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Abstract

The problem of studying the thermal stress state of structures arises in many areas of mechanical engineering. The paper deals with a method for studying multilayer glazing elements of aircrafts under temperature effects. We consider a glazing element as the multilayer shell with constant thickness isotropic layers and various physical properties. The number of layers and their layout is arbitrary. Convective heat exchange occurs on the shell surfaces. The multilayer shell with a non-canonical form in plan is heated with interlayer film heat sources. Temperature fields are obtained by solving the nonstationary heat conduction problem. The problem of thermoelasticity of shells is solved by the extension method. This method is based on extending a non-canonical-shaped shell to a simple domain. It enables to present the problem solution in analytical form. We describe a behavior of the shell by using of the of the first-order refined theory with account transverse shear strains in each layer. The thermal elastic equilibrium equations and the boundary conditions on the contour are obtained using Lagrange's variational principle. The method feasibility has tested on five- and seven-layer glazing. Results of calculation of stresses in layers are compared with the data obtained by the finite difference method. The method proposed can be used for defining thermal stresses in the multilayer structural elements and designing anti-icing systems.

Keywords: Glazing element, Multilayer shell, Thermoelasticity