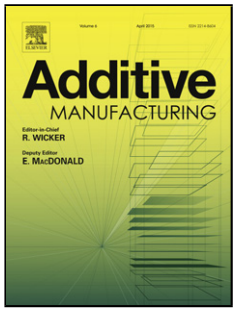

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Parametric Studies on Bending Stiffness and Damping Ratio of Sandwich Structures

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Abstract

Sandwich structures are extensively used in aviation industries to reduce the overall weight of the system. Although the mechanical behavior of these structures has been widely studied, the performance of core shape in vibration response has been minimally explored. This study focuses on understanding the various influences of sandwich structures considering the following parameters: (i) nature of core shape, (ii) number of infill shapes, and (iii) orientation of cores, which affect the dynamic behavior namely of sandwich structures. Nine sandwich structures comprising three different core shapes, hexagon, triangle, and square shapes, in three different orientations, namely 0^0, 45^0, and 90^0, were considered for the present study. These structures in the beginning were put by modal analysis using finite element method (FEM). All the nine structures were printed using the fused deposition method to validate the FEM findings, while the DEWE soft data acquisition system was used to estimate the modal parameters (i) natural frequency and (ii) damping ratio. Natural frequency and damping ratio were estimated using FRF and Nyquist circle plot, respectively. This study demonstrates that although the square core orientated at 0^0 exhibited superior stiffness in bending loads, the hexagonal core orientated at 0^0 displayed an admirable combination of both stiffness and damping properties.

Keywords: Sandwich beam, additive manufacturing, sandwich cores, vibration, modal analysis

1. Introduction

The demand for new materials and structures results from the vigorous efforts made by the automobile and aviation industries for saving the natural resources (fuel) and