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REDUCTION OF THE PLANE ELASTICITY PROBLEM IN INHOMOGENEOUS STRIP TO SOLVING THE INTEGRAL VOLTERRA TYPE EQUATION

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To solve the problems of the theory of elasticity in inhomogeneous media, a lot of approximate, analytic, and numerical methods have been developed [1]. However, most of the methods are orientated towards the statement of the problems in terms of displacements. These methods are effective only for some specific cases of inhomogeneity or thermosensitivity.

We consider construction of an analytic solution to a plane problem of the theory of elasticity in terms of stresses for a strip inhomogeneous with respect to its width. To solve the problem, we apply the approach of Prof. Vihak [2] based on direct integration of model equations in terms of stresses.

Integration of the equilibrium equations is the essence of our method. So, we avoid using any auxiliary harmonic or biharmonic functions. Since the equilibrium equations are independent of the mathematical model of physical relations between the stresses and strains, we can easily apply the method for solving the problems in inhomogeneous solids. We extend the procedure applied for one-dimensional problems [3] to the case of the plane boundary value elasticity problem in the strip inhomogeneous with respect to width.

The set of equilibrium and compatibility equations governing the problem is reduced to the system of two harmonic equations imposed on the so called governing stresses – the total stress $\sigma = \sigma_x + \sigma_y$ and the normal stress component σ_y. We solve the key equations in Fourier transforms. By applying the method of exclusion, we arrive at the integral Volterra type equation of the second kind. Its solution, i.e. the Fourier transform of the total stress, is determined by the method of simple iterations. Other stress tensor components are found by integration of equilibrium equations.

The analysis of the stressed state of an inhomogeneous strip is carried out for some specific force loadings and elastic characteristics.

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