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SYSTEM ANALYSIS, CONTROL AND INFORMATION PROCESSING

V. I. Wagner, N. V. Pereborova, Ya. S. Tomashevich

DOI 10.46418/2619-0729_2023_2_1

MATHEMATICAL MODELING AND SYSTEM ANALYSIS OF THE VISCOELASTICITY OF ORIENTED POLYMERIC TEXTILE MATERIALS

The article describes the mathematical modeling of the viscoelasticity of polymeric textile materials. One of the generally recognized variants of mathematical modeling of the viscoelasticity of polymeric materials is the variant based on the analytical approximation of experimental «families» of relaxation and deformation curves by normalized relaxation and deformation functions on the logarithmic scale of the reduced time.

Keywords: viscoelastic properties, mathematical modeling, oriented polymer materials, textile materials, relaxation processes, deformation processes.

A. V. Demidov, A. G. Makarov

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MODELING AND PREDICTION OF ELASTIC, VISCOELASTIC AND PLASTIC PROPERTIES OF SYNTHETIC THREADS

The article deals with the issues of mathematical modeling and prediction of elastic, viscoelastic and plastic properties of synthetic threads. Methods are proposed for dividing the total strain and the mechanical work of deformation of synthetic yarns into elastic, viscoelastic, and plastic components that are essential in determining the functionality of these yarns.

Keywords: mathematical modeling, numerical prediction, textile materials, synthetic threads, elasticity, viscoelasticity, plasticity.

N. S. Klimova

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MATHEMATICAL MODELING AND SYSTEM ANALYSIS OF DEFORMATION PROPERTIES OF POLYMER FIBERS FOR PARACHUTE CONSTRUCTION

The article deals with the issues of mathematical modeling and system analysis of the deformation properties of polymeric textile threads used in parachute construction in the manufacture of parachute lines. For this mathematical modeling, two types of models of relaxation and deformation processes are proposed.

Keywords: mathematical modeling, forecasting, polymer parachute lines, operational properties, relaxation processes, deformation processes.

A. A. Kozlov, S. V. Kiselev

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SYSTEM ANALYSIS OF DEFORMATION PROPERTIES OF POLYMER SEA ROPES

The article considers the methods of system analysis of deformation properties of polymer sea ropes, based on mathematical modeling of processes of the same name. The solution of the problem of systematic analysis of the deformation properties of polymer sea ropes is given on the basis of studying the relationship between properties and structure, as well as predicting short-term and long-term mechanical effects.

Keywords: mathematical modeling, system analysis, polymer sea ropes, deformation properties, relaxation properties.

A. G. Makarov, A. V. Demidov

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DEVELOPMENT OF A METHODOLOGY FOR QUALITATIVE ASSESSMENT OF DEFORMATIONAL AND OPERATIONAL PROPERTIES OF POLYMERIC PARACHUTE LINES

The article discusses options for assessing the deformation and operational properties of polymeric parachute lines. At the same time, various options for mathematical modeling and prediction of their relaxation and deformation processes are considered. Elastic, viscoelastic and plastic properties of polymeric parachute lines of various component composition are also evaluated.

Keywords: mathematical modeling, forecasting, polymer parachute lines, operational properties, relaxation processes, deformation processes.

MACHINES, AGGREGATES AND TECHNOLOGICAL PROCESSES

A. A. Romanovich, V. P. Voronov, M. A. Romanovich, V. S. Prokopenko

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UNIT FOR OBTAINING CUBIC-SHAPED STONE FROM ROCKS WITH SHALE TEXTURE

The article is concerned a description of the unit for obtaining cube-shaped crushed stone from rocks with a shale texture, including a press-roll unit and a device for directional feeding of materials, the design of which allows oriented feeding in the direction of its major axis of pieces of rocks with a shale texture and their destruction pressure between the teeth rigidly fixed on the working surface of the rolls. The process of destruction of rocks with a slate texture between the working bodies of the unit, which makes it possible to obtain cube-shaped crushed stone with a high percentage, has been analytically studied. A mathematical description of the process of crushing materials between the teeth of the working bodies of the unit is given. When deriving the equations, they were based on theoretical studies of the mechanical destruction of rocks between teeth set with a certain step, during which a part is separated from a piece of rock. As a result of the transformation of the formulas, an equation was obtained for calculating the power consumption required for the destruction of rocks, taking into account the physical and mechanical characteristics of the feedstock and the design features of the unit.

Keywords: shale rocks, cube-shaped crushed stone, press-roll grinder, directional feed.

I. E. Menyailo

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DIAGNOSTIC PARAMETERS DETERMINATION OF THE LOOM TECHNICAL CONDITION BY THE METHODS OF FUZZY MODELING

The developed software allows to determine the diagnostic parameters of the loom technical condition using fuzzy modeling methods in the Matlab software environment. The software evaluates the degree of wear of the loom mechanisms according to the received information signals from the three-axis accelerometer of the diagnosing system of the loom

Keywords: loom, technical condition, diagnostics, sensor, vibration parameters, information block, communication module, software.

N. R. Tourkina, A. A. Rak, D. A. Katsuba, G. O. Nagaev

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ANALYSIS OF THE STRESS-DEFORMED STATE OF THE DIE TOOLING WHEN CRIMPING BALL PLUGS

Static calculations and calculations for the loss of stability of the die tooling during ball crimping in the ANSYS software package were carried out.

Keywords: die tooling, ball plugs, stress-strain state, equivalent stresses.

A. K. Tsybikova, T. V. Ulzutueva

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THE INFLUENCE OF TECHNOLOGICAL PROCESSES OF PRODUCTION ON THE OPERATIONAL PROPERTIES OF CORRUGATED CARDBOARD

This paper presents the results of work on the study of the resistance of the end compression of corrugated cardboard grades T24, T26 and P32 produced by JSC "Selenginsky CCK" and the analysis of the influence of humidity on this indicator. Tests for the destructive force during compression of the ring in the transverse direction of the KS-125 kraft liner before and after humidification are also presented.

Keywords: Corrugated cardboard, kraft liner, performance properties, resistance to mechanical compression, destructive force when compressing the ring in the transverse direction, humidification.

A. A. G. Alshebly, N. V. Rokotov, N. N. Gulyaev, A. A. Ponomar

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ANALYSIS OF THE EFFECT OF WINDING PARAMETERS ON THE REDUCTION OF THE PACKAGE LENGTH

When winding filamentous material into packages of various forms of cross winding, zones with increased thread content appear at the edges of the packaging. This phenomenon has a very negative character and causes, in addition to problems when winding the thread, increased injury to the thread at the edges of the packing and non-staining in areas of high density. To eliminate the noted drawback, a mechanism has been implemented to reduce the stroke of the threader. Analytical dependences are obtained to determine the reduction of the packing length depending on the winding parameters and the type of reverse of the threader.

Keywords: winding, thread tension, winding process control, packing length.

PRODUCT QUALITY CONTROL. STANDARDIZATION. ORGANIZATION OF PRODUCTION

N. V. Pereborova

DOI 10.46418/2619-0729_2023_2_11

DEVELOPMENT OF A METHODOLOGY FOR QUALITATIVE ASSESSMENT OF PERFORMANCE PROPERTIES OF POLYMERIC TEXTILE MATERIALS

The article discusses the development of a methodology for the qualitative assessment of the performance properties of polymeric textile materials in terms of the parameters of the mathematical model of the creep of these materials. The advantage of the proposed method is that a qualitative assessment of the operational properties of polymeric textile materials does not require an expensive experiment, but it is sufficient to analyze the parameters of the mathematical model of the deformation process or the creep process.

Keywords: qualitative assessment, mathematical modeling, polymers, textile materials, assessment criteria, relaxation properties, restorative properties.

S. V. Kiselev, A. A. Kozlov

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METHODS FOR INVESTIGATION OF DEFORMATION AND RELAXATION PROPERTIES OF POLYMER SEA ROPES

The article considers methods for studying the deformation and relaxation properties of polymer sea ropes. Such a study is based on mathematical modeling of the viscoelasticity of these materials. It is shown that as the basis of mathematical models of relaxation and deformation processes of polymer sea ropes, it is advisable to choose the integral function of the Cauchy probability distribution, which has the additivity property.

Keywords: research, mathematical modeling, polymer sea ropes, deformation properties, relaxation properties.

M. B. Sukhanov, M. D. Dudnik

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DEVELOPMENT OF RESEARCH ON THE APPLICATION OF MACHINE LEARNING IN THE TEXTILE INDUSTRY

*The introduction of data mining and machine learning methods in the textile industry leads to improved product quality and increased production efficiency. The **aim of the work** is to identify trends in the application of machine learning in the digitalization of textile industries. **Research objectives:** 1. Obtaining and visualizing data on the dynamics of the number of publications related to the industrial application of machine learning for 2013-2022. 2. Building a rating of publications on the application of machine learning in research using textile materials. **Research methods:** analysis of scientific publications in the electronic scientific library eLibrary and on the portal www.researchgate.com.*

Results: in the eLibrary system over the past 10 years, the number of publications on machine learning has been increasing every year, which indicates the importance of this scientific area. At the same time, there is a linear dependence between the number of documents and the year of their publication. In 2022, the rate of growth in the number of publications has slowed down. The number of publications on the industrial application of textiles and products increased from 2013 to 2021, and in 2022 was markedly lower than in 2021, which seems to be mainly due to changes in supply chains.

Researchers' attention is focused on the following textile-related applications of machine learning: improving the glove for gesture recognition in VR/AR applications; use in smart systems of personal thermal comfort; signal quality assessment and easy QRS detection in a wearable ECG system; gas detection on a textile base containing graphene; detection of defects during automated visual inspection of tissue. Innovative developments are aimed at creating and improving digital twins of textile materials, online services for predicting their properties and identifying them from images using a neural network.

Keywords: product quality management, organization of defect-free production, textile materials, neural network, data mining, machine vision, training set, artificial intelligence.

D. A. Ermin, V. I. Pimenov, N. V. Pereborova

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NEUROMARKETING EXPERIMENTS DATA IN TEXTILE INDUSTRY PRODUCTS EXAMINATION

The article conducts the concept of applying the results of neuromarketing studies in the process of objectifying the expert survey procedure. The eye-tracking experiment data are given. The visual perception characteristics of images by different groups of respondents were analyzed.

Keywords: neuromarketing, eye-tracking, examination of products.

R. A. Gorshkov, P. P. Rymkevich

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THE USE OF SOLAR ENERGY FOR HOT WATER SUPPLY IN AN INDUSTRIAL ENTERPRISE

The article considers a model for calculating the potential of energy saving and thermal energy saving for hot water supply, achieved as a result of the use of solar heat receivers (solar systems) related to renewable energy sources at textile and light industry enterprises. Schematic solutions for dual-circuit solar systems are given. Formulas for calculating the savings of thermal energy and cash flows achieved as a result of the use of solar systems at an industrial enterprise are given.

Keywords: textile and light industry, industrial enterprise, consumption of energy resources, cost of production, energy intensity of industrial enterprises, energy saving, energy efficiency, hot water supply, heat of solar energy, solar system.

A. Yu. Tumanov

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FUNCTIONAL QUALITY MANAGEMENT SYSTEM OF THE PRODUCTION FACILITY SUSTAINABILITY SYSTEM

The purpose of the work is to develop a functional quality management system for ensuring the stability of an instrument-making facility. The object of the study is a system for ensuring the stability of an instrument-making facility. The subject of the study is the quality management of systems for ensuring the stability of instrument-making industries. The hypothesis of the study: the functional quality management system of the instrument-making industries for a certain number of iterations makes it possible to provide the required (set) level of quality both at the subject-logical, predictive-analytical and information-technological levels.

Keywords: quality management, system, production facility, sustainability.

A. Yu. Tumanov

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SCIENTIFIC AND METHODOLOGICAL CONCEPT OF QUALITY MANAGEMENT OF SYSTEMS FOR ENSURING THE STABILITY OF THE FUNCTIONING OF INSTRUMENT-MAKING FACILITIES IN EMERGENCY CONDITIONS

The purpose of the presented work is to develop a scientific and methodological concept of quality management (QMS) of systems for ensuring the stability of the functioning of objects in emergency conditions. The object of the study is a system for ensuring the stability of an instrument-making facility. The subject of the study is the quality management of systems for ensuring the stability of instrument-making industries. Research hypothesis: The main unified idea of the proposed scientific and methodological concept is a three-level representation of the quality of the information system.

Keywords: quality management, system, production facility, sustainability.

D. A. Ermin

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APPLICATION OF DIGITAL PREDICTION OF DEFORMATION PROCESSES OF PARACHUTE LINES FOR CARRYING OUT A QUALITATIVE ASSESSMENT OF THEIR FUNCTIONALITY

The developed methods of digital prediction of deformation processes of parachute lines are based on mathematical modeling and system analysis of viscoelastic processes of polymers. Solving the problem of qualitative analysis of the deformation properties of parachute lines will improve the operational characteristics of domestic parachute systems, increase their safety, functionality and competitiveness.

Keywords: digital forecasting, mathematical modeling, polymeric materials, parachute lines, qualitative assessment, deformation processes.

D. A. Ermin

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QUALITATIVE ASSESSMENT OF PERFORMANCE PROPERTIES OF POLYMERIC

TEXTILE ELASTOMERS

Methods for conducting a qualitative assessment of the performance properties of polymeric textile elastomers are considered. Mathematical modeling and further qualitative analysis of these materials makes it possible to evaluate their functional characteristics.

Keywords: polymeric textile elastomers, functional properties, operational properties, mathematical modeling, qualitative analysis.

TECHNOLOGY OF PRODUCTION OF TEXTILE AND LIGHT INDUSTRY PRODUCTS

I. M. Egorov, A. A. Kozlov

DOI 10.46418/2619-0729_2023_2_20

CONSTRUCTION OF MATHEMATICAL MODELS OF DEFORMATION PROCESSES OF TEXTILE MEDICAL ELASTOMERS

The article presents a method for constructing mathematical models of deformation processes in textile medical elastomers. On the basis of the above version of the mathematical model of deformation processes, the corresponding parameters of this mathematical model are determined, which are essential for a qualitative assessment of the deformation properties of the materials under study and for determining their functionality.

Keywords: research, mathematical modeling, elastomers, textile materials, deformation processes, functionality.

A. A. Kozlov, S. V. Kiselev

DOI 10.46418/2619-0729_2023_2_21

DEVELOPMENT OF METHODS FOR PREDICTION OF PROCESSES OF REVERSE RELAXATION OF POLYMERIC TEXTILE MATERIALS

The article shows that when predicting complex relaxation processes, in particular, the processes of reverse relaxation of polymeric textile materials, it is possible to apply universal mathematical models developed for simple relaxation processes, while predicting the processes of reverse relaxation of these materials, results are obtained quite close to experimental ones.

Keywords: mathematical modeling, prediction, oriented polymeric materials, deformation properties, relaxation processes, reverse relaxation.

N. S. Klimova

DOI 10.46418/2619-0729_2023_2_22

MATHEMATICAL MODELING OF DEFORMATION PROCESSES OF POLYESTER TWISTED YARNS

The article studies the issues of mathematical modeling of the deformation processes of polyester yarns of various degrees of twist. Reducing the degree of twist within acceptable limits while maintaining the necessary mechanical properties of the threads reduces the time spent on the technological process of production and brings an economic effect.

Keywords: mathematical modeling, polyester threads, textile materials, deformation properties, relaxation.

A. G. Makarov

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MATHEMATICAL MODELING AND PREDICTION OF DEFORMATION AND RECOVERY PROCESSES OF POLYMER FILARS

The article deals with the issues of mathematical modeling and prediction of deformation-

recovery processes of polymer threads. To improve the accuracy of the specified mathematical modeling and forecasting of deformation-recovery processes, it is proposed to introduce a correction for the irreversible component of deformation, which corresponds to its plastic component. The introduction of the deformation reversibility factor into the mathematical models of these processes makes it possible to refine the predicted values of deformation and stress in deformation and deformation-recovery processes, which increases the accuracy of their prediction.

Keywords: mathematical modeling, numerical prediction, textile materials, synthetic threads, elasticity, viscoelasticity, plasticity.

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