Abstract Submitted
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A model-based investigation of the effect of actuator geometry on boundary layer flows[1] IGAL GLUZMAN, DENNICE GAYME, Johns Hopkins University — An input-output approach is used to study actuated boundary layers arising from different types of input signals and actuator geometries. We obtain the manipulated flow fields through the Navier-Stokes equations linearized about a given base flow with the spatial geometry of the actuator represented as an array of localized input sources organized in the pattern of interest. The actuated fields are then obtained by superposing the response of each localized source in the array pattern, e.g., a saw tooth plasma actuator whose signal varies in intensity over the geometry. Actuation signals including a single pulse, a train of pulses, and a continuous input are modeled through analytical solutions of the LNS system. As an example, a steady-state step response is used to reproduce the stationary actuated flow-fields due to different plasma actuator configurations in transitional boundary layers. The model is found to reproduce the vortical and streamwise velocity structures obtained in experimental and simulation studies qualitatively well. Our results demonstrate the promise of such an analytical tool in determining beneficial actuator configurations prior to detailed experimental or high fidelity simulations, which are too costly for expansive parametric studies.

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