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MODAL ANALYSIS OF MICRO AIR VEHICLE WINGS

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ABSTRACT

Micro air vehicle wings are constructed with the polyester fabric, attached to the flexible composite reinforced structures. Finite element models are developed for the modal characteristics of the wings. The effect of added mass, damping, and aerodynamic pressure on the modal characteristics (natural frequencies and mode shapes) of the wings is investigated. The wings are vibrated in vacuum and in air for investigating the effect of added mass and damping on their modal characteristics. Aerodynamic pressure is estimated from the low-speed wind-tunnel test data, where the angle of attack of the wings and freestream velocity of air are varied. Natural frequencies of the wings increase with mode; however, they decrease in air from those in vacuum due to the added mass of air. Damping is low and has minimal influence on the natural frequencies of the wings, but helps to reduce the out-of-plane modal amplitude of vibration. The effect of aerodynamic pressure on the first and second natural frequencies of the wings is not significant, although the third natural frequencies of the wings increase with aerodynamic pressure.

Keywords: Micro Air Vehicle, Vibration, Added Mass, Damping, Aerodynamic Pressure, Natural Frequencies, Mode Shapes.