Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A Soft Material Anemometer[1] JOHAN SUNDIN, SHERVIN BAGHERI, KTH Mechanics, Royal Institute of Technology, KATHERINE KOKMANIAN, MATTHEW FU, MARCUS HULTMARK, Mechanical and Aerospace Engineering Department, Princeton University — Micro air vehicles (MAVs) often operate in wind speeds of the same magnitude as their own velocity. In order to navigate and control them efficiently, there is a need to estimate the wind speed. Because of their low weight, around 100 g, a wind speed sensor must be small and lightweight. The sensor must also be able to withstand impulses from impacts or wind gusts. Most conventional sensor concepts today are unable to fulfill these requirements. We suggest a new flow sensor concept, based on electrically conductive soft materials, denoted organic elastic filament velocimetry (OEFV). This technique estimates flow velocity by measuring the strain a polymer ribbon in the flow experiences. The polymer ribbon can withstand strains of the order of $\epsilon \sim 1$, making it extremely durable, in contrast to most conventional materials. The ribbon is manufactured in polydimethylsiloxane (PDMS) and made piezoresistive by adding a thin layer of silver nanowires, so that the resistance of the ribbon can be related to the flow velocity. The large aspect ratio of the ribbon (length to thickness) simplifies the description of the flow around it and amplifies the sensor output. A fairly simple model of the sensor behavior is constructed and compared to experimental data.

[1]Supported by SSF (FFL15:0001) and by AFOSR (FA9550-16-1-0170)

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Date submitted: 04 Jul 2019 Electronic form version 1.4