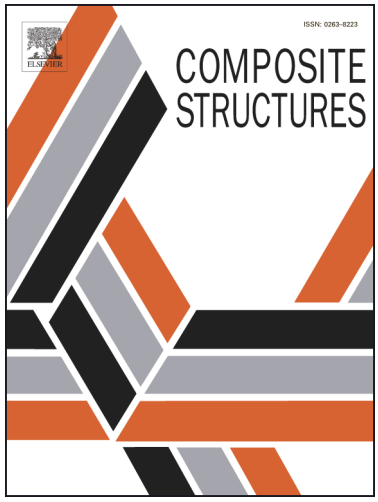
Accepted Manuscript



Non-linear vibration and dynamic instability of internally-thickness-tapered composite plates under parametric excitation

Mehdi Darabi, Rajamohan Ganesan

PII: S0263-8223(16)31548-3
DOI: http://dx.doi.org/10.1016/j.compstruct.2017.04.059
Reference: COST 8490

To appear in: *Composite Structures*

Received Date: 15 August 2016
Revised Date: 8 February 2017
Accepted Date: 23 April 2017

Please cite this article as: Darabi, M., Ganesan, R., Non-linear vibration and dynamic instability of internally-thickness-tapered composite plates under parametric excitation, *Composite Structures* (2017), doi: http://dx.doi.org/10.1016/j.compstruct.2017.04.059

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

Non-linear vibration and dynamic instability of internally-thickness-tapered composite plates under parametric excitation

Mehdi Darabi [a], Rajamohan Ganesan [a*]

[a] Concordia Center for Composites, Department of Mechanical and Industrial Engineering, Concordia University, 1455 de Maisonneuve Blvd. W. Montreal, Quebec, Canada

Abstract

Internally-tapered composite plates are formed by terminating or dropping-off some of the plies in the laminates at pre-determined locations, which is an important method for stiffness tailoring and weight saving in these structures. In the present work, the dynamic instability of internally-thickness-tapered laminated composite plates subjected to harmonic in-plane loading is studied based on non-linear vibration analysis. The non-linear von Karman strains associated with large deflections and curvatures are considered. The in-plane displacements are determined from the two in-plane force-equilibrium equations of motion of non-linear large deflection tapered plate. Consequently, the in-plane force-resultants can be obtained from the in-plane displacements and further applying the boundary conditions. Then the general Galerkin method is used for the moment-equilibrium equation of motion to satisfy spatial dependence in the partial differential equation of motion to produce a set of non-linear Mathieu-Hill equations. These equations are ordinary differential equations, with time-dependency. By applying the Bolotin's method to these equations, the dynamically-unstable regions, stable-, and unstable-solutions amplitudes of the steady-state vibrations are obtained. The non-linear dynamic stability characteristics of symmetric cross-ply laminates with different taper configurations are examined. A comprehensive parametric study is carried out to examine and compare the effects of the taper angles, magnitudes of both tensile and compressive in-plane loads, aspect ratios of the tapered plate including length-to-width and length-to-average-thickness ratios on the instability regions and the parametric resonance particularly the steady-state vibrations amplitude. For linear vibrations, the present results show good agreement with that available in the literature which were obtained based on linear analysis.

Keywords: Dynamic stability; Composite Laminates; Non-linear vibrations ; Tapered plate; Parametric resonance

[*] Corresponding author. Tel: +1 514 848 2424 x3164
E-mail Address: ganesan@encs.concordia.ca

ACCEPTED MANUSCRIPT

Download English Version:

https://daneshyari.com/en/article/4911705

Download Persian Version:

https://daneshyari.com/article/4911705

Daneshyari.com