Accepted Manuscript

Buckling and free vibration analyses of functionally graded graphene reinforced porous nanocomposite plates based on Chebyshev-Ritz method

Jie Yang, Da Chen, Sritawat Kitipornchai

PII: S0263-8223(18)30786-4
DOI: https://doi.org/10.1016/j.compstruct.2018.03.090
Reference: COST 9537

To appear in: *Composite Structures*

Received Date: 25 February 2018
Revised Date: 22 March 2018
Accepted Date: 26 March 2018

Please cite this article as: Yang, J., Chen, D., Kitipornchai, S., Buckling and free vibration analyses of functionally graded graphene reinforced porous nanocomposite plates based on Chebyshev-Ritz method, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.03.090

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

Buckling and free vibration analyses of functionally graded graphene reinforced porous nanocomposite plates based on Chebyshev-Ritz method

Jie Yang [a,*], Da Chen [b], Sritawat Kitipornchai [b]

[a] *School of Engineering, RMIT University, PO Box 71, Bundoora, VIC 3083 Australia*

[b] *School of Civil Engineering, the University of Queensland, Brisbane, St Lucia 4072, Australia*

Abstract

This paper is concerned with the buckling and free vibration behaviors of functionally graded (FG) porous nanocomposite plates reinforced with graphene platelets (GPLs). The porous plates are constructed based on a multiplayer model with GPLs uniformly or non-uniformly distributed in the metal matrix containing open-cell internal pores. The modified Halpin-Tsai micromechanics model, the extended rule of mixture, and the typical mechanical properties of open-cell metal foams are used to determine the effective properties of the porous nanocomposite. By using the first-order shear deformation plate theory (FSDT) to account for the transverse shear strain and Chebyshev-Ritz method to discretize the displacement fields, the governing equations are derived and then solved to calculate the critical uniaxial, biaxial and shear buckling loads and natural frequencies of the plates with different porosity distributions and GPL dispersion patterns. After a convergence and validation study to verify the present analysis, a comprehensive parametric investigation on the influences of the weight fraction and geometric parameters of GPL nanofiller and the porosity coefficient is conducted to identify the most effective way to achieve improved buckling and vibration resistances of the porous nanocomposite plate.

Keywords:

Porous nanocomposite plate; graphene platelet; elastic buckling; free vibration; Chebyshev-Ritz method.

1. Introduction

Since the discovery in 1991, carbon nanotubes (CNTs) are widely used as the reinforcing nanofillers to develop high-strength nanocomposites owing to their exceptional mechanical properties and chemical stability [1-11]. However, a newly-developed carbon material – graphene nanoplatelets (GPLs) which are the two-dimensional counterparts of CNTs can

*Corresponding author

E-mail address: j.yang@rmit.edu.au (J. Yang).

Download English Version:

https://daneshyari.com/en/article/6703590

Download Persian Version:

https://daneshyari.com/article/6703590

Daneshyari.com