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A New Model for Wave Propagation in Functionally Graded Anisotropic Doubly-Curved Shells

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ABSTRACT

This research is devoted to an investigation on the wave propagation in doubly-curved shell made of Functionally Graded Anisotropic materials in the framework of an accurate higher order shear deformation theory. In this recently developed theory, an exponential formula in combination with a trigonometric function are used for modeling the displacement field. This type of theory has only five unknowns but it seems that it can have precise results in various conditions for thick and thin shells. In the functionally graded anisotropic material, all components of the elastic stiffness tensor and density are varied exponentially through the thickness direction. Hamilton's principle is utilized with the purpose of deriving the governing equations in orthogonal curvilinear coordinates. The analytical dispersion relations are obtained by solving an eigenvalue problem. These methods are validated by comparing authors' results with other papers available in open literature for isotropic and functionally graded plates. Detailed parametric studies are then carried out to scrutinize the influences of wave number, geometrical shape, exponential factor and volume fraction index on the circular frequencies, phase velocities and group velocities. From the best knowledge of authors, it is the first time that functionally graded anisotropic doubly-curved shells are investigated in open literature.

Keywords: Functionally Graded Anisotropic Materials, Doubly-Curved Shells, Higher Order Shear Deformation Theory.

1. Introduction

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