## Accepted Manuscript

Nonlinear analyses of functionally graded microplates based on a general fourvariable refined plate model and the modified couple stress theory

Jia Lou, Liwen He, Jianke Du, Huaping Wu

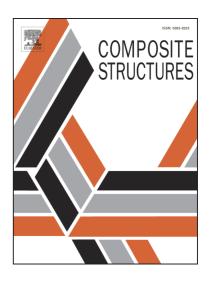
PII: S0263-8223(16)30446-9

DOI: http://dx.doi.org/10.1016/j.compstruct.2016.05.001

Reference: COST 7414

To appear in: Composite Structures

Received Date: 22 January 2016
Revised Date: 31 March 2016
Accepted Date: 1 May 2016



Please cite this article as: Lou, J., He, L., Du, J., Wu, H., Nonlinear analyses of functionally graded microplates based on a general four-variable refined plate model and the modified couple stress theory, *Composite Structures* (2016), doi: http://dx.doi.org/10.1016/j.compstruct.2016.05.001

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.

## **ACCEPTED MANUSCRIPT**

# Nonlinear analyses of functionally graded microplates based on a general four-variable refined plate model and the modified couple stress theory

Jia Lou<sup>a</sup>, Liwen He<sup>a,\*</sup>, Jianke Du<sup>a</sup>, Huaping Wu<sup>b</sup>

 <sup>a</sup> Piezoelectric Device Laboratory, Department of Mechanics and Engineering Science, Ningbo University, Ningbo, Zhejiang 315211, China
 <sup>b</sup> Key Laboratory of E&M (Zhejiang University of Technology), Ministry of Education & Zhejiang Province, Hangzhou 310014, China

#### **Abstract:**

In this paper, a general nonlinear four-variable refined plate model is developed to investigate the bending and free vibration behavior of a functionally graded (FG) microplate resting on an elastic foundation. In this model, a shape function is defined to describe the effect of the transverse shear deformation, and the size effects of the microplate are captured by using the modified couple stress theory. Firstly, the equations of motion and boundary conditions are derived from the Hamilton's principle. Then the equations of motion are reduced to ordinary differential equations by applying the Galerkin method, and via solving the ordinary differential equations, closed-form solutions for the nonlinear bending deflection and vibration frequency are obtained. It is found that the solutions for the general refined plate model are identical to those for a size-dependent Kirchhoff plate model and a refined first-order plate model respectively when the shape function of the transverse shear deformation is chosen to be certain forms. In addition, numerical studies are carried out to compare a special nonlinear size-dependent refined higher-order plate model with its linear counterpart as well as the nonlinear refined first-order plate model.

### **Keywords:**

Functionally graded microplate; Nonlinear bending; Nonlinear free vibration; Refined plate theory; Modified couple stress theory; Galerkin method

E-mail addresses: physi mechanism@163.com (L.W. He), jiajia smile@163.com (J. Lou).

1

<sup>\*</sup>Corresponding author.

### Download English Version:

# https://daneshyari.com/en/article/6705360

Download Persian Version:

https://daneshyari.com/article/6705360

<u>Daneshyari.com</u>