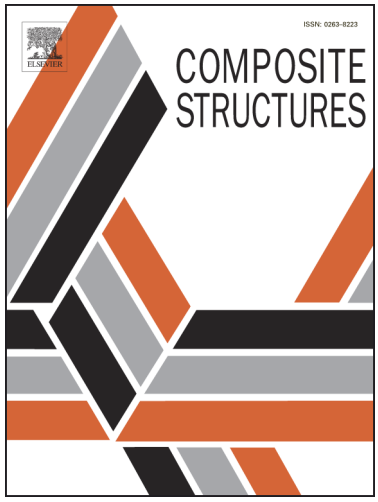

Dynamics of magneto electro elastic curved beams: quantification of parametric uncertainties

M.T. Piovan, J.F. Olmedo, R. Sampaio

PII: S0263-8223(15)00630-3
DOI: http://dx.doi.org/10.1016/j.compstruct.2015.07.084
Reference: COST 6665

To appear in: *Composite Structures*

Received Date: 31 March 2015
Accepted Date: 15 July 2015

Please cite this article as: Piovan, M.T., Olmedo, J.F., Sampaio, R., Dynamics of magneto electro elastic curved beams: quantification of parametric uncertainties, *Composite Structures* (2015), doi: http://dx.doi.org/10.1016/j.compstruct.2015.07.084

Dynamics of magneto electro elastic curved beams: quantification of parametric uncertainties

M.T. Piovan[a,c,*], J.F. Olmedo[c], R. Sampaio[b]

[a] *Universidad Tecnolgica Nacional - F.R.B.B., Centro de Investigaciones en Mecnica Terica y Aplicada, 11 de Abril 461, Baha Blanca, BA, B8000LMI, Argentina*

[b] *PUC-Rio, Mechanical Engineering Department. Rua Marqus de So Vicente 225, Rio de Janeiro RJ-22453-90, Rio de Janeiro, Brazil*

[c] *Universidad de las Fuerzas Armadas, Departamento de Ciencias de la Energa y Mecnica, Av. Rumiahui s/n Sangolqui, Ecuador.*

Abstract

The objective of this paper is the evaluation of uncertainty propagation associated to several parameters in the dynamics of magneto-electro-elastic (MEE) curved beams. These MEE structures can be employed as imbedded parts in high performance technological systems to control motions and/or attenuate vibrations, for energy harvesting, etc. Although a lot of research connected with these structures was done for dynamics and statics, it is remarkable the scarcity of articles analyzing random dynamics of MEE structure, provided that many models have uncertainties associated to their parameters: loads and/or material properties, among others. A theory for MEE curved beams is derived and assumed as the deterministic model. The response is calculated by means of a finite element formulation. The probabilistic model is constructed appealing to the finite element formulation of the deterministic approach, by adopting random variables for the uncertain parameters selected. The probability density functions of the random variables are derived with the Maximum Entropy Principle. The Monte Carlo method is used to perform simulations with independent realizations. Studies are carried out in order to evaluate the influence of Magneto-elastic and/or piezoelectric coupling in the dynamics of MEE curved beams in both contexts: the deterministic and the stochastic.

Keywords: MEE structures, curved beams, dynamics, composite materials, parametric probabilistic approach, shear deformability

1. Introduction

The MEE material are a kind of smart composites exhibiting various coupling effects that can be of useful in many high-tech structural applications. That is why many investigation on the mechanics of MEE structures have received considerable attention of the research community since the last 10 years.

Especial composite materials consisting of piezoelectric and magnetostrictive components are used in smart structures such as sensors, actuators, hydrophones, etc. The smart structures provide

*Corresponding Author

Email address: mpiovan@frbb.utn.edu.ar (M.T. Piovan)