Performance Evaluation of Piezoelectric Synthetic Jet Actuators Using Design Parameters Approach

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ABSTRACT

The primary objective of active flow control research is to develop a cost-effective technology that has the potential for revolutionary advances in aerodynamic performance and maneuvering compared to conventional approaches. The development of such systems have many implications for aerospace vehicles including: reduced mechanical complexity and hydraulic failure, reduced noise and weight, lower energy and fuel consumption, lower downtime and maintenance, enhanced maneuvering and agility with enhanced aerodynamic performance and safety. Interest in active flow control for aerospace applications has stimulated the recent development of innovative actuator designs that create localized disturbances in a flow field. The primary objective of this thesis is to set up a finite element model of piezoelectric synthetic jet actuators and two experiment devices to research the optimization of designing parameters of influences in flow speed. The designing parameters are the area of piezoelectric synthetic jet, flow field volume, cavity depth and slot size. Characteristics of system (frequency, amplitude and flowing speed) will be measured experimentally when the designing parameters are changed. By system model, the designing parameters will be optimized and the performance of piezoelectric synthetic jet will be evaluated. Natural frequencies and parameters of equivalent circuit of piezoelectric actuator will be measured by impedance analyzer, to provide a useful tool to make studies of the relation of dimensions and flowing speed of piezoelectric synthetic jet.

Keywords : piezoelectric actuators, synthetic jet actuators, impedance model

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