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Abstract

This paper presents an investigation on the nonlinear bending behaviors of nanocomposite laminated cylindrical panels made of graphene-reinforced composites (GRCs) supported by an elastic foundation under thermal environmental conditions. The extended Halpin-Tsai micromechanical model together with results from MD simulations is employed to obtain the material properties of GRCs which are temperature dependent. A piece-wise functionally graded distribution of graphene fillers along the panel thickness direction is adopted in order to maximize the effect of graphene reinforcement to the panels. The Reddy's third order shear deformable shell theory is applied to derive the governing equations for the bending problem of the panels and the von Kármán geometric nonlinearity, the foundation support and the temperature effect are also included in the derivation. The governing equations are solved by applying a two-step perturbation approach to obtain the panel load-deflection and load-bending moment curves of FG-GRC laminated cylindrical panels subjected to a transverse uniform or sinusoidal load. The influences of loading conditions and temperature variation on the nonlinear bending behaviors of FG-GRC laminated cylindrical panels are discussed in details.

Key words: A. Nano-structures; B. Laminates; C. Analytical modeling; Functionally graded materials

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