MANUFACTURING ERRORS OF THERMOSTABLE 
COMPOSITE PANELS

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SUMMARY
Problems of influence of manufacturing errors on 
thermomechanical properties of a composite laminate have 
been produced. Also in this paper preliminary stretching of 
fibers for shape distortions of thermostable epoxy-carbon in 
manufacturing and operation have been analyzed.

1. Thin wall multilayer panels manufactured from high 
strength and high modulus carbon fibers have found their 
applications in modern large thermostable composite 
structures [1].

The problems are connected with the manufacturing of 
precise and thermostable structures which exclude 
distortions caused by thermal stresses during their 
manufacturing and meet the requirements for strength and 
stress-strain behavior in operational conditions. 
Theoretical analysis of stress-strain state makes it 
possible to obtain standards of working surfaces.
deformation for an antenna both at the production stage and in the conditions of operation taking into account some errors and irregularities during manufacture.

Equation for the components of stress in k-th layer, according to the theory of laminated plates, considering temperature and preliminary tension of fibers is written as

\[ \langle \sigma i \rangle^{(k)} = \{Q_{ij}\}^{(k)} \{Ei^0\} + \{K_{ij}\}^{(k)} \Delta T - \{\alpha i\}^{(k)} \]

(1)

\( i, j = x, y, xy(1, 2, 6) \)

Correspondingly the governing equation for the laminated plates is taken as follows \([2]\)

\[ \begin{bmatrix} E_i^0 \\ K_i^0 \end{bmatrix} = \begin{bmatrix} A_i & B_i \\ B_i & D_i \end{bmatrix}^{-1} \begin{bmatrix} N_i + H_i^0 + H_i^1 \\ M_i + L_i^0 + L_i^1 \end{bmatrix} \]

(2)

The displacement \( W \) of a middle surface in Z-direction is taken as follows

\[ W = \frac{-1}{2 \pi} K_{xy} X^2 + K_{yy} Y^2 \]

(3)

Stress-strain of a laminated panel in operation is determined under the conditions of hinged longitudinal edges and free fixing on transversal ones. Corresponding boundary conditions with \( y = 0 \) and \( y = 1 \) will thus take the form of

\[ W(x, O) = M_y(x, O) = U_0(x, 0) = N_y(x, 0) = 0, \]

(4)

\[ W(x, 1) = M_y(x, 1) = U_0(x, 1) = N_y(x, 0) = 0. \]

The solution satisfying boundary conditions (4) will be represent as the following series:

\[ \phi(x, y) = \sum_{n=1}^{\infty} \phi_n(x) \cdot \sin(n \pi Y) \]

(5)

where \( \phi_n(x) \) is to be defined.

Considering the task which is symmetric relative to transversal edges we retain only even functions in solving

\[ \phi(x, y) = \sum_{n=1}^{\infty} \left[ B_{nl} \cdot \text{Ch}(\lambda_{nl} \cdot x) + \phi_{nl} \right] \cdot \sin(n \pi Y) \]

(6)

In this case \( \phi_{nl} \) is an integral of an ordinary nonuniform linear differential equation, but \( \lambda_{nl} \) are roots