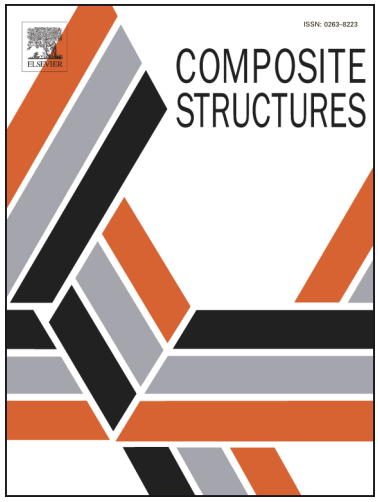

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Fundamental frequency of a composite anisogrid lattice cylindrical panel with clamped edges

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Abstract

A derivation and validation of an analytical formula for the calculation of the fundamental frequency of a composite anisogrid lattice cylindrical panel with clamped edges is presented in this paper. Free vibration analysis is performed based on the continuous model of a lattice structure using the equations of engineering theory of orthotropic cylindrical shells. The problem was solved using the Galerkin method in which the displacements of the panel were approximated by the clamped-clamped beam functions. The analytical formula derived from this solution was employed to study the effects of the structural parameters of composite lattice panels on their fundamental frequencies. The results of these parametric analyses were successfully verified by comparisons with the finite-element solutions. It is shown that the analytical model that only takes into account the inertia of the transverse motion of the panel in the direction normal to its surface provides a reasonable estimate of the value of fundamental frequency. It is also demonstrated how the formula works in the calculations delivering the required fundamental frequency when designing the composite lattice panels.

Keywords: Composite anisogrid lattice cylindrical panel; clamped edges; fundamental frequency; Galerkin method; beam functions; finite-element analysis.

1. Introduction

Composite lattice aerospace structures are designed and manufactured in different shapes and geometries depending on their application and operational requirements [1]. One of such structures is a lattice cylindrical panel. Such a panel framed by curved and straight stiffeners could be a part of a larger assembly, e.g. a closed round cylindrical shell, or might function as a separate structural component. In many of these cases, the lattice structure can be modelled as a panel with the clamped edges. Often in practice, the modal structural

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