

Abstract Submitted
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Experimental Studies of the Response of the Turbulent Boundary Layer to Periodic Actuation¹ MITCHELL LOZIER, STANISLAV GORDEYEV, FLINT THOMAS, University of Notre Dame — It has been established that the dynamics of large-scale structures (LSS) in outer region of turbulent boundary layers (TBL) and the near-wall small-scale turbulence are correlated. In the study reported here, a plasma-based active flow control device was placed at various heights within a TBL in order to introduce periodic disturbances into the wake region. The boundary layer Reynolds number was $Re_\tau = 700$, that no naturally occurring large-scale structure was present. Via actuation, a periodic large-scale structure was introduced into TBL, and the TBL's near-wall response to this structure was studied using a single hot-wire. In previous experiments, it was shown that this large-scale structure had a strong modulating effect on the near-wall turbulence downstream of the actuator. Here the TBL response was tested at different actuator wall normal positions and different actuation frequencies in order to characterize the near-wall modulating effect. Results showed the largest modulation effect when the actuation frequency is equal to the burst/sweep frequency of the near-wall TBL structure. Results also showed that by moving the actuator closer to the wall, the near-wall turbulence intensity was reduced and the modulation effect became more localized to the near-wall region.

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