UDC 539.3

THREE-DIMENSIONAL STRESS ANALYSIS OF AN INHOMOGENEOUS TRANSVERSELY ISOTROPIC ELASTIC LAYER

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An exhaustive elastic analysis of inhomogeneous composite structure members presents a major challenge for analytical methods due to the lack of techniques for solving governing differential eqautions with unknown variable coefficients formulated within the framework of a relevant mathematical model of macromechanics [1, 2]. The problems become even more involved when the composites exhibit anisotropic behavior.

This talk presents a method for constructing analytical solutions to three-dimensional problems of elasticity and thermoelasticity for an inhomogeneous transversely isotropic layer $|x|<\infty$, $|y|<\infty$, $|z|\le 1$ with all the elastic moduli exhibiting arbitrary variation within the thickness coordinate z. Here, (x, y, z) are the dimensionless Cartesian coordinates, normalized by the thickness of the layer. By making use of the direct integration method [2], a system of governing equations in terms of stresses is derived for the stress-tensor components. The obtained equations are uncoupled and then reduced to the second-kind integral equations for individual stress-tensor components. Making use of the resolvent-kernel method, the integral equations are solved analyticaly in the form of explicit functional dependences on the force and thermal loadings.

This work was partially supported through the joint Ukrainian-Polish Research and Development Project "Identification of the thermomechanical parameters of nonhomogeneous composite materials and protective coatings" (2023-2024).

1. *Tokovyy Y., Ma C.-C.* Elastic analysis of inhomogeneous solids: history and development in brief // Journal of Mechanics. – 2019. – **35**, No. 5. – P. 613–626.
2. *Tokovyy Y., Ma C.-C.* The direct integration method for elastic analysis of nonhomogeneous solids. – Newcastle: Cambridge Scholars Publishing, 2021. – 329 p.

АНАЛІЗ ТРИВИМІРНОГО НАПРУЖЕНОГО СТАНУ НЕОДНОРІДНОГО ТРАНСВЕРСАЛЬНО ІЗОТРОПНОГО ШАРУ

Запропоновано підхід до побудови явних розв'язків тривимірних задач теорії пружності та термопружності для трансверсально-ізотропного шару, властивості якого мають довільно залежності профілів розподілу за товщиною шару.

http://iapmm.lviv.ua/mpmm2023/materials/me02_11.pdf