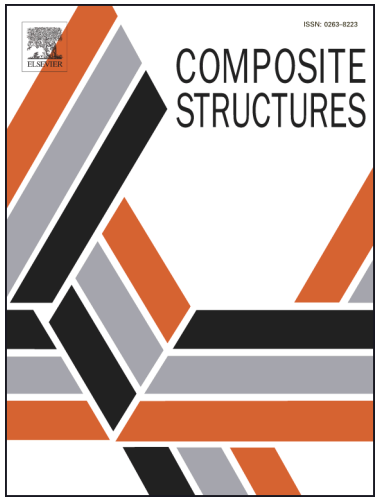

Reflection and transmission of plane wave in multilayered nonlocal magneto-electro-elastic plates immersed in liquid

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Reflection and transmission of plane wave in multilayered nonlocal magneto-electro-elastic plates immersed in liquid

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Abstract: Taking the nonlocal effect into account, we investigate the reflection and transmission of the plane wave propagating in three-dimensional multilayered magneto-electro-elastic (MEE) plates which are immersed in liquid. Based on the basic equations with nonlocal effect, the first-order state-space system is established to describe the relations of magnitudes of the extended stress and displacement. The general solutions of the extended stress and displacement are expressed in terms of the eigenvalues and eigenvectors which are derived from the first-order state-space system. Then the stiffness matrix method is employed to find the relation between the displacement and traction on the upper and lower interfaces of the layer. After defining the mechanical, electric and magnetic boundary conditions, we derive the reflection and transmission coefficients of the plane wave propagating in the MEE plates by deriving the global stiffness matrix. Finally, numerical examples are provided to show the effect of the nonlocal parameter, stacking sequences, frequency and incident angle on the reflection and transmission coefficients.

Key words: Nonlocal effect; Reflection and transmission; Wave propagation; Multilayers; Magneto- electro-elastic plate; Stiffness matrix method

1. Introduction

Due to their powerful functions for transforming energy among mechanical, electric and magnetic fields, the magneto-electro-elastic materials showed potential applications in smart devices and components [1]. Except for traditional nondestructive inspection, plane wave in MEE plates can be used to design biosensors or ultrasound transducers. In some of those applications, the MEE plate may work in insulated or conductive liquid. In such case it is very important to understand the propagation behaviors of plane wave in MEE plates immersed in liquid. As for the purely elastic solid immersed in non-viscous liquid, the propagation behaviors