UDK 677.057.434

CONCEPTUAL MODEL OF THE MECHANICAL EFFECTS OF TEXTILE MATERIAL IN THE APPARATUS ROLLER WITH DINAMIC MODE LOADING

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A conceptual model of the mechanical impact of the textile material on a roller device in a mode of dynamic loading of the executive bodies, which gives a possibility to solve this problem by modeling cell.

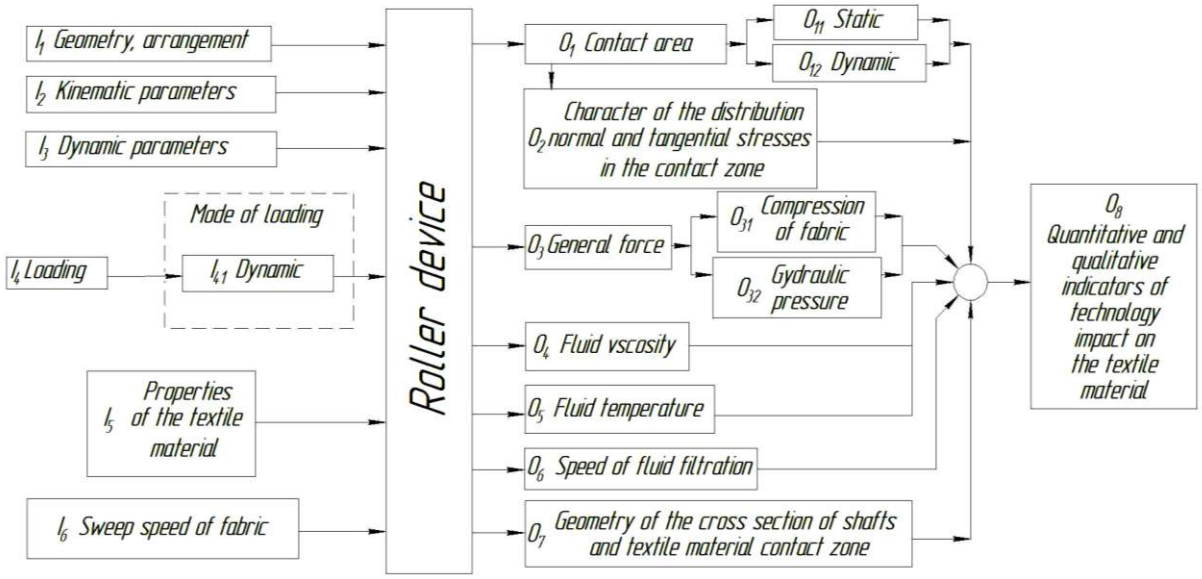
Keywords: dynamic loading conditions, mass transfer, kapillyarno-porous structure, the roller device, a conceptual model.

The purpose is to create a computer model of the "Roller device - textile material" that is the basis of the method of prediction of mass transfer processes in capillary-porous structure of the textile material during its processing of the pressure distribution in the dynamic mode of loading.

Object of investigation is a logistical system that is characterized by the properties of technical tools such as conversion and communication to ensure that the processes of transformation of mass, energy and information.

The end result of the operation of the system "Roller device - textile material" are the options submitted by the output in the form of a fabric weight of textile material and the amount of fluid removed from it in the process of dehydration, an information output in the form of the structural characteristics of textile materials, percentages of residual moisture and other variables in more detail reflecting the essence of the process, implemented in the field device.

Consolidated view of information, energy and mass transfer as Massenet's transformation process occurring in the processing of textile material distributed pressure to contact zone of shafts, in that the free water filtration through the capillaring and between fibers space in two-phase structure consisting of solid particles and liquid phase, part of that is held at the fiber surface, forming a film, we presented in Picture 1 as a conceptual model [1].



Picture 1.

Inputs on the present level of detail system we adopted the theme I_1 - the geometric characteristics of the workers - working width of the shaft unit b, the diameter D of the working rolls and the diameter d_i of the pins, the thickness Δ flexible, and the moments of inertia of the cross section of the shaft; layout of the device process flow decay decomposition trees. I_2 - the kinematic parameters of the device - district V and angular ω velocity of drive shaft, the angular acceleration ε. I_3 - the dynamics of the actuators and actuator device - mass, mass moments of inertia, the dynamic stiffness of shafts and core. I_4 - on-load, present on the device: I_{41} - dynamic load - more dynamic component of the static load P_f at dynamically loading shaft, the moment M_n of pair of forces from the general non-equilibrium of the shaft. I_5 - properties of textile material - the geometric characteristics: width of textile material a, m, length of blade textile material b, m, thickness of fabric in the free state, h_{tk}, m; humidity of textile materials, δ, %. I_6 - transport speed of fabric, V, m/sec.

For output parameters include O_1 - width of the shafts contact area, characterized by static O_{11} and dynamic O_{12} standing system; O_2 - the distribution of normal and tangential stresses in the contact zone along the generator shaft and the circle, whose work surface of the shaft; O_3 - total force squeezing roller pair, we arrive at the creation of specific load O_{31} needed to compress the tissue, and water pressure along the contact zone shafts and textile material needed to construct the hydrodynamic pressure O_{32}. O_4 – kinematic viscosity of the fluid filling the capillary-porous material ν, m^2/sec. O_5 - temperature of the liquid capillary-porous structure of the textile material t, ºC; O_6 - the rate of fluid filtration V_f, m/sec in the contact zone of shafts and textile material; the coefficient of filtration fabric k_f, m/sec; O_7 - geometric parameters of section the contact zone of shafts and textile materials - the length of the contact area and change the thickness of its cross-section defined by the thickness of compressed tissue - the minimum distance between dryers shafts of a given radius; O_8 - qualitative impact indicators for textile material, characterized by output (residual) moisture textile material - the uniformity of dehydration in width tissue, and when the final finish - indicators of the achieve of the effects.

We defined the relationship and communication systems are the basis for the construction of the phenomenological, and then the computer model, allowing to provide mass-exchange processes at the impact on the textile material in the form of dynamic loading of structural-parametric mathematical relationships and dependencies are in place to study physical phenomena in capillary-porous structure of the textile material in the zone of its interaction with the device shafts.

Traditionally, the process of mechanical treatment elongated material pressure distribution in the roller devices considered in static loading under constant load process. Finding ways to improve the process and effectiveness treatment of fibrous material in the roller device is a first-promising nature of the issue of modern science. One of the areas this problem is to predict the physical phenomena occurring in the forced movement of fluid through the capillary-porous structure of fibrous material in the stress-strain state in the contact zone of the technological machine shafts with dynamically loading its executive bodies. Uses of dynamic loading mode allows intensify process of mass transfer in capillary-porous structure continuously moving textile material, to reduce the power consumed by the roll-drive unit and reduce energy consumption at the far thermal treatment (drying).

Dynamic loading of the executive bodies of the roller machines provided, for example, summarizing ultrasonic vibrations to the technological device shafts [2], that means to create elastic vibrations of high frequency electromagnetic transformation, that creates periodical action on the loading mechanism creates dynamic load.

Physical content of the process is intensified impact impression roller to the material caused by the fact that the use of dynamic conditions impact on the textile wet processes in its treatment is more effective to dehydration and a more intense and uniform impregnation by the initiation of cavitation, and gravitational phenomena in shock stream of fluid moving through the capillary molecular-porous textile material.

CONCLUSIONS

In such a way we formed a conceptual model of the machining process of textile material distributed pressure in the regime of dynamic loading executive roller machine, without complication and unnecessary at this stage of formulation of the problem of detail system allows you to move on to further address the problem using the method of cell model based on the theory Markov chains.

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Recommended by the editorial board. Received 03.06.11.