Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Could an implantable sensor both monitor lung flow and generate power? LUCY FITZGERALD, LUIS LOPEZ RUIS, JIANZHONG ZHU, JOHN LACH, DANIEL QUINN, University of Virginia — The rise of Smart Health has led to implantable healthcare devices that can diagnose and monitor diseases in real-time. Some diagnoses are based on fluids in the body, like asthma. A key challenge of current implantables is that they are difficult to power and require surgeries to replace batteries. We show that a piezoelectric flow sensor could monitor a fluid flow and simultaneously power itself from that flow. The effectiveness of this sensor/harvester depends on flow properties. It therefore demands advanced models that capture tradeoffs between sensing fidelity and harvesting potential. To develop these models, we built a platform for testing the sensing/harvesting capability of piezocantilevers in airflows modeled after human breathing. We found that oscillating voltage on the piezocantilever can both charge a capacitor and map to the amplitude and frequency of the breath. We explored how well models can predict harvesting and sensing potential based on breath type. These models open up a broad range of applications that we are exploring, including a smart stent that alerts patients to obtrusions or dislodging. How these models scale with flow speed/direction, turbulence intensity, and cantilever size offer design ideas for sensing/harvesting in other bodily channels.

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Date submitted: 31 Jul 2019 Electronic form version 1.4