Accepted Manuscript

New 2D and quasi-3D shear deformation theories for free vibration of functionally graded plates on elastic foundations

Fatima Zohra Zaoui, Djamel Ouinas, Abdelouahed Tounsi

PII: S1359-8368(18)32120-6

DOI: 10.1016/j.compositesb.2018.09.051

Reference: JCOMB 6021

To appear in: *Composites Part B*

Received Date: 6 July 2018

Revised Date: 19 September 2018

Accepted Date: 21 September 2018

Please cite this article as: Zaoui FZ, Ouinas D, Tounsi A, New 2D and quasi-3D shear deformation theories for free vibration of functionally graded plates on elastic foundations, *Composites Part B* (2018), doi: https://doi.org/10.1016/j.compositesb.2018.09.051.

New 2D and quasi-3D shear deformation theories for free vibration of functionally graded plates on elastic foundations

Fatima Zohra Zaoui[1*], Djamel Ouinas[1], Abdelouahed Tounsi[2]

(1) Laboratory of numerical and experimental modeling of the mechanical phenomena, Mechanical Engineering Department, Faculty of sciences and Technology / Ibn Badis University, Mostaganem 27000, Algeria

(2) Material and Hydrology Laboratory, Civil Engineering Department, Faculty of Technology / Djillali Liabes University, Sidi Bel Abbes 22000, Algeria.

(2) Department of Civil and Environmental Engineering, King Fahd University of Petroleum & Minerals, 31261 Dhahran, Eastern Province, Saudi Arabia.

Abstract

The aim of this work is to establish a two dimensional (2D) and quasi three dimensional (quasi-3D) shear deformation theories, which can model the free vibration of FG plates resting on elastic foundations using a new shear strain shape function. The proposed theories have a novel displacement field which includes undetermined integral terms and contains fewer unknowns with taking into account the effects of both transverse shear and thickness stretching. The mechanical properties of the plates are assumed to vary through the thickness according to a power law distribution in terms of the volume fractions of the constituents. The elastic foundation parameters are introduced in the present formulation by following the Pasternak (two-parameter) mathematical model. Hamilton's principle is employed to determine the equations of motion. The closed form solutions are derived by using Navier's method and then fundamental frequencies are obtained by solving the results of eigenvalue problems. The efficiency of the proposed theory is ascertained by comparing the results of numerical examples with the different 2D, 3D and quasi-3D solutions found in literature.

Keywords: Functionally graded material; Elastic foundation; Shear deformation theory; Natural frequency; Stretching effect.

* Corresponding author at: LMNEPM, Mechanical Engineering Department, University Abdelhamid Ibn Badis of Mostaganem, Algeria. E-mail adresses : fatima.zaoui@univ-mosta.dz (F.Z. Zaoui), douinas@gmail.com (D. Ouinas), tou_abdel@yahoo.com (A. Tounsi)