Hygrothermal analysis of a rotating smart exponentially graded cylindrical shell with imperfect bonding supported by an elastic foundation

M. Saadatfar, M. Aghaie-Khafri

PII: S1270-9638(15)00069-3
DOI: http://dx.doi.org/10.1016/j.ast.2015.02.012
Reference: AESCTE 3260

To appear in: *Aerospace Science and Technology*

Received date: 6 August 2014
Revised date: 18 October 2014
Accepted date: 17 February 2015

Please cite this article in press as: M. Saadatfar, M. Aghaie-Khafri, Hygrothermal analysis of a rotating smart exponentially graded cylindrical shell with imperfect bonding supported by an elastic foundation, *Aerosp. Sci. Technol.* (2015), http://dx.doi.org/10.1016/j.ast.2015.02.012

Hygrothermal analysis of a rotating smart exponentially graded cylindrical shell with imperfect bonding supported by an elastic foundation

M. Saadatfar, M. Aghaie-Khafri[a]

Faculty of Mechanical Engineering, K.N. Toosi University of Technology, Postal Code: 1999143344, Tehran, Iran

Abstract

In the present study, a rotating functionally graded cylindrical shell (FGM) with imperfectly surface bounded functionally graded piezoelectric material (FGPM) subjected to an axisymmetric hygrothermo-electro-mechanical loading is considered. The shell is simply supported and could be rested on an elastic foundation. The material properties of FGM and FGPM are assumed to be exponentially graded in the radial direction. The Fourier series expansion method through the longitudinal direction and the differential quadrature method (DQM) across the thickness direction are used for solving governing differential equations. To check the validity of the present work, comparisons with the previous results are performed. Finally, numerical results are shown to clarify the effects of important parameters on the behavior of the smart shell.

Keywords:

Hygrothermal analysis; Hygrothermopiezoelectric; Imperfect bonding; Exponentially graded hybrid cylindrical shell; Elastic foundation.

1. Introduction

In recent years, smart structures including FGMs or multilayered composite members bonded with piezoelectric actuators and sensors are being increasingly used in the aerospace, automobile, and other engineering areas. Therefore, the ability to predict the response of smart structures in multiphysics environments and subjected to multifield loads is of interest for engineers and researchers [1, 2].

[a]Corresponding author, Associate Professor, Tel: +98 09123088389; Fax: +98 21 886 74748.
E-mail addresses: maghaei@kntu.ac.ir (M. Aghaie-Khafri); msaadatfar@dena.kntu.ac.ir (M. Saadatfar).