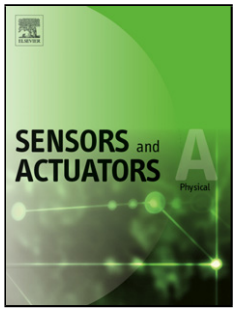

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PII: S0924-4247(15)30223-5
DOI: http://dx.doi.org/doi:10.1016/j.sna.2015.11.010
Reference: SNA 9401

To appear in: *Sensors and Actuators A*

Received date: 9-7-2015
Revised date: 9-10-2015
Accepted date: 12-11-2015

Please cite this article as: V. kasiviswanathan, A. Arockiarajan, Analytical, numerical and experimental studies on effective properties of layered (2-2) multiferroic composites, *Sensors & Actuators: A. Physical* (2015), http://dx.doi.org/10.1016/j.sna.2015.11.010

Analytical, numerical and experimental studies on effective properties of layered (2-2) multiferroic composites

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Abstract

An analytical model based on equivalent layered approach based on iso-field assumptions is proposed to evaluate the effective properties of layered multi-ferroic composites where three phases (piezoelectric, piezomagnetic and epoxy) are considered for homogenization. Also, a finite element (FE) analysis with periodic boundary conditions is carried out in the present work to determine the effective properties of multiferroics wherein interphase and geometric (shape and position) properties are considered. The simulated results based on the proposed analytical and numerical models are compared with exact matrix method available in the literature. Experiments are performed on multiferroic composites under magnetic loading to measure magneto-electric (ME) coupling constant and the results are compared with the simulated results. A parametric study is conducted to investigate the variations of the overall material behavior of layered composite with respect to piezo-electric and piezomagnetic poling/orientation directions. The outcome of the present study demonstrates the influence of poling and orientation of individual constituents on effective properties of multiferroic composites.

Key words: 2-2 layered multi-ferroic composite, Effective properties, Equivalent layered approach, ME coupling coefficient, Finite element model

1 Introduction

In recent years, composite materials consisting of piezoelectric, piezomagnetic, shape memory alloys and active polymers have drawn significant interest in structural health monitoring and adaptive con-

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