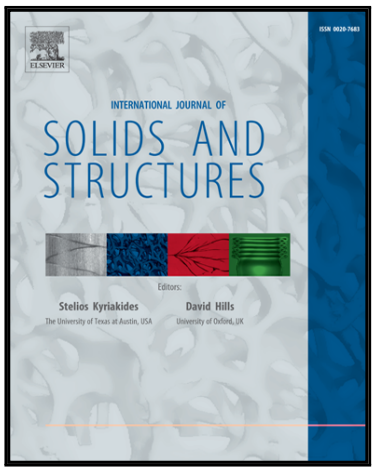

Propagation and control of shear waves in piezoelectric composite waveguides with metallized interfaces

D.G. Piliposyan , G.T. Piliposian , K.B. Ghazaryan

PII: S0020-7683(16)30362-6
DOI: 10.1016/j.ijsolstr.2016.11.027
Reference: SAS 9380

To appear in: *International Journal of Solids and Structures*

Received date: 2 June 2016
Revised date: 24 November 2016
Accepted date: 26 November 2016

Please cite this article as: D.G. Piliposyan , G.T. Piliposian , K.B. Ghazaryan , Propagation and control of shear waves in piezoelectric composite waveguides with metallized interfaces, *International Journal of Solids and Structures* (2016), doi: 10.1016/j.ijsolstr.2016.11.027

Propagation and control of shear waves in piezoelectric composite waveguides with metallized interfaces

D G Piliposyan[1], G T Piliposian[1,2], K B Ghazaryan[3]
[1,3]Department of Dynamics of Deformable Systems and Coupled Fields,
375024 Bagramyan ave., Institute of Mechanics, Yerevan, Armenia
piliposyan@mechins.sci.am, KGhazaryan@mechins.sci.am
[2]Department of Mathematical Sciences, The University of Liverpool,
M&O Building, L69 7ZL, Liverpool, gayane@liv.ac.uk

Abstract

This paper investigates coupled electro-elastic shear waves propagating along a piezoelectric finite width waveguide consisting of layers separated by metallized interfaces and arranged in a periodic way along the guide. The modified matrix method is applied to obtain the dispersion equation for a waveguide with straight walls. Bragg resonances and the presence of trapped modes and slow waves are revealed and analysed for a periodic structure consisting of unit cells made up firstly from two different piezoelectric materials, and secondly from two identical piezoelectric materials. An analytical expression for the transmission coefficient for the waveguide with a defect layer is found that can be used to accurately detect and control the position of the passband within a stopband. This can be instrumental for constructing a tuneable waveguide made of layers of identical piezoelectric crystals separated by metallized interfaces.

Key words

Piezoelectric composite waveguide, periodic phononic crystal, bandgap, Bloch waves.

1. Introduction

Recently the problem of elastic wave propagation in piezoelectric periodic structures has been attracting increasing attention due to extensive applications in smart materials and structures, particularly those made of two or more different constituents arranged periodically. For example, thin film piezoelectric layered structures have been widely used in high frequency, high performance, small size, low cost, low energy consumption technologies.

Electro-mechanical coupling in piezoelectric materials can significantly affect the properties of acoustic waves in periodic structures and reveal new properties compared to those of purely elastic crystals. These properties have been widely discussed and investigated in one,

[1] Corresponding author