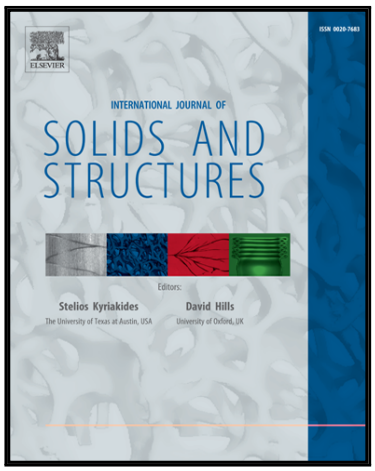

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Roey Getz, Gal Shmuel

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Band gap tunability in deformable dielectric composite plates

Roey Getz and Gal Shmuel*

Faculty of Mechanical Engineering, Technion–Israel Institute of Technology, Haifa 32000, Israel

Abstract

Subject to voltage, dielectric elastomers deform and stiffen. We show that harmonic excitations at certain frequencies cannot propagate in incompressible dielectric elastomer fiber composite *films*. Importantly, we demonstrate that these *band gaps* are tunable by the voltage. To show this, we formulate the equations governing small-amplitude waves in a deformed film, taking into consideration its surfaces. We develop a scheme to numerically solve the resultant equations, based on the supercell plane wave expansion method. To arrive at the findings above, we apply our scheme to a composite with circular fibers, and parametrically study the propagation dependency on the phase properties, film thickness, and voltage. Our results are another step towards the use of soft dielectric films as active wave manipulators.

Keywords: Dielectric elastomer film, Wave propagation, Band gap, Composite, Phononic crystal, Plane wave expansion, Nonlinear elasticity

1 Introduction

Mechanical waves traveling through elastic composites encounter periodic boundaries, which create secondary waves and, in turn, an interference pattern. This interference prevents the propagation

*Corresponding author. Tel.: +1 972 778871613. *E-mail address*: meshmuel@tx.technion.ac.il (G. Shmuel).