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Nonlinear vibration of compressed and thermally postbuckled nanotube-reinforced composite plates resting on elastic foundations

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Abstract

This paper investigates the small- and large-amplitude vibrations of compressed and thermally postbuckled carbon nanotube-reinforced composite (CNTRC) plates resting on elastic foundations. For the CNTRC plates, uniformly distributed (UD) and functionally graded (FG) reinforcements are considered where the temperature-dependent material properties of CNTRC plates are assumed to be graded in the thickness direction and estimated through a micromechanical model. The motion equations containing plate-foundation interaction are derived based on a higher order shear deformation plate theory and von Kármán nonlinear strain-displacement relationships. The initial deflections caused by compressive or thermal postbuckling are included. The numerical illustrations concern small- and large-amplitude vibration characteristics of compressed postbuckled CNTRC plates in thermal environments and thermally postbuckled CNTRC plates under uniform temperature field. The effects of CNT volume fraction and distribution patterns as well as foundation stiffness on the vibration characteristics of CNTRC plates are examined in detail.

Keywords: Nanocomposites; Functionally graded materials; Temperature-dependent properties; Plates; Vibration

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