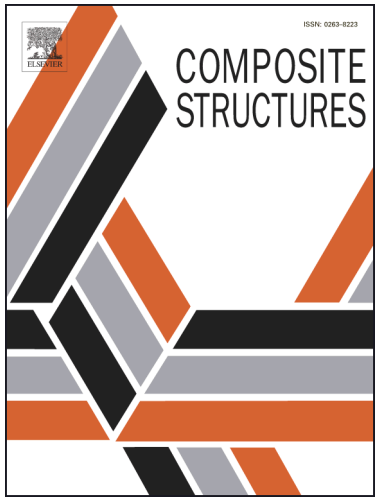

Nonlinear Vibrations of FG cylindrical shells subjected to parametric and external excitations

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PII: S0263-8223(17)32843-X
DOI: https://doi.org/10.1016/j.compstruct.2018.02.018
Reference: COST 9368

To appear in: *Composite Structures*

Received Date: 3 September 2017
Revised Date: 31 January 2018
Accepted Date: 8 February 2018

Please cite this article as: Sheng, G.G., Wang, X., Nonlinear Vibrations of FG cylindrical shells subjected to parametric and external excitations, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.02.018

Nonlinear Vibrations of FG cylindrical shells subjected to parametric and external excitations

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Abstract

The nonlinear dynamic behaviours of functionally graded (FG) cylindrical shells under combined parametric and external excitations are presented in this paper. Based on the von Kármán nonlinear theory, Galerkin's method and the static condensation method, the coupled nonlinear differential equations with two modes are derived. The method of multiple scales is applied to solve the coupled nonlinear differential equations having both quadratic and cubic nonlinearities, and the principal resonance and internal resonance of the system are investigated by the frequency response curves. The dynamic stability of parametric excitations is also investigated by time responses of the fundamental mode. The effects of different parameters on the nonlinear vibration are discussed by numerical simulation. Some comparisons are made with the available published work and good agreement is obtained.

Keywords: Functionally graded; Cylindrical shell; Nonlinear vibration; Internal resonance

1. Introduction

Functionally graded (FG) shells have excellent mechanical properties and can be used as thermal barrier structures in modern industries such as aerospace, chemical industry and nuclear engineering [1-5]. To design a stable and reliable structure, these engineering applications have attracted the attention of many scientists to investigate

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