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Energy Harvesting for Micropower Applications by Flow-Induced Flutter of an Inverted Piezoelectric Flag[1] KOUROSH SHOELE, RAJAT MITTAL, Johns Hopkins University — Piezoelectric flexible flags can be used to continuously generate energy for small-scale sensor used in a wide variety of applications ranging from measurement/monitoring of environmental conditions (outdoors or indoors) to *in-situ* tracking of wild animals. Here, we study the energy harvesting performance as well as the flow-structure interaction of an inverted piezoelectric flag. We use a coupled fluid-structure-electric solver to examine the dynamic response of the inverted flag as well as the associated vortical characteristics with different inertia and bending stiffness. Simulations indicate that large amplitude vibrations can be achieved over a large range of parameters over which lock-on between the flag flutter and the intrinsic wake shedding occurs. The effects of initial inclination of the flag to the prevailing flow as well as Reynolds number of the flow are explored, and the effect of piezoelectric material parameters on the energy harvesting performance of this flutter state is examined in detail. The maximum energy efficiency occurs when there is a match between the intrinsic timescales of flutter and the piezoelectric circuit. The simulations are used to formulate a scaling law that could be used to predict the energy harvesting performance of such devices.

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