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Scaling of Plasma Synthetic Jet Actuators JAMEY JACOB, Oklahoma State University, ARVIND SANTHANAKRISHNAN, University of Kentucky
— The plasma synthetic jet actuator (PSJA) is a geometric variant of a plasma actuator, consisting of an annular electrode array that results in a circular region of dielectric barrier discharge plasma. Quiescent flow PIV measurements of the PSJA reveal that the flowfield on actuation resembles that of a zero-mass flux or synthetic jet that is useful for flow control, particularly separation reduction. Like synthetic jets, unsteady pulsed actuator operation results in formation of multiple vortex rings. The output jet momentum is found to be affected by the power input, actuator dimension and pulsing frequency. While increasing the input power increases the maximum jet velocity, an optimum range of pulsing frequencies and actuator dimensions are observed to exist in order to maximize jet momentum. This presentation examines scaling relations for PSJA operation in quiescent flow. Specifically, the relation between input power, actuator dimension, pulsing frequency, and output jet velocity is demonstrated analytically starting from fundamental fluid dynamics principles. The relations obtained from the scaling analysis are compared with experimental results for validation of the model.

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