

# Author's Accepted Manuscript

Buckling, free vibration and bending analysis of functionally graded sandwich plates based on an optimized hyperbolic unified formulation

J.L. Mantari, JC Monge



PII: S0020-7403(16)30489-1

DOI: <http://dx.doi.org/10.1016/j.ijmecsci.2016.10.015>

Reference: MS3457

To appear in: *International Journal of Mechanical Sciences*

Received date: 13 June 2016

Revised date: 29 September 2016

Accepted date: 14 October 2016

Cite this article as: J.L. Mantari and JC Monge, Buckling, free vibration and bending analysis of functionally graded sandwich plates based on an optimized hyperbolic unified formulation, *International Journal of Mechanical Sciences* <http://dx.doi.org/10.1016/j.ijmecsci.2016.10.015>

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 galley proof before it is published in its final citable 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

# Buckling, free vibration and bending analysis of functionally graded sandwich plates based on an optimized hyperbolic unified formulation

J.L. Mantari<sup>\*</sup>, JC Monge

Faculty of Mechanical Engineering, Universidad de Ingeniería y Tecnología (UTEC)  
Engineering and Technology, Jr. Medrano Silva 165, Barranco, Lima, Perú

<sup>\*</sup>Corresponding author. Tel.: +00511 3540070; Cell: +0051 96224551; [jmantari@utec.edu.pe](mailto:jmantari@utec.edu.pe)

## Abstract

This paper presents an analytical solution of the linear buckling, free vibration and bending behavior of simple supported functionally graded sandwich plates subjected to transverse and axial mechanical loads. The used optimization strategy allows to express the transverse and in-plane displacement fields as a function of the  $n$  and  $m$  parameter, respectively, so the used Carrera's unified formulation (CUF) is also  $n$  and  $m$  parameters dependent. Principle of virtual displacement (PVD) is utilized to obtain the highly coupled differential equations. The solution is obtained via Navier-Type solution. Good agreements with quasi-3D solutions are found. The optimized parameters are used for solving the buckling problem of functionally graded sandwich plates with different side-to-thickness ratios. Numerical results for buckling are compared to different advanced theories since there isn't 3D solution available in the literature. Overall, the presented results have a high accuracy to estimate the critical loads, modes and natural frequencies.

Keywords: Sandwich plate, functionally graded materials, Carrera's unified formulation, linear buckling, free vibration.

## 1. Introduction

Functionally graded materials (FGMs) are heterogeneous advanced composite materials which. The thermal and elastic mechanical properties are defined by a gradual through the plate thickness variation of the mechanical properties influenced by the volume fraction. FGMs were

Download English Version:

<https://daneshyari.com/en/article/5016356>

Download Persian Version:

<https://daneshyari.com/article/5016356>

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