Smetankina N.[1], Misiura Ie.[2], Misiura S.[1, 3]

([1]A. Pidhornyi IPMS of NASU; [2]S. Kuznets KhNUE; [3]NTU «KhPI», Kharkiv)

MATHEMATICAL MODELING OF THERMOMECHANICAL FIELDS IN SHELL STRUCTURES SUBJECTED TO THERMAL INFLUENCE

E-mail: misuraeu@gmail.com

Among the phenomena accompanying the functioning of an object with distributed parameters subjected to thermal influence, an important place belongs to thermomechanical processes [1, 2]. They occur in all elements of the technological system without exception. Thermomechanical processes have the greatest influence on the level of heating of the object elements and their stress-strain state [3, 4]. Due to high heat intensity of some types of processing or operation, defects such as cracks, structural and phase transformations that change the initial hardness are formed on the surfaces of structures, including shell structures. Being stress concentrators, these defects in the process of operation lead to premature failures and destruction. Therefore, the development of mathematical models of thermomechanical processes in structures subjected to thermal influence is an urgent problem. This study proposes a mathematical model describing the deformation of shell structures taking into account the parameters of the system of stabilization of thermophysical processes formed in the structures under thermal influence. Using the method of successive approximations, the nonlinear problem is reduced to an iterative process where a linear parabolic equation is solved at each step. It is assumed that the deformation of the structure under temperature action does not exceed the elastic-plastic zone so that the structure does not lose its load-bearing properties. The model of thermoelasticity is considered in a quasi-static formulation. The analysis of thermal stresses shows that in the conditions of the model under consideration, tensile stresses reach the highest values on the axis, and compressive stresses on the surface of the heated object.

The proposed mathematical model allows to investigate thermal stresses in shell structures to obtain optimal parameters of thermal effects on the modeled object.

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Smetankina N.[1], Sychova T.[2], Sychov A.[2]

([1]A. Pidhornyi IPMS of NASU; [2]State Biotechnological University, Kharkiv)

MATHEMATICAL MODELING OF DYNAMICS OF SPATIAL SYSTEMS

E-mail: sychov2009@ukr.net

Mathematical modeling of linear dynamic systems with distributed parameters describes processes that depend on time and spatial coordinates by means of initial boundary value problems for partial derivative equations [1, 2]. In the presence of