Conclusions

A wide class of problems regarding the stress-strain state and free vibrations of anisotropic inhomogeneous shells using refined and spatial models was solved. The governing systems of partial differential equations with variable coefficients were presented, and the boundary-value and boundary-value eigenvalue problems describing the relevant mechanical processes were stated. In order to solve this class of problems, the discrete-continual numerical-analytic approach proposed by the authors and based on the combined application of the spline-collocation and discrete-orthogonalization methods, which are described in detail in the first book, was employed. The algorithm of the approach was implemented in the form of computer-aided software.

The following problems were solved based on the refined model:

- stress-strain state of anisotropic shallow shells with rectangular base and varying thickness under different boundary conditions;
- stress-strain state of anisotropic spherical shells with variable thickness under localized loads subjected to different boundary conditions;
- stress state of anisotropic conical shells with varying thickness under different boundary conditions;
- stress state of anisotropic noncircular shells with varying thickness for different boundary conditions;
- free vibration of anisotropic shallow shells with rectangular base and variable thickness under different boundary conditions;
- free vibrations of closed and open cylindrical anisotropic shells with varying thickness for different boundary condition;
- free vibrations of cylindrical shells made of functionally gradient materials under different boundary conditions.

The following problems were solved based on a 3D-model:

- stress-strain state of finite length anisotropic inhomogeneous cylinders finite length under different boundary conditions;
- free vibrations of anisotropic inhomogeneous cylinders of finite length under different boundary conditions.

A.Y. Grigorenko et al., *Recent Developments in Anisotropic Heterogeneous Shell Theory*, SpringerBriefs in Continuum Mechanics,
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The effect of variation of thickness, mechanical parameters, boundary conditions, and the type of loads on the behavior of the displacement, stresses, natural frequencies and vibration modes of anisotropic inhomogeneous shells structures was analyzed.

The reliability of the obtained results was demonstrated of inductively by comparing results of calculations for different numbers of orthogonalization and collocation points, by comparison with the results of calculations based on the refined shells model and 3-D theory, 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 for solution of a new class of problems of the mechanical behavior of a wide class of shell constructions made from modern anisotropic layered and continuously-inhomogeneous materials.