Investigation of THUNDER Actuators in Micro Aerial Vehicle

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ABSTRACT

This research presented an experimental analysis in which a THUNDER (Thin Unimorph DrivER) actuator was proposed to actuate the flapping Micro Aerial Vehicles (MAV). The THUNDER is a curved, bilayer actuator made up of a piezoelectric layer and a stainless steel layer. The commercially available THUNDER model 8-R rectangular actuators were chosen for the research presented here. Experiments were conducted on 4 different configurations, single layer with fixed-fixed ends, single layer with cantilever ends, double layers with clamp-shell type and double layers with cantilever ends. The parameters measured included natural frequency, mode shape, displacement and force with different driving voltage. A laser sensor and miniature load cells recorded the displacement and force at a fixed voltage range (0 – 500 V peak-to-peak), over a predetermined frequency range (1 – 2000 Hz). These displacement and force measurements were performed using a dynamic analyzer that controlled the process of activating and measurin the displacement of the device. The results which can be used to predict which configuration will produce the most displacement and force for a THUNDER device. The nonlinear phenomenal of THUNDER actuator was also studied in this research. The developed experimental techniques provide an invaluable tool for the designing and predicting the THUNDER performance which can be in turn be used in many applications including MAV.

Keywords : THUNDER ; piezoelectricity actuator ;the flapping wing, micro aerial vehicles

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