Abstract Submitted
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Modeling and Simulation of Aerodynamic Single Dielectric Barrier Discharge Plasma Actuators[1] DMITRI ORLOV[2], GABRIEL FONT, USAFA — This work presents different approaches to modeling of the plasma actuator, an electrical flow control device, which is now widely used in aerodynamics for separation control, lift enhancement, drag reduction and flight control without moving surfaces. Study of the physics of the discharge in air at atmospheric pressure was performed using particle (PIC-DSMC) and fluid plasma simulations. Based on the experimentally obtained data electro-static and lumped-element circuit models were developed for engineering purposes. Numerical flow simulations were performed to study the effect of the plasma body force on the neutral fluid. The results agreed well with the experiments. An application of the plasma actuators to the leading-edge separation control on the NACA 0021 airfoil was studied numerically. The results were obtained for a range of angles of attack. Improvement in the airfoil characteristics was observed in numerical simulations at high angles of attack in cases with plasma actuation.

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