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Influence of the 3D Printing Parameters on the Dynamic Characteristics of Composite Structures

Authors : Ali Raza, Rūta Rimašauskienė

Abstract : In the current work, the fused deposition modelling (FDM) technique is used to manufacture PLA reinforced with carbon fibre composite structures with two unique layer patterns, 0°\0° and 0°\90°. The purpose of the study is to investigate the dynamic characteristics of each fabricated composite structure. The Macro Fiber Composite (MFC) is embedded with 0°/0° and 0°/90° structures to investigate the effect of an MFC (M8507-P2 type) patch on vibration amplitude suppression under dynamic loading circumstances. First, modal analysis testing was performed using a Polytec 3D laser vibrometer to identify bending mode shapes, natural frequencies, and vibration amplitudes at the corresponding natural frequencies. To determine the stiffness of each structure, several loads were applied at the free end of the structure, and the deformation was recorded using a laser displacement sensor. The findings confirm that a structure with 0°\0° layers pattern was found to have more stiffness compared to a 0°\90° structure. The maximum amplitude suppression in each structure was measured using a laser displacement sensor at the first resonant frequency when the control voltage signal with optimal phase was applied to the MFC. The results confirm that the 0°/0° pattern's structure exhibits a higher displacement reduction than the 0°/90° pattern. Moreover, stiffer structures have been found to perform amplitude suppression more effectively.

Keywords : carbon fibre composite, MFC, modal analysis stiffness, stiffness
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