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Active Control of Airfoil Boundary Layer Separation and Wake using Ns-DBD Plasma Actuators[1] CLAUDIA DURASIEWICZ, JORGE CASTRO MALDONADO, JESSE LITTLE, University of Arizona — Nanosecond pulse driven dielectric barrier discharge (ns-DBD) plasma actuators are employed to control boundary layer separation and the wake of a NACA 0012 airfoil having aspect ratio of three. Ns-DBD plasma actuators are known to operate via a thermal mechanism in contrast to ac-DBDs which are momentum-based devices. Nominally 2D forcing is applied to the airfoil leading edge with pulse energy of 0.35 mJ/cm. Experiments are conducted at a Reynolds number of 0.74×10^6 primarily at 18° incidence which is well within the stalled regime. Baseline and controlled flow fields are studied using surface pressure measurements, constant temperature anemometry (CTA) and PIV. Forcing at a dimensionless frequency of $F^+ = fc/U_\infty = 1.14$ results in reattachment of nominally separated flow to the airfoil surface. Lower frequency forcing is less optimal for separation control, but produces strong fluctuations in the wake which are intended for use in the study of vortex body interaction in the future. Actuation below $F^+ = 0.23$ shows behavior consistent with an impulse-like response while forcing in the range $0.23 < F^+ < 0.92$ produces a single dominant frequency in the wake. Spanwise uniformity of the wake is documented using CTA at various locations downstream ($x/c < 7$).

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