction of these processes of polymeric textile materials is simplified by their digitalization.
Keywords: mathematical modeling, prediction, polymeric textile materials, deformation properties, relaxation, creep.

The issues of increasing the accuracy of digital prediction of deformation processes of textile materials, which are important both from the scientific and practical side, are considered, since this makes it possible to obtain recommendations for the creation of new promising materials

with desired functional properties. The article considers a method for optimizing mathematical modeling of the fundamental deformation-operational modes of polymeric textile materials.

Keywords: accuracy improvement, mathematical modeling, numerical prediction, textile materials, polymers, deformation modes of operation.

MACHINES, AGGREGATES AND TECHNOLOGICAL PROCESSES

A. A. Kozlov
DOI 10.46418/2619-0729_2023_1_5
RESEARCH OF DEFORMATION PROCESSES OF TEXTILE ELASTOMERS FOR IMPLANTOLOGY
The article presents methods for studying the deformation processes of medical textile elastomers used in implantology. As the main deformation processes of textile elastomers, the fundamental relaxation processes and creep deformation processes are chosen.
Keywords: mathematical modeling, elastomers, textile materials, deformation properties, relaxation, creep.

A. Yu. Ataeva, G. I. Sverdlik
DOI 10.46418/2619-0729_2023_1_6
METHOD OF CALCULATION OF A GAS-PURIFICATION LINE WITH A PROPERTY SAMPLE OF A JET BUBBLER
The article deals with the design of gas cleaning systems using the wet method of gas cleaning. The developed method for calculating the hydraulic resistance of the gas cleaning line elements with a prototype jet bubbler having a patented distribution plate design is presented. The technique contains a detailed consideration of the components of the hydraulic resistance of the gas duct and the bubbler. The total resistance value, together with the line performance, is taken into account when choosing a fan that provides exhaust gases. The technique was applied in the development of a line with a prototype bubbler and is recommended for use in the design of gas cleaning systems for trapping fine dust containing nanoparticles..
Keywords: gas cleaning line, jet bubbler, distribution plate, cap, capillary drop, foam mode, nanoparticles.

PRODUCT QUALITY CONTROL. STANDARDIZATION. ORGANIZATION OF PRODUCTION

N. V. Pereborova, N. S. Klimova, D. A. Ermin, Ya. S. Tomashevich
DOI 10.46418/2619-0729_2023_1_7
RECOMMENDATIONS FOR THE DEVELOPMENT OF TEXTILE MATERIALS FOR MEDICAL PURPOSE
The article is devoted to the development of recommendations for the design of textile materials for medical purposes. Recommendations are obtained on the basis of a systematic analysis of the performance properties of the materials under study, carried out in accordance with the developed criteria for a qualitative assessment of their functionality.
Keywords: design, mathematical modeling, polymers, textile materials, implants

N. V. Pereborova
DOI 10.46418/2619-0729_2023_1_8
QUALITATIVE ASSESSMENT OF RELAXATION AND RESTORATION PROPERTIES OF TEXTILE MATERIALS
The article discusses a method for conducting a qualitative assessment of the relaxation and restorative properties of polymeric textile materials according to the parameters of the mathematical model of relaxation of these materials. The advantage of the proposed method is

that a qualitative assessment of the relaxation and recovery properties of polymeric textile materials does not require an expensive experiment, but it is sufficient to analyze the parameters of the mathematical model of relaxation.

D. E. Platonov
EVALUATION OF PROCESS NETWORK PERFORMANCE IN SINGLE PRODUCT FLOW PROCESSING USING COMPUTER SIMULATIONS

The problem of evaluating the performance of a technological network, the input of which receives a periodic flow of products (raw materials, semi-finished products) of the same type, is considered. Products are distributed along various routes, so that a multi-product flow of finished products of various types is formed at the outlet of the network. The performance of individual machines is known. It is required to establish the final characteristics of the flow through the network at a given time interval. The description of the accepted approach to the construction of flow models, a separate machine and a technological network as a whole is given. An algorithm for calculating the characteristics of the process is proposed.

E. A. Ageeva, L. V. Makhova, A. S. Gorshkov
SIMPLE PAYBACK PERIOD OF INVESTMENTS IN ENERGY SAVING IN AN INDUSTRIAL ENTERPRISE

The article presents a calculation model for simple payback period of investments in energy saving at textile and light industry enterprises. The calculation model is based on the method of reduced costs. The advantages and disadvantages of the model are provided. A qualitative analysis of the model was carried out for both one-time and time-distributed investment in an energy-saving project.

R. A. Gorshkov, A. S. Stepashkina
ENERGY SAVING POTENTIAL AND RETURN ON INVESTMENT FOR THE ENTERPRISE WITH A HYBRID HEAT PUMP SYSTEM

The paper analyzes an example of the implementation of a hybrid heat pump system design at a textile and light industry enterprise. The project is designed to provide hot water supply at the enterprise using ground heat. The calculation of thermal energy savings due to the introduction of a heat pump system of hot water supply at the enterprise has been performed. The cash flows and the discounted payback period of investments in the energy-saving project are calculated. Recommendations for improving the efficiency of the proposed technical solution are provided.

V. A.Chetvergov

ITERATIVE MODELING AS A TOOL FOR MANAGING THE PRODUCTION PROCESS AT THE DEFENSE INDUSTRY ENTERPRISE, TAKING INTO ACCOUNT THE DEVELOPMENT OF MANUFACTURING NEW PRODUCTS

The article is devoted to the consideration of the possibilities of using iterative modeling methods to create models of artificial technical systems. The use of methods is shown by the example of creating a production plan model at a defense industry enterprise, including the process of mastering new products.

A. D. Kilimova
PROSPECTS FOR USING THE GPT-3 AND MIDJOURNEY NEURAL NETWORK MODEL TO ORGANIZE PRODUCTION IN THE SEWING INDUSTRY

The article is devoted to the use of modern tools based on artificial intelligence such as GPT-3 and Midjourney in the clothing industry when developing prints on T-shirts. The pros and cons of using such technologies are described, the question of the further existence of the profession "designer" is raised.

E. V. Kislyakova, M. A. Kislyakov
W. SHEWHART'S CONTROL CHARTS AS A TOOL FOR ASSESSING THE QUALITY OF INSULATING GAPS OF HIGH-VOLTAGE EQUIPMENT

The article discusses a technique for assessing the state of the insulation system of high-voltage equipment based on the analysis of the spectrum of polarization currents. The method for obtaining the spectrum of polarization currents based on field tests of high-voltage oil-filled equipment was developed and tested by the scientific team of the department of TOE of the branch of NRU MPEI in Smolensk. One of the methods for assessing the quality of insulation is the comparison of the experimental spectrum with the reference one, obtained as a result of averaging a large number of spectra and physical and mathematical modeling of insulation gaps with various types of defects. In the course of data analysis, the authors faced the problem of choosing a tool for comparing spectra, which would make it possible to obtain an objective assessment of the quality of the insulating gap, as well as to judge the presence or absence of significant defects in the insulation. As a comparison tool, it is proposed to use W. Shewhart's control charts of sample mean deviations. The article presents the results of field tests of two high-voltage oil-filled transformers, polarization current spectra and Shewhart control charts for standard deviations σ of the experimental spectrum from the reference one in accordance with the requirements of GOST R ISO 7870-2-2015. An analysis and interpretation of Shewhart's control charts is given, based on the results of which random causes of spectrum variability are excluded and a generalized level of isolation quality is determined. Analysis of the spectrum for the presence of typical structures allows us to draw conclusions about the presence of significant insulation defects, leading to a significant decrease in the quality level and the risk of equipment breakdown

TECHNOLOGY AND PROCESSING OF SYNTHETIC AND NATURAL POLYMERS AND COMPOSITES

N. P. Midukov, T. I. Efremov, N. V. Evdokimov

A 3D PRINTING TECHNOLOGY IN THE PRODUCTION OF DECORATIVE PRODUCTS FOR FURNITURE FROM SAWDUST

The article is devoted to 3D modeling and production of decorative products for furniture. Information is given about the main stages of 3D modeling of the shape of the product, which is made using 3D printing with a paste containing sawdust and a multicomponent binder. The stencil of the product is made using 3D printing with a plastic polymer thread, which is subsequently removed from the product. Modeling of the shape of a decorative product is carried out in the Autodesk Fusion 360 program. The paper presents the characteristics of 3D printing, which are specified in the Repetier-Host program: layer height; plastic feed rate; speed of trevel of the extruder; filling the mold with plastic; substrate characteristics; extruder temperature; table temperature etc. The quality control of the sample was carried out visually and by caliper. The roughness and dimensions of the shape were evaluated.
Keywords: sawdust, 3D printing, water-soluble polymer, decorative product for furniture.

M. B. Kirillova, I. V. Porotikova
COMPARATIVE EVALUATION OF A 3D-MODEL MADE BY MODELING IN A GRAPHICAL PROGRAM VS USING 3D SCAN

The article presents the main stages of building a 3D-model of a complex-shaped part using a 3D-scanner and in a graphical program. As an example, a 3D-model was created using a 3D-laser scanner, as well as in a graphics program. A 3D-model of the part was created using a laser trigonal scanner. The result of the 3D-scann was a ".stl" file, which was compared with the 3D-model file exported from the graphics program, also in ".stl" format. The paper presents the results of comparing two 3D-models in the program AutoCAD, determine the errors of 3D-scanning with a modern laser trigonal scanner.
Keywords: 3D-design, 3D-scanner, complex shape detail.

M. V. Kolosova, N. P. Midukov, V. S. Kurov
THE MODERN LEVEL OF FOREIGN RESEARCH ON THE STRUCTURE AND PROPERTIES OF CORRUGATED CARDBOARD

The article is the first part of the review devoted to the current state of development of the scientific direction for the study of the properties and structure of corrugated cardboard abroad. The second part will be devoted to the state of domestic research and development in the field of developing methods for assessing the properties of corrugated cardboard. Information dedicated to the most modern methods of the main scientific centers in the world engaged in the study of the properties of corrugated cardboard. By a critical analysis of international articles published on this topic, the authors come to a new solution that allows them to develop a 3D structure of corrugated cardboard produced at homeland enterprises, which will allow them to more accurately predict the properties of the packaging material. Compared with the existing international studies of the properties of corrugated cardboard, mainly based on the finite element method and 3D modeling of the ideal shape of corrugated cardboard, followed by its comparison with samples that have passed the destructive control, the authors propose to evaluate the 3D model of the cardboard actually produced at the factory before and after the destructive control. The proposed method will also allow to control the roughness, uniformity of the distribution of flutings and liners, the quality and uniformity of the sizing of three and five-layer corrugated cardboard base for packaging.
Keywords: corrugated cardboard, structure, 3D modeling, properties of corrugated cardboard.

S. V. Kiselev
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF DEFORMATION PROPERTIES OF TEXTILE ELASTOMERS FOR IMPLANTOLOGY

The article deals with the issues of conducting experimental and theoretical studies of the performance properties of polymeric textile elastomers for implantology, which are important for determining the functionality of these materials. A detailed step-by-step plan for conducting experimental and theoretical studies of the performance properties of polymeric textile elastomers is proposed. The article also presents the technical characteristics of a representative group of polymeric materials used for the manufacture of textile elastomers for implantology.
Keywords: research, mathematical modeling, elastomers, textile materials, deformation properties, relaxation, creep.

I. M. Egorov, A. A. Kozlov
SIMULATION OF RELAXATION OF TEXTILE ELASTOMERS FOR IMPLANTOLOGY

The article presents the most popular option for modeling the relaxation of textile elastomers used in implantology. On the basis of the proposed version of the mathematical model of relaxation, the corresponding parameters of this mathematical model were determined, which are essential for a qualitative assessment of the relaxation properties of the materials under study and for determining their functionality.
Keywords: research, mathematical modeling, elastomers, textile materials, relaxation properties, relaxation.

V. I. Wagner, N. V. Pereborova, D. A. Ermin, Ya. S. Tomashevich
METHODS FOR INVESTIGATION OF VISCOELASTIC PROPERTIES OF ARAMID TEXTILE MATERIALS

The article provides a description of the main viscoelastic properties of aramid textile materials and methods for their study. Primary information about the viscoelasticity of the materials under study can be obtained from experimental tension diagrams, and a more detailed study of viscoelastic properties requires mathematical modeling of relaxation or deformation processes.
Keywords: viscoelastic properties, mathematical modeling, polymers, textile materials, relaxation processes, deformation processes.

A. M. Korinteli, I. V. Cherunova, A. V. Merkulova
INVESTIGATION OF THE THERMAL EFFECTS OF THE UNDERWATER WELDING PROCESS ON PROTECTIVE HYDRAULIC CLOTHING

The article is devoted to the study of thermal risks of underwater welding for the surface of protective clothing. The paper presents a mathematical model describing the transfer of dangerous heat to the surface of clothing by hot metal particles of electric arc welding under water. The hydro- and thermodynamic characteristics of the system "underwater welding electrode – a drop of hot metal — underwater environment — hydraulic clothing-man" are theoretically investigated. Modeling and theoretical prediction of the surface temperature of the workwear in the contact zone with hot metal particles during underwater welding was performed using the example of conditions: depth – 20 m, water temperature - +20 ^{o}C, water velocity – 2.5 m/s, which allowed us to establish criteria for thermal stability of the materials of the surface of workwear for underwater welding for these conditions. The developed model provides the

development of a new theoretical apparatus for designing thermally efficient materials and workwear made of them for underwater welding.
Keywords: special clothing, foamed materials, thermal stability, underwater welding, materials science of sewing production.

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