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Numerical Modeling and Simulations on Electo-Active Polymer Flow Control ANDREW WEDDLE, MICHAEL AMITAY, LUCY ZHANG, Rensselaer Polytechnic Institute — The primary focus of this study is to identify the effects of vibrating Electro-Active Polymer (EAP) flow control on the flow field, specifically within the boundary layer. The EAPs represent a light-weight and adaptable flow control solution for micro-air vehicles (MAV). In this study, the interaction of the flow field over a flat plate and NACA 0009 airfoil are modeled at a Reynolds number of 20,000 using an Arbitrary Lagrangian Eulerian finite element formulation. In the simulations, the EAP vibration is prescribed based on the measurements from the experiments. The results show the EAPs do alter the boundary layer flow field and the size of the separation bubble. Three different diameter EAPs are examined on the flat plate model: 6mm, 9mm, and 12mm. Each is evaluated at different vibrational frequencies and maximum amplitudes. The performance of the EAPs on the NACA 0009 model are also evaluated while the airfoil is experiencing a pitching motion and gusts. Both instantaneous and time averaged flow fields are analyzed. The results from the numerical simulations are compared to baseline CFD simulations and wind tunnel results.

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