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**Study of Unsteady Flow Actuation Produced by Surface Plasma Actuator on 2-D Airfoil** MINH KHANG PHAN, JICHUL SHIN, University of Ulsan — Effect of flow actuation driven by low current continuous or pulsed DC surface glow discharge plasma actuator is studied. Schlieren image of induced flow on flat plate taken at a high repetition rate reveals that the actuation is mostly initiated near the cathode. Assuming that the actuation is mostly achieved by ions in the cathode sheath region, numerical model for the source of flow actuation is obtained by analytical estimation of ion pressure force created in DC plasma sheath near the cathode and added in momentum equation as a body force term. Modeled plasma flow actuator is simulated with NACA0012 airfoil oscillating over a certain range of angle of attack (AoA) at specific reduced frequencies of airfoil. By changing actuation authority according to the change in AoA, stabilization of unsteady flow field is improved and hence steady aerodynamic performance can be maintained. Computational result shows that plasma actuation is only effective in modifying aerodynamic characteristics of separated flow. It turns out that plasma pulse frequency should be tuned for optimal performance depending on phase angle and rotating speed. The actuation authority can be parameterized by a ratio between plasma pulse frequency and reduced frequency.

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