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STOCHASTIC DYNAMICS OF CURVED FG BEAMS RESTING ON ELASTIC FOUNDATIONS AND SUBJECTED TO ELECTROMECHANICAL LOADS: PARAMETRIC AND NON-PARAMETRIC APPROACHES

Marcelo T. Piovan[a,b], Sebastian Domini[a] and Rubens Sampaio[c]

[a]*Centro de Investigaciones en Mecánica Teórica y Aplicada, Universidad Tecnológica Nacional - F.R.B.B., 11 de Abril 461, Bahía Blanca, BA, B8000LMI, Argentina, mpiovan@frbb.utn.edu.ar, dominis@frbb.utn.edu.ar, http://www.frbb.utn.edu.ar*

[b]*Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET)*

[c]*Departament of Mechanical Engineering. Pontifícia Universidade Católica do Rio de Janeiro. Rua Marquês de São Vicente 225, Rio de Janeiro RJ-22453-90, Brazil, rsampaio@puc-rio.br, http://www.unmeseta.edu.ar/gia*

Abstract. This article deals with the stochastic dynamics of curved Functionally Graded (FG) beams with piezoelectric layers resting on elastic foundation. The beam, which is subjected to electromechanical and thermal loads, has uncertainty in its material properties.

The beam model is deduced in the context of common variational principles, incorporating shear flexibility and a Pasternak-Winkler elastic foundation. It serves as a mean deterministic approach to the studies on stochastic dynamics, which are the objective of the present article. The stochastic study follows two approaches: by employing random variables to characterize the uncertainty in the material properties such as elasticity moduli, density, etc. of the material constituents (i.e a parametric approach) or by adopting random matrices of the whole model (i.e. a non-parametric approach). The probability density functions of the random variables (or matrices) are derived appealing to the Maximum Entropy Principle.

Once the probabilistic model is discretized in the context of the finite element method, the Monte Carlo method is employed to perform statistical simulations.

Numerical studies are carried out to show the main advantages of the modeling schemes employed, as well as to quantify the propagation of the uncertainty in the dynamics of curved FG beams.