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Development of a Touch Mode Pressure Transducer using Electroactive Polymers (EAP) PHILIPPE LAVOIE, FLORENCE ROSENBLATT, LORENZO IANNUCCI, JONATHAN F. MORRISON, Department of Aeronautics, Imperial College, London, SW7 2AZ, UK — Accurate measurements of pressure fluctuations at small temporal, O(1) kHz, and "meso" spatial scales, O(10-100) μm, are of critical importance in a number of applications such as the study and control of turbulent boundary layers at high Reynolds numbers and quantification of vorticity in super-fluids. While MEMS technology is enabling important advances in the performance of miniaturized pressure sensors, the challenge posed by the diminishing sensitivity with decreasing sensor size remains an important issue. Preliminary work on the development of a novel transducer design is presented. It takes advantage of both the increased sensitivity associated with a capacitance-based sensor operating in touch mode and the properties of EAP which have not hitherto been used for this application. EAP have high electromechanical efficiency, are capable of very large strains and can also be operated so that the diaphragm is operating as a constant displacement device. Results from a macro-scale, proof-of-concept prototype are compared to a finite element analysis (FEA) model. The FEA model, which uses an electro-mechanical coupling to represent the behavior of the EAP membrane, is used to optimize the design and predict transducer sensitivity at the meso-scale.

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