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SYSTEM ANALYSIS, CONTROL AND INFORMATION PROCESSING

The article presents a methodology for systematic analysis of the deformation properties of polymer textile materials. The developed methodology was positively tested on a large group of polymer materials, which allows us to conclude that the constructed theory and developed methods are universal, and also recommend their use in materials science research to study the viscoelastic properties of a wide range of promising polymer materials for technical purposes in various sectors of the national economy.
Keywords: system analysis, deformation, relaxation, creep, polymer textile materials, mathematical modeling, digital forecasting.

A variant of mathematical modeling of the mechanical properties of textile polymers is proposed, on the basis of which digital prediction of mechanical processes of varying complexity is carried out - from the processes of simple relaxation and simple creep to complex strain-recovery processes and reverse relaxation processes with alternating load and unloading.
Keywords: deformation, relaxation, creep, polymers, recovery, elasticity, mathematical modeling, digital forecasting.

The issues of system analysis of viscoelastic creep of geotextile nonwoven materials are considered. The basis for constructing a mathematical model of creep is the spectral-temporal one, taking into account the smallness of the delay times.
Keywords: creep, viscoelasticity, polymers, nonwoven materials, geotextiles, needle-punched materials, deformation, mathematical modeling.

MACHINES, AGGREGATES AND TECHNOLOGICAL PROCESSES

The article discusses the possibility of using neural networks to diagnose the technical condition of looms. A technique based on the analysis of vibration parameters obtained using 3D accelerometers installed on looms is described. The technique for building and training a neural network involves the use of the ANFIS graphical editor built into MATLAB. The output data refines the definition of defectiveness of nodes. The technique can be used in the development of automated systems for diagnosing the technical condition of looms.

M. S. Chepchurov, B. S. Chetverikov, V. E. Minasova, I. A. Teterina
SIMULATION OF THE OPERATION OF A PORTABLE MANIPULATOR BASED ON THE KINEMATICS OF A CAD MODEL

The aim of the research is to ensure the efficiency of the robot-loader, made in the form of a portable manipulator by analyzing the movements of the simulated kinematic model of its work.

The main objective of the study is the accurate positioning of the structural elements of a portable manipulator based on the found dependencies of their relative position during the operation of the equipment. To achieve this goal, the authors offer to simulate the operation of a portable manipulator based on the kinematics of the CAD model. It helps to develop and debug an algorithm for controlling its mechanisms.

In the course of the study, the authors have analyzed the movements of all the main elements of the robot-loader, developed and presented a diagram of its axes, and also proposed a scheme for the combined movements of its working body, made in the form of a carriage with grippers. The study gives calculations that the implementation of the proposed scheme of combined and synchronized movements can significantly reduce the time spent on individual operations of the working cycle, for example, raising and lowering the carriage with grippers.

An analysis of the design of the CAD model of the robot-loader and the kinematic model of the movements of its working body has showed that it is possible to ensure the required efficiency of the equipment, obtain the necessary time reserve for maintenance, and repair if it is the combined movements of the working body.

Qusai Mahdi Hamdian Al-Abu Jaiash
DEFORMATION OF THE FLAP IN A VACUUM GRIP: EXPERIMENTS AND MODELS (REVIEW)

The article presents the results of experiments on capturing textile flaps with vacuum grippers and laying them on a certain work surface for further processing. The shape of the flaps deformed by grippers is compared with the shape of their computer models obtained by minimizing the potential energy of the flap as an elastic shell in order to evaluate the effectiveness of the modeling method.

Ali Abdulzaxra Gatea Alshebli
COMPUTER SIMULATION OF THE OPERATION OF THE MECHANISM OF PACKAGE END DECOMPASSION

When winding cross-wound packages on the edges of the package in the area of the thread guide reverse, there are zones with an excess amount of thread caused by a change in the winding angle to 0. One of the possible ways to combat this phenomenon is to periodically change the course of the thread guide. The article discusses the various laws of change in the course of the thread guide based on the method of mathematical modeling in the MATLAB environment. Proposed optimal law.

E. A. Ageeva, L. V. Makhova, A. S. Gorshkov
STRUCTURE OF ENERGY-SAVING AT LIGHT INDUSTRY ENTERPRISES

The article describes the structure of energy-saving at light industry enterprises. The relevance of the implementation of energy-saving at light industry enterprises are shown. The main directions of research aimed at improving the energy efficiency of enterprises are given.
Keywords: textile and light industry, industrial enterprise, consumption of energy resources, energy intensity of industrial enterprises, energy saving, energy efficiency.

A. A. Kirichenko, Ya. V. Denisova
THE USE OF RISK ASSESSMENT METHODS TO MINIMIZE THE OCCURRENCE OF INCONSISTENCIES IN THE DEVELOPMENT OF DESIGN DOCUMENTATION

The success of any enterprise directly depends on the quality of its products. Nonconformities that may occur at any stage of the product life cycle should be minimized, and the risks of their occurrence should be calculated in advance.
The authors show the possibility of using risk assessment methods in the practical activities of the enterprise to determine inconsistencies in the work of personnel. Using these methods, it is possible not only to establish different levels of risks and potential hazards, but also to determine the need for personnel training to minimize them and improve the quality of products.
In this article, the definition of the need for personnel training is considered on the example of a separate structural unit – the office of the chief designer of JSC "Kazan Helicopter Plant".
Keywords: personnel training system, analysis, standard control, risk assessment methods, errors in design documentation.

V. V. Sidorin, N. B. Khalilulina
FORECASTING AND MANAGEMENT OF RESEARCH AND DEVELOPMENT WORK BY MARKOV METHODS

The article presents the developed model of the control system for design and development, implementation of research and development work (R&D and R&D) by Markov methods. The peculiarity of the project activity is the solution of a new task set for the first time in a limited time with limited resources. The lack of previous experience determines the need for tools for predicting results and managing the implementation of research and development. The development of such tools to increase the likelihood of achieving the set goal at the stages of setting and planning research and development is an urgent task. Its solution ensures the adoption and implementation of adequate management decisions, manageability of the work performed. The application of the mathematical model of the R&D and R&D management system presented in the article will also increase their effectiveness by eliminating unpromising scientific, technical and constructive technological solutions at the early stages of implementation.
Keywords: Research work, development work, Markov methods, science-intensive high-tech products, systems approach, change management, risk management.

A. Yu. Tumanov

A METHOD FOR REDUCING THE RISKS OF PROJECTS TO CREATE SYSTEMS TO ENSURE THE STABILITY OF THE FUNCTIONING OF INSTRUMENT-MAKING FACILITIES

The purpose of the presented work is to develop a method for reducing the risk of projects for the creation of information automated systems for ensuring the stability (AISES) of the functioning of instrument-making facilities in order to achieve their quality. The object of the study is the project of creating an AISES. The subject of the study is the risk management of projects for the creation of AISES. Research hypothesis: the method of reducing the risks of projects for the development of AISES is an integral part of the methodological apparatus for managing these risks and allows for a finite number of iterations of assessment and planning of appropriate measures to achieve risk reduction.
Keywords: quality management, system, production facility, sustainability.

N. V. Khomyakov

LEAN 4.0. THE IMPACT OF INDUSTRY 4.0 TOOLS ON LEAN MANAGEMENT

The application of lean production can significantly increase the efficiency of a company by focusing on value-added activities. At the same time Industry 4.0 is seen as another promising trend in industry. Combining these trends has led to the emergence of such a term as "Lean 4.0". However, the existing literature lacks a comprehensive and complete description of combining both paradigms. This paper fills this gap in the research with two objectives: firstly, on the basis of existing work to conclude whether Lean Manufacturing and Industry 4.0 can complement each other. Second, this paper examines how Industry 4.0 can support specific lean manufacturing methods. This is shown using the example of part production with a milling machine.
Keywords: lean management; Industry 4.0; Lean 4.0; quality management, GOST R 56020-2020.

A. A. Azanova, I. G. Davletbayev, A. F. Gaisin, G. T. Kalimullina

ON THE ISSUE OF THE QUALITY DENIM CLOTHING

The article presents an analysis of the most common defects of denim products based on the results of commodity expertise conducted by an expert organization and inspections of products presented in shopping centers in the city of Kazan. Consumer appeals over the past five years have been analyzed. It was revealed that the largest part of them are claims to low resistance of fabric coloring to operational impacts, mechanical damage (tears and abrasion of the material) and sewing defects. The reasons for these shortcomings are briefly described. The practical aspects of the examination of the quality of clothing returned by the consumer as a whole are considered. It is noted that no defects were detected on all products inspected in stores, but a lack of labeling was found. In conclusion, it is noted that special attention should be paid to the quality acceptance of denim products.
Keywords: quality assessment, defect, marking, examination, clothing returned by the consumer.

N. V. Pereborova

SOLVING THE PROBLEM OF IMPROVING THE QUALITY OF TEXTILE AND LIGHT INDUSTRY PRODUCTS BASED ON DIGITAL TECHNOLOGIES

The methods being developed to improve the quality of textile and light industry products are

based on the idea of introducing modern information technologies into scientific research, which is especially important for the development of the economy of the Russian Federation during the period of ongoing international sanctions. Solving the set tasks will make it possible to accelerate both the comprehensive dynamic development of the country's textile and light industry as a whole, and to carry out the fastest possible transition to import substitution of manufactured products.

Keywords: standardization, quality management, quality management, information technology, efficiency improvement, textile and light industry, commercialization of research, organization of scientific research, innovation, technology, materials.

A. V. Demidov, N. V. Pereborova, N. S. Klimova
DOI 10.46418/2619-0729_2023_3_15
DEVELOPMENT OF DIGITAL CRITERIA FOR QUALITATIVE ASSESSMENT OF CONSUMER PROPERTIES OF TEXTILE AND LIGHT INDUSTRY PRODUCTS
The article is devoted to the development of digital criteria for qualitative assessment of consumer properties of textile and light industry products based on mathematical modeling and optimization of their functional and operational characteristics.
Keywords: mathematical modeling, relaxation, creep, deformation, textile and light industry materials, forecasting, restoration, product quality, certification, optimization criteria.

A. G. Makarov, N. V. Pereborova
DOI 10.46418/2619-0729_2023_3_16
DEVELOPMENT OF METHODS FOR CONTROL OF PERFORMANCE CHARACTERISTICS OF MATERIALS IN TEXTILE AND LIGHT INDUSTRY
It is proposed to introduce the developed innovative technologies for monitoring and improving the quality of manufactured products not only at the stage of production of finished products, but also at the stage of design and technological research. These methods are developed on the basis of methods of mathematical modeling of the physical and mechanical characteristics of textile materials and conducting a systematic comprehensive analysis of the consumer properties of designed products, taking into account the use of advanced information technologies and computational methods.
Keywords: quality management, quality management, information technology, efficiency improvement, textile and light industry.

TECHNOLOGY AND PROCESSING OF SYNTHETIC AND NATURAL POLYMERS AND COMPOSITES

N. P. Midukov, T. I. Efremov, N. V. Evdokimov
DOI 10.46418/2619-0729_2023_3_17
ESTIMATION OF GRINDED LARCH WOOD PARTICLE SIZE DISTRIBUTION USING OPTICAL MICROSCOPY AND IMAGEJ PROGRAM
The article presents the results of determining the particle sizes of larch wood after grinding in a disc mill. Optical microscopy with further processing of the obtained images using the ImageJ program was used as a method. Digital images were automatically processed and checked, then translated into a binary image, on which areas were identified and their areas, perimeters and equal diameters calculated. According to the values of these areas corresponding to larch particles, a diagram of their size distribution was constructed. The presented method may be of interest to small and medium-sized factories whose activities are related to the processing of wood for a quick and affordable determination of the fractional composition using an optical microscope and the free ImageJ program. Also, the considered method may be of interest to researchers, since it determines particle sizes with sufficient accuracy in a wide range from 10 microns to several mm.

A. Yu. Svetlolobov, M. A. Litvinov, N. P. Midukov, V. S. Kurov, M. V. Kolosova
DOI 10.46418/2619-0729_2023_3_18
THE METHOD AND DEVICE FOR PAPER AND CARDBOARD SAMPLES TO VISUALIZATION OF MICROSTRUCTURE IN CROSS SECTION

The article is devoted to the description of the method and device for obtaining images of the microstructure of fibrous materials, namely, paper and cardboard. For this purpose, the main components of the polishing machine are developed and manufactured in the project program. The elements for fixing the samples are made using a 3D printer, and an abrasive is installed on a rotating polishing table. A detailed description of the principle of operation of the device is given and examples, results obtained using optical and electron microscopy are presented. A program has been written for the autonomous operation of the device without control via a computer. The method and device for preparing paper and cardboard samples allow to visualize the microstructure of a cross-section of paper and cardboard, which can be used to evaluate some physical properties of the samples under study (surface profiles (roughness), porosity, thickness, approximate mass per square meter), and also possible to create a 3D model of the microstructure of paper or cardboard.

TECHNOLOGY OF PRODUCTION OF TEXTILE AND LIGHT INDUSTRY PRODUCTS

A. G. Makarov
DOI 10.46418/2619-0729_2023_3_19
PREDICTION OF THERMOVISCOELASTICITY OF POLYMER TEXTILE MATERIALS

The article proposes a generalization of the method for predicting the processes of nonlinear-hereditary viscoelasticity of polymer textile materials for the case of processes occurring under conditions of changing temperature.

N. S. Klimova, A. G. Makarov
DOI 10.46418/2619-0729_2023_3_20
SPECTRAL-TIME THEORY OF VISCOELASTICITY OF POLYMER TEXTILE MATERIALS

На примере использования конкретной нормированной функции при аппроксимации процесса релаксации или ползучести рассматривается спектральная интерпретация деформационных параметров-характеристик указанных процессов.

A. A. Kozlov, S. V. Kiselev
DOI 10.46418/2619-0729_2023_3_21
DIGITAL PREDICTION OF DEFORMATION PROCESSES OF TECHNICAL FABRICS

Methods for predicting viscoelastic processes are considered using the example of sewing materials used for the manufacture of personal protective equipment (PPE) for humans from external mechanical influences.

A. A. Kozlov
DOI 10.46418/2619-0729_2023_3_22
COMPUTER PREDICTION OF CREEP OF NONWOVEN MATERIALS

The issues of numerical prediction of creep of nonwoven materials are considered based on mathematical modeling of viscoelasticity. The introduction of developed methods for confident prediction of deformation processes of nonwoven materials is possible thanks to their computerization.

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