Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Self-Excited Fluidic Energy Harvesters with Finite-Length Cylinders[1] HUSEYIN DOGUS AKAYDIN, The City College of New York, CHLOE DUQUESNOIS, INSA de Lyon, France, NIELL ELVIN, YIANNIS ANDREOPOULOS, The City College of New York — In this experimental work, we explore the possibility of using piezoelectric materials for harvesting electrical energy from fluid flow. Such harvesters may be used for powering small sensors and obviate the need for batteries and/or power lines. Piezoelectric harvesters behave as AC-coupled devices and need oscillatory motion to generate an electrical output. The harvester should be designed to be "self-excited," i.e. capable of initiating and sustaining the necessary oscillations in steady and uniform flows. The present configuration consists of a piezoelectric cantilever beam with a cylindrical tip body which promotes aeroelastic vibrations induced by vortex shedding. The harvester was tested in a wind tunnel and it produced 0.1 mW of electrical power at a flow speed of about 1.19 m/s. Using strain measurements and a distributed parameter model, the harvested electrical power was predicted, and a reasonable agreement is obtained with the measurements. The magnitude and frequency of the driving aerodynamic forces were also estimated. Results were comparable with literature data on flow past oscillating cylinders. Finally, the effect of using various shapes of tip body is presented.

[1]Sponsored by NSF Grant: CBET #1033117.

Huseyin Dogus Akaydin
The City College of New York

Date submitted: 10 Aug 2011 Electronic form version 1.4