Experiments on the Vibration Attenuation of Homeycomb Sandwich Panels Using MFC Actuators

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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. In this research, dynamic characteristics of honeycomb sandwich panels were experimentally examined in order to develop efficient and reliable vibration control mechanisms. The experimental measurements of dynamic characteristics of honeycomb sandwich panels were validated using ANSYS finite element model. Macro Fiber Composite (MFC), a newly developed piezoelectric actuator by the NASA LaRC, is typically directional or anisotropic, and more flexible and conformable as compared to a traditional monolithic isotropic piezoceramic actuator. The honeycomb sandwich panel was proposed as a test platform to demonstrate the effectiveness of MFC actuators in vibration suppression of honeycomb sandwich panel. Experimental investigation was implemented to evaluate the effectiveness of vibration control of honeycomb sandwich panel with MFC actuators. Four pieces of MFC actuators are surface-bonded in two effective locations for controlling vibration of lowest four modes. The surface-bonded locations were determined by modal analysis of honeycomb sandwich panel. The results of single mode and multiple modes vibration attenuation with different MFC actuating locations were presented in this study. The study suggested that using the MFC actuators in vibration control of honeycomb sandwich panel had been highly effective.

Keywords : Macro Fiber Composite ; vibration reduction ; honeycomb sandwich panels

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