

## Accepted Manuscript

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

Gui-Lin She, Fuh-Gwo Yuan, Yi-Ru Ren, Hai-Bo Liu, Wan-Shen Xiao

PII: S0263-8223(18)31277-7

DOI: <https://doi.org/10.1016/j.compstruct.2018.07.063>

Reference: COST 9981

To appear in: *Composite Structures*

Received Date: 6 April 2018

Revised Date: 2 June 2018

Accepted Date: 16 July 2018



Please cite this article as: She, G-L., Yuan, F-G., Ren, Y-R., Liu, H-B., Xiao, W-S., Nonlinear bending and vibration analysis of functionally graded porous tubes via a nonlocal strain gradient theory, *Composite Structures* (2018), doi: <https://doi.org/10.1016/j.compstruct.2018.07.063>

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.

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

Gui-Lin She<sup>a</sup>, Fuh-Gwo Yuan<sup>a,b</sup>, Yi-Ru Ren<sup>a,\*</sup>, Hai-Bo Liu<sup>a</sup>, Wan-Shen Xiao<sup>a</sup>

<sup>a</sup>. State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha 410082, China;

<sup>b</sup>. Department of Mechanical and Aerospace Engineering, North Carolina State University, 911 Partners Way, Raleigh, NC 27695, USA.

### 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

Download English Version:

<https://daneshyari.com/en/article/6702867>

Download Persian Version:

<https://daneshyari.com/article/6702867>

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