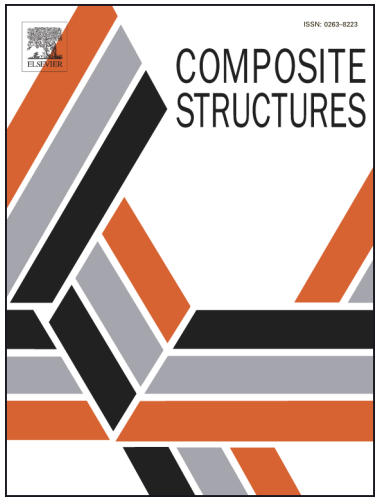

Free vibration of anti-symmetric angle-ply layered circular cylindrical shells filled with quiescent fluid under first order shear deformation theory

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Free vibration of anti-symmetric angle-ply layered circular cylindrical shells filled with quiescent fluid under first order shear deformation theory

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Abstract

Free vibration of layered circular cylindrical shell filled with fluid with an anti-symmetric angle-ply walls including first-order shear deformation theory is presented. The fluid is assumed to be quiescent and inviscid. The permeability condition on the fluid-shell interface is applied to ensure the contact between the fluid and shell wall. The governing equations are obtained in terms of displacement and rotational functions. These functions are assumed in a separable form, resulting into a system of ordinary differential equation. Bickley-type spline of order three is applied to the problem, along with the equations of boundary conditions, bringing out into the system of homogeneous equations and become as a generalized eigenvalue problem. This problem is solved for frequency parameter with an associated eigenvectors. The effect of shell geometry, types of material, ply-orientations, number of layers and boundary conditions on frequencies are studied.

Keywords
Free vibration, cylindrical shell, first order shear deformation, inviscid fluid, splines

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1. Introduction

Laminated composites have received considerable attention in many industries due to their significant characteristics such as high strength and high stiffness. Moreover, laminated composites are popular compared to a single material because the value of frequency can be altering by changing the orientation of lamina as well as the number of layers. There are a lot of studies concerning the vibration behavior of laminated composite shell structure, especially in cylindrical shell [1-15].

In addition, there exists research related to the vibration behavior of cylindrical shell having fluid. In the case of fluid, it can be fully filled, partially filled, flowing or submerged. Investigation on the interaction between the fluid and shell has been made in order to analyze the effect of the frequency of the shell. Jain [16] investigated the vibration of the cylindrical shell partially filled or completely with incompressible and non-viscous fluid using the