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Higher Order Response of the Laminar Boundary Layer to a Step Input by Spanwise Periodic Forcing[1] HOSSEIN KHANJARI, RONALD HANSON , York University — The Blasius boundary layer response to a step input forcing by a streamwise array of simulated plasma actuators is studied. The actuators' effect is simulated in a commercial computational fluid dynamics code. A parametric study is used to calibrate an applied momentum source that simulates the actuators' output. Both the spatial distribution and the magnitude of the momentum source are tuned to match an experimental dataset that is limited to measurements of the streamwise velocity. For the step response, the simulated actuators are activated for approximately 80 boundary layer turnover times and then switched off. This choice of actuation parameter is sufficient to reach an approximately steady state at the downstream planes considered prior to deactivation of the actuators. In the far field region downstream of the actuators, the response to forcing exhibits a higher order response with respect to the shear stress, which is attributed to secondary vortex structures produced by the actuators as the primary vortices are convected downstream. The magnitude of the resulting streamwise velocity streaks caused by the actuators also exhibits a higher order response. The observed overshoots are shown to be caused by the rearrangement of the boundary layer during the onset of forcing.

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