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Electric Circuit Model for a Single-dielectric Barrier Discharge Plasma Actuator[1] DIMTRI ORLOV, THOMAS CORKE, University of Notre Dame, MEHUL PATEL, Orbital Research Inc. — It has been shown previously that the lumped-element circuit model correctly describes the temporal behavior of the aerodynamic plasma actuator. To incorporate this model into the Navier-Stokes (N-S) solver, it was modified to include the spatial behavior of the discharge within the plasma. To model this, the single dielectric barrier discharge plasma actuator is represented as a network of electric circuit elements. The electric circuit consists of N elementary subcircuits, each representing a small physical domain with finite width and length. Each subcircuit consists of an air capacitor, dielectric capacitor, plasma resistive element, and diodes with time-dependent properties that govern the presence of the plasma. The results of the simulation are compared to the experimental data of the plasma spatial distribution obtained with a photomultiplier tube. The obtained results are used to provide accurate time-dependent models of the actuator in N-S simulations as well as to optimize the actuator designs to enhance their flow control effectiveness.

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