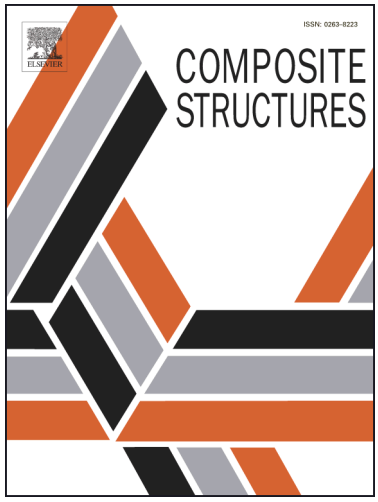

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Nonlinear free vibration analysis of defective FG nanobeams embedded in elastic medium

Zheng Lv, Zhiping Qiu[1], Jingjing Zhu, Bo Zhu, Wenyu Yang

Institute of Solid Mechanics, Beihang University (BUAA), Beijing 100191, China

ABSTRACT

Defects in atomic structure can deteriorate the mechanical properties of nanomaterials, which is crucial to the potential application in nano electromechanical systems. This work studies the effect of the material defects on nonlinear vibration behavior of embedded functionally graded (FG) nanobeams. Employing the nonlocal strain gradient theory, the size-dependent governing equations accounting for the geometric nonlinearity and elastic medium are derived and the analytical solution for nonlinear frequency is presented. To quantify the material defects, the concept of defect degree is freshly introduced and then the defective FG nanobeam model is developed. Two methods, i.e., sensitivity based interval analysis method and iterative algorithm based interval analysis method, are proposed to solve this model in the framework of interval analysis theory. After model verification, the detailed parametric investigations are carried out to understand the combined effects of the material defects and size-dependent parameter, elastic medium as well as power-law index on the vibration frequency of FG nanobeam. Numerical results validate some significant conclusions which will offer guidance in the design of nanodevices.

Keywords: Functionally graded nanobeam; Nonlinear vibration behavior; Material defects; Nonlocal strain gradient theory; Interval analysis

[1] Corresponding Author:
E-mail address: zpqiu@buaa.edu.cn