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On Radially Symmetric Vibrations of Bi-Directional Functionally Graded Circular Plates on the Basis of Mindlin's Theory and Neutral Axis

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Abstract : The present paper deals with the free axisymmetric vibrations of bi-directional functionally graded circular plates using Mindlin's plate theory and physical neutral surface. The temperature-dependent, as well as temperature-independent mechanical properties of the plate material, varies in radial and transverse directions. Also, temperature profile for one- and two-dimensional temperature variations has been obtained from the heat conduction equation. A simple computational formulation for the governing differential equation of motion for such a plate model has been derived using Hamilton's principle for the clamped and simply supported plates at the periphery. Employing the generalized differential quadrature method, the corresponding frequency equations have been obtained and solved numerically to retain their lowest three roots as the natural frequencies for the first three modes. The effect of various other parameters such as temperature profile, functionally graded indices, and boundary conditions on the vibration characteristics has been presented. In order to validate the accuracy and efficiency of the method, the results have been compared with those available in the literature.

Keywords : bi-directionally FG, GDQM, Mindlin's circular plate, neutral axis, vibrations
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