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Towards Feedback Control of Bypass Transition: Experiments on Laminar Boundary Layer Response to Dynamically Actuated Roughness[1]
KYLE BADE, AHMED NAGUIB, Michigan State University, Mechanical Engineering, RONALD HANSON, PHILIPPE LAVOIE, University of Toronto, Institute for Aerospace Studies — The current work details observations of the growth of streamwise streaks emanating from cylindrical roughness elements undergoing dynamic actuation into-and-out of a Blasius boundary layer flow. The growth and streamwise propagation of these motions is of interest in a larger study in collaboration with Princeton University in which a multi-university effort aims to develop and implement a robust feedback control system for the weakening/elimination of the streaks (because of their role in initiating bypass transition). Phase-averaged hotwire measurements in the transverse and spanwise directions provide two-dimensional visualizations of the spatial and temporal growth of these motions. Various roughness heights as well as actuation velocities are examined in order to identify the actuation parameters range for which the streaks can be produced while avoiding the introduction of T-S wave packets. This work validates the ability to introduce the proper disturbances into the boundary layer in preparation for the follow up control study.

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