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Laminar boundary layer response to impulse forcing by an array of plasma actuator vortex generators[1] HOSSEIN KHANJARI, RONALD HANSON, York University, Department of Mechanical Engineering, Toronto, Ontario, Canada — In this computational and experimental study the response of the Blasius boundary layer to an impulse force is examined. The array of actuators are arranged to act as vortex generators. This arrangement of actuators has previously been used to control steady and quasi-steady streaks occurring in the boundary layer. In the experimental portion of the study, hot-wire velocity measurements are performed. Using the actuator input as reference, the dynamic response of the streamwise velocity in the boundary layer to the pulsed plasma actuation is reconstructed by a phase-averaging technique. Several experimental cases are used to calibrate a momentum source distribution to model the effect of the actuator numerically. The forcing model is applied in conjunction with a commercial computational fluid dynamics code to simulate the boundary layer flow and the response to forcing. Following validation of the computed flow it is shown that the key aspects related to the dynamics response, such as a non-minimal phase behavior of the wall shear stress can be explained by a secondary vortex structure that depends on the streamwise extent of the actuator. The results have important implications to the overarching motivation of a dynamic control system.

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