Active Vibration Suppression of Aerobatic Aircraft Wing by Acceleration Feedback Controller

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Abstract

Vibration of some structures might be accepted under restricted limits depending on their design, application and many other factors. Aircraft wing is a structure need to be stable as possible, but there are many disturbances act on wing, so using of active vibration control for vibrated wing can serve to eliminate or suppress the major amount of wing oscillation. In the present work, direct acceleration feedback method is utilized to be used as a controlling technique to satisfy wing stability. Numerical model was simulated in ANSYS environment where the controlling method was totally integrated to generate necessary actuation voltage to derive piezoelectric actuators based on acceleration feedback. Six piezoelectric transducers were modeled in ANSYS by using element SOLID5. Experimental part includes manufacturing (1:6) scaled aircraft wing with two boxes inside and equipped with six piezoelectric transducers worked as sensor/actuator besides labview software inside which the controlling loop was
integrated. Modal analysis was performed for numerically simulated model and includes the first six modes of vibration. Free and controlled responses of the tested wing were presented for numerical and experimental model. Results show high degree of agreement between experimental and numerical models. Results show that utilizing the acceleration feedback method for active vibration controlling method can suppress wing vibration and that will pave the way for further application of this controlling method.

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Index Terms

Computer Science

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Keywords

Aircraft wing, Direct acceleration feedback, Finite element, Piezoelectric transducers, Modal analysis, Active vibration control.