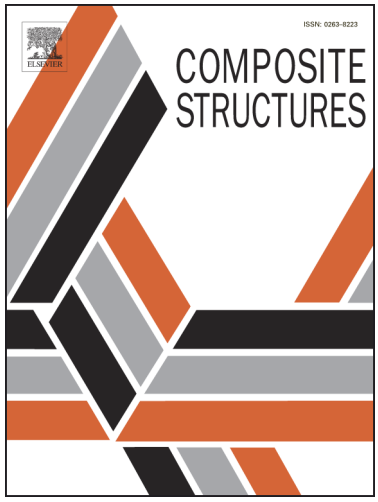

Nonlinear vibration of matrix cracked laminated beams containing carbon nanotube reinforced composite layers in thermal environments

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Nonlinear vibration of matrix cracked laminated beams containing carbon nanotube reinforced composite layers in thermal environments

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Abstract:

This paper investigates the large amplitude vibration behavior of a matrix cracked laminated beam which contains carbon nanotube reinforced composite (CNTRC) layers resting on an elastic foundation in thermal environments. The motion equations are based on a refined shear-lag model and Euler-Bernoulli beam theory and solved by means of a two-step perturbation approach. The beam-foundation interaction and thermal effects are also included. The material properties of both fiber reinforced composite layers and CNTRC layers are assumed to be temperature-dependent. The effects of the crack density, CNT volume fraction, temperature variation, foundation stiffness, as well as the beam end conditions on the vibration characteristics of hybrid laminated beams with multiple matrix cracks are discussed in detail. Numerical results reveal that the crack density plays an important role in the linear vibration of the hybrid laminated beam, but the effect of crack density is less pronounced on the nonlinear to linear frequency ratios of the same beam.

Keywords: Hybrid laminated beam; Matrix crack; Nonlinear free vibration; Temperature-dependent properties; Elastic foundation

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