Conclusions

Methods of analysis of the mechanical behavior of anisotropic inhomogeneous shell structures was proposed. As a first mechanical model, the classic Kirchhoff-Love shell theory, the Timoshenko-Mindlin refined theory, and three-dimensional elasticity theory were used. Approaches to the solution of linear problems of mechanics (statics and dynamics) of shells on the basis of discrete-continual methods in classical, refined, and tree dimensional formulations for anisotropic inhomogeneous shells with variable geometrical and mechanical parameters were presented. The developed approaches were realized in form of software-based algorithms. Advantages of the method include: reduction of the partial differential equations to one dimensional problems (spline collocation method, the discrete Fourier series method) and exact treatment of boundary conditions, and practically, the exact solution of boundary value problems and eigenvalue problems for systems of ordinary differential equations with variable coefficients (discrete orthogonalization method). The results of investigations of the stress state and dynamic characteristics of shells of various shape and structure were analyzed depending on the variation of basic parameters. Calculations of specific structural members were carried out.

The following problems based on the classical model were solved:

- the stress-strain state of multilayer shallow rectangular in-plane shells that are symmetrical about the mid-surface of the structure and composed of an odd number of orthotropic layers of variable thickness;
- the stress-strain state in noncircular isotropic and anisotropic thin cylindrical shells with a thickness varying along a generatrix and directrix under arbitrary surface load; an elliptic cross-section of noncircular cylindrical shells and corrugated cylindrical shells was considered;
- the stress state of a high-pressure balloon made of a glass-reinforced plastic;
- the free vibration of orthotropic rectangular plates of variable thickness under different boundary conditions;
- the free vibrations of truncated conical shells with a circumferentially inhomogeneous cross-section;

  the effect of variation in thickness, mechanical parameters, and boundary conditions and the type of the loads on the behavior of displacement, stresses,

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natural frequencies, and vibration modes of the anisotropic inhomogeneous shells structures was analyzed.

- the reliability of the obtained results is proved by means of an inductive technique, by comparison with test examples for isotropic materials and some types of boundary conditions, and also by comparison with experimental data. The possibility of application of the developed approach to the solution of a new class of problems related to the mechanical behavior of a wide class of shell constructions made of modern anisotropic layered and continuously-inhomogeneous materials is shown.