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Harvesting Energy from the Flow-Induced Flutter of a 'Piezoleaf'
ANDRE RUAS, SANTIAGO ORREGO, KYLE DORAN, AARON RIPS, KOUROSH SHOELE, SUNG HOON KANG, RAJAT MITTAL, Johns Hopkins University — The objective of our research is to examine energy harvesting from the flow-induced flutter of a small piezoelectric membrane, which we call a 'Piezoleaf'. Piezoleaves are small, low-cost, low-maintenance devices capable of powering small portable electronics or wireless sensors in remote areas. It is well known that piezoelectric membranes subjected to time-varying strains generate electrical energy that can be harvested. In the current project, we have designed and constructed a new, low-speed wind-tunnel (1'x1', cross-section) to analyze the flow-induced flutter and energy harvesting performance of a small (approximately 1"x2") piezoleaf. One of the novel features of this research is that the membrane is fixed at its trailing-edge (i.e. an inverted flag) since this is expected to generate more energy than a regular flag configuration. Guided by numerical simulation, we are conducting tests of this configuration in our wind tunnel for various wind speeds (maximum speeds of about 10 m/s) to examine the effect of wind-speed on the flutter and energy harvesting. High-speed videography is also being used to examine the dynamics of the flag and results from this project will be presented.

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