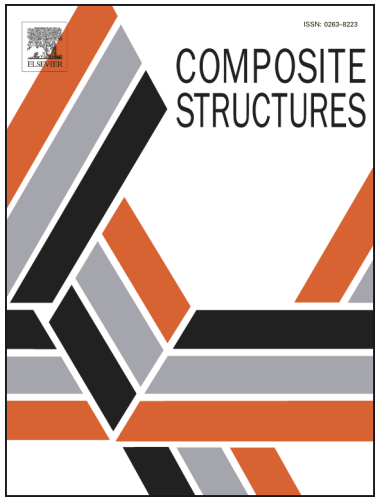

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Nonlinear bending and vibration analysis of functionally graded porous tubes via a nonlocal strain gradient theory

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Abstract

In this paper, the nonlinear bending and vibrational characteristics of porous tubes are analyzed for the first time. Within the framework of the nonlocal strain gradient theory, a size-dependent model for the tubes with radial inhomogeneity is formulated. It is assumed that the tube is made from functionally graded materials (FGM). Employed a new model for tubes which takes into account of the shear deformation effects, the motion equations are derived with the help of Hamilton variational principle and determined by the two-step perturbation technique. The validity and feasibility of the method are verified by actual examples. The effects of different parameters such as scaling parameters, porosity volume fraction, power law index and inner-to-outer radius ratio on the nonlinear bending and vibration behaviors of the porous tubes are particularly discussed.

Keywords

Nonlinear; Bending; Vibration; Porous tubes; Nonlocal strain gradient theory.

1. Introduction

At present, introducing new non-classical theories for modeling of nanostructures has attracted many attentions of researchers. Most research works for modeling of nanostructures is based on the Eringen's nonlocal theory [1] in which long range force between atoms are