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Buckling and vibration analysis of embedded functionally graded carbon nanotube-reinforced composite annular sector plates under thermal loading

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Abstract

The main objective of this paper is to present the buckling and vibration analysis of thermally pre-stressed functionally graded carbon-nanotube-reinforced composite (FG-CNTRC) annular sector plates resting on the elastic foundation via the variational differential quadrature (VDQ) method. The material properties of nanocomposite plate are considered to continuously vary across the thickness and are estimated according to the modified rule of mixture. The governing equations are derived on the basis of first order shear deformation theory. Applying two-dimensional generalized differential quadrature (GDQ) method, the energy functional of the structure is discretized. Then, based on Hamilton's principle and the VDQ method, the reduced forms of mass and stiffness matrices are obtained. After verifying the accuracy of the present method, comprehensive numerical results are presented to examine the effects of important parameters on the stability and vibrational behavior of the nanotube-reinforced composite annular sector plates. The results indicate that functionally graded distributions of CNTs in the thickness direction and the increase of elastic foundation coefficients can improve the stability of the structure.

Keywords: FG-CNTRC annular sector plates; Vibration and thermal buckling; Variational formulation; Differential quadrature method, Elastic foundation

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