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Fluid Structure Interactions on an Electro-Elastomer Membrane Wing LAWRENCE UKEILEY, ADAM HART, University of Florida, MICHAEL HAYS, WILLIAM OATES, Florida State University, BENJAMIN DICKINSON, Air Force Research Laboratory — Wing flexibility is an important aspect of many natural flyers that has been demonstrated to have several specific aerodynamic benefits. An engineering abstraction of flexibility in wings is to use an extensible membrane stretched over a rigid frame. A key aspect of a membrane wing's performance is its tension as that will dictate how far it can stretch and its natural vibrational frequency. In this work we use a dielectric elastomer membrane, whose ability to stretch is a function of a voltage applied across it. The membrane is adhered to an elliptical planform wing which was placed in the freestream of an open jet wind tunnel. Measurements of the aerodynamic performance, membrane shape and flow field over the wing have been acquired as a function of angle of attack and voltage across the elastomer independently as well as synchronously. These measurements demonstrate how the membrane's characteristics alter the flow over it and translate to the generation of aerodynamic forces. These characteristics are studied in terms of both the static deflection increasing the wings camber as well as the time dependent excitation through the membrane's vibrations.

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