

Accepted Manuscript

Post-buckling and nonlinear free vibration analysis of geometrically imperfect functionally graded beams resting on nonlinear elastic foundation

Hessameddin Yaghoobi, Mohsen Torabi

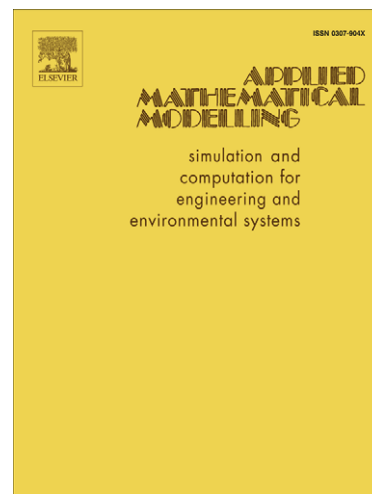
PII: S0307-904X(13)00211-4
DOI: <http://dx.doi.org/10.1016/j.apm.2013.03.037>
Reference: APM 9400

To appear in: *Appl. Math. Modelling*

Received Date: 2 November 2011
Revised Date: 1 March 2013
Accepted Date: 24 March 2013

Please cite this article as: H. Yaghoobi, M. Torabi, Post-buckling and nonlinear free vibration analysis of geometrically imperfect functionally graded beams resting on nonlinear elastic foundation, *Appl. Math. Modelling* (2013), doi: <http://dx.doi.org/10.1016/j.apm.2013.03.037>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Post-buckling and nonlinear free vibration analysis of geometrically imperfect functionally graded beams resting on nonlinear elastic foundation

Hessameddin Yaghoobi ^{1,a}, Mohsen Torabi ^b

^a Young Researchers and Elite Club, Central Tehran Branch, Islamic Azad University, Tehran, Iran

^b Department of Mechanical and Biomedical Engineering, City University of Hong Kong, 83 Tat Chee Avenue, Hong Kong

Abstract

In this paper, post-buckling and nonlinear vibration analysis of geometrically imperfect beams made of functionally graded materials (FGMs) resting on nonlinear elastic foundation subjected to axial force are studied. The material properties of FGMs are assumed to be graded in the thickness direction according to a simple power law distribution in terms of the volume fractions of the constituents. The assumptions of a small strain and moderate deformation are used. Based on Euler-Bernoulli beam theory and von-Karman geometric nonlinearity, the integral partial differential equation of motion is derived. Then this partial differential equation (PDE) problem, which has quadratic and cubic nonlinearities, is simplified into an ordinary differential equation (ODE) problem by using the Galerkin method. Finally, the governing equation is solved analytically using the variational iteration method (VIM). Some new results for the nonlinear natural frequencies and buckling load of the imperfect functionally graded (FG) beams such as the effects of vibration amplitude, elastic coefficients of foundation, axial force, end supports and material inhomogeneity are presented for future references. Results show that the imperfection has a significant effect on the post-buckling and vibration response of FG beams.

Keywords: Functionally graded beams; Imperfection; Nonlinear vibration; Post-buckling; Quadratic and cubic nonlinearity.

¹ Corresponding author.

E-mail: Yaghoobi.Hessam@gmail.com (H. Yaghoobi), Torabi.mech@gmail.com (M. Torabi)

Download English Version:

<https://daneshyari.com/en/article/8052903>

Download Persian Version:

<https://daneshyari.com/article/8052903>

[Daneshyari.com](https://daneshyari.com)