Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Piezoelectric energy harvesting of an inverted flag behind a bluff body OLUWAFEMI OJO, KOUROSH SHOELE, Florida State University — Piezoelectric inverted flags can be employed to harness energy from unidirectional flows. The bluff body can be employed to reduce the wind speed at which inverted flags exhibit sustained large amplitude vibration as well as produce vortex streets that oscillate the piezoelectric structure. In this study, we employ large deformation coupled electric-structure-flow interaction model and explore the piezoelectric energy harvesting of an inverted piezoelectric flag behind a bluff body subject to uniform unidirectional flow. Flags with different aspect ratios were simulated with several representative cylinder diameters and their electric energy harvesting efficiency is compared. The roles of flow conditions, structural parameters and electrical setup on the oscillatory behavior of the flag are assessed and combined to predict the optimal parameters that ensure maximum energy harvesting. Also, we employ a nonlinear modal model of the structure and dissect the fluid forces based on their causes to capture the role of different flow features on the flapping dynamics of the inverted flag.

Oluwafemi Ojo
Florida State University

Date submitted: 09 Aug 2020 Electronic form version 1.4