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Free vibration study of multilayer sandwich spherical shell panels with viscoelastic core and isotropic/laminated face layers

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Abstract

The present work deals with the free vibration and damping characteristics study of multilayer sandwich spherical shell panels with viscoelastic material core layers and elastic face layers based on first order shear deformation theory. The displacements of the core layers are assumed to vary linearly along the thickness. Longitudinal and transverse deformations of the core layers are taken in to account with the consideration of independent transverse displacements of the elastic layers. The equation of motion is derived using Hamilton's principle in conjunction with the finite element method. Eight number of sandwich shell panels are studied mainly in two groups viz. sandwich panels with laminated base layer and isotropic base layer. Fundamental frequencies and associated system loss factors of different sandwich shell panels are deduced by solving the equation as an eigenvalue problem. The effect of thickness of the constraining layers, thickness of the core layers, viscoelastic material loss factor and aspect ratio on the natural frequencies and system loss factors of the sandwich structures are investigated.

Keywords: A. Laminates, Viscoelastic core, B. Loss factor, Vibration, C. Finite element analysis (FEA)

1. Introduction

Viscoelastic sandwich composite structures find their niche in the areas of automobile, aviation, aerospace, marine, power plants, many civil and mechanical applications due to their capacity to absorb shock, vibration suppression, and noise reduction. The viscoelastic soft core dissipates the energy during the deformation due to its high damping capacity, when it is constrained by stiffer elastic layer resulting in high

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