Vibration Attenuation of Honeycomb Sandwich Panels Using MFC Smart Patches

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ABSTRACT

New all-composite aircraft fuselage designs are being developed with a flexible honeycomb core sandwiched between carbon fiber reinforced composite laminate face sheets. The honeycomb sandwich panels offer potential advantages for significant weight reduction, while maintaining strength and fatigue properties. However, the excessive levels of vibration and noise of honeycomb sandwich panels have been a major cause for concern. Thus, vibration suppression and noise reduction in honeycomb sandwich panels pose major challenges for future aircraft design.

A 1m x 0.7m MFC smart patches/ honeycomb panel with CFCF configuration is utilized as a demonstrated structure in this study. The finite element analysis of the honeycomb panel is developed to predict the lowest three natural frequencies and corresponded mode shapes. The FEA results are validated experimentally by using modal analysis techniques. The dynamic characteristics of the MFC smart patches/honeycomb panel are demonstrated to develop efficient and reliable vibration control mechanisms and the optimum locations of surface bonded MFC actuators. The velocity feedback control is utilized to suppress the multimodes of vibration of the MFC smart patches/honeycomb sandwich panel. The experimental results show 29%, 64% and 18% attenuation of the first, second and third vibration modes with 20dB gain with velocity feedback, respectively. The experimental results indicate the potential of the proposed methodology to be a viable method for controlling the vibration of honeycomb sandwich panels using MFC smart patches.

Keywords : dynamic、future

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