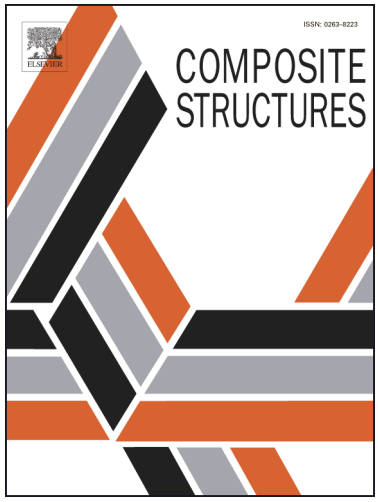

Three-dimensional vibration analysis of beams with axial functionally graded materials and variable thickness

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Three-dimensional vibration analysis of beams with axial functionally graded materials and variable thickness

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Abstract

In this paper, the vibration problem of beams with axial functionally graded materials (FGMs) and variable thickness is firstly investigated by isogeometric analysis (IGA) in conjunction with three-dimensional (3D) theory. Based on guaranteeing geometry exactness of the strength of non–uniform rational B–splines (NURBS), the curves of non-uniform thicknesses of beams are exactly described. Two beams models (slender model and plump model) are taken into account. Then the material properties smoothly varying in axial direction are calculated by two types of material distributions, power-law and exponential law. The requirement for the weak form of FGMs beams is easily satisfied as NURBS can provide higher order derivative. In numerical results, the convergence is demonstrated, then the accuracy of the current work is validated through comparing solutions with those from the commercial package ANSYS. Moreover, the effects of geometrical proprieties, material parameters as well as boundary conditions on the frequency are also examined.

Keywords: Vibration; FGMs beams; Three-dimensional theory; Variable thickness; Isogeometric analysis

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