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PII: S0020-7403(14)00308-7
DOI: http://dx.doi.org/10.1016/j.ijmecsci.2014.09.005
Reference: MS2817

To appear in: *International Journal of Mechanical Sciences*

Received date: 16 March 2014
Revised date: 19 July 2014
Accepted date: 10 September 2014

Cite this article as: Guoyong Jin, Zhu Su, Tiangui Ye, Xingzhao Jia, Three-dimensional vibration analysis of isotropic and orthotropic conical shells with elastic boundary restraints, *International Journal of Mechanical Sciences,* http://dx.doi.org/10.1016/j.ijmecsci.2014.09.005

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Three-dimensional vibration analysis of isotropic and orthotropic conical shells with elastic boundary restraints

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Abstract

In this paper, a three-dimensional (3-D) solution method is presented for the free vibration of isotropic and orthotropic conical shells with elastic boundary restraints. The formulation is derived by means of the Rayleigh-Ritz procedure based on the three-dimensional elasticity theory. Displacement components of the conical shells are represented by Fourier series in the circumferential direction and a double Fourier cosine series supplemented with several auxiliary functions in thickness and meridional directions. The supplementary functions in the form of the product of a polynomial function and a single cosine series are introduced to ensure and accelerate the convergence of the series representations. To validate the present method, the convergence behavior is demonstrated, and several comparisons of the numerical results with those published in literature and obtained by ANASYS are performed. Numerous new results for the isotropic and orthotropic conical shells with elastic boundary conditions are presented. The effects of the geometrical parameters, orthotropic properties and boundary conditions on the natural frequencies of conical shells are illustrated.

Keywords: isotropic and orthotropic; conical shell; three-dimensional elasticity theory; free vibration; elastic boundary restraints

1. Introduction

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