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Time-Dependant Model of Single Dielectric Barrier Discharge Plasma Actuators BENJAMIN MERTZ, THOMAS CORKE, University of Notre Dame — Single dielectric barrier discharge (SDBD) plasma actuators have been used in a growing number of flow control applications. With their increased use comes the need for numerical models that are capable of simulating their effect in flow solvers for use as a flow control design tool. These models must capture the essential physics of the flow actuators, as well as be computationally efficient. This work deals with the development of a time-dependant model for SDBD plasma actuators that relies on a mix of first-principle concepts and empirical results. It uses a lumped-element circuit model to calculate the spatial time-dependent current due to the ionization of the air. The current is then used to provide the time-dependant boundary conditions for the electrostatic equations used to calculate the time-dependant vector body-force distribution. A dynamic representation of the body force vectors will be presented. The vector body-force distribution has been incorporated into a flow solver (FLUENT) code. Example applications will include a simulation of plasma actuators to suppress the Von Karman vortex street from a circular cylinder in a cross-flow at a $Re_d = 40,000$.

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