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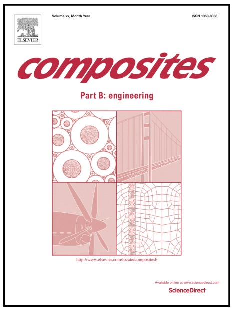

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Nonlinear bending and thermal postbuckling of functionally graded fiber reinforced composite laminated beams with piezoelectric fiber reinforced composite actuators

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Abstract

This paper investigates the nonlinear bending in thermal environments and thermal postbuckling of hybrid laminated beams with piezoelectric fiber reinforced composite (PFRC) actuators resting on an elastic foundation. The beam is made of fiber-reinforced composites (FRCs) with the reinforcement being distributed either uniformly (UD) or functionally graded (FG) of piece-wise type along the thickness of the beam. The formulations are based on a higher order shear deformation theory and von Kármán strain displacement relationships. The beam-foundation interaction and thermo-piezoelectric effects are also included, and the material properties of both FRCs and PFRCs are estimated through a micromechanical model and are assumed to be temperature dependent. The nonlinear bending load-deflection curves and the thermal postbuckling equilibrium paths of hybrid laminated beams are determined by means of a two-step perturbation approach. The effects of the material property gradient, temperature variation, applied voltage, stacking sequence as well as the foundation stiffness on the nonlinear bending and thermal postbuckling behaviors of the hybrid laminated beams are investigated through a comprehensive parametric study.

Keywords: A. Layered structures; B. Buckling; C. Analytical modeling

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