Abstract Submitted
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Turbulent skin-friction reduction by electroactive polymer surfaces with in-plane and out-of-plane motion[1] KEVIN GOUDER, JONATHAN MORRISON, Department of Aeronautics, Imperial College, London — An electroactive polymer (EAP) surface capable of in-plane and out-of-plane deformations is used to apply periodic near-wall forcing to a fully-developed turbulent boundary layer to reduce friction drag. The in-plane wall deformation consists of a flat surface with streamwise-oriented narrow strips of electrode which cause the EAP to expand and contract in the spanwise direction in response to an applied voltage. The out-of-plane wall deformation takes the form of a spanwise travelling harmonic surface wave with amplitude of the order of the viscous sublayer height. Direct measurements of friction drag by means of a drag balance (with accuracy $\pm 2\%$) and hot-wire measurements of mean and higher-order moments are presented for a range of frequencies, amplitudes and wavelengths. It is expected that the imposition of a spatially and temporally varying Stokes-like layer will enable the direct manipulation of the quasi-streamwise near-wall structures and the reduction of the frequency and intensity of sweep events. While the effectiveness of this form of near-wall forcing has been demonstrated in simulations, the development of EAP surfaces allows experimental assessment of the technique at laboratory Reynolds numbers.

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