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Temporal and Spatial Response of a Turbulent Boundary Layer to Forcing by Synthetic Jets[1] RONALD HANSON, University of Toronto, BHARATHRAM GANAPATHISUBRAMANI, University of Southampton, PHILIPPE LAVOIE, University of Toronto, TIM BERK, University of Southampton — In this experimental study we examine the spatial and temporal response of a turbulent boundary layer affected by a single, and pair of, synthetic jet actuator(s). The spatial signature of the boundary layer mean-flow has been previously shown to result from large vortical motions caused by the interaction between the synthetic jets and the cross flow. By means of hot-wire measurements, phase-locked to the synthetic jet input, the propagation of the unsteady disturbance can be quantified over the actuation cycle of a synthetic jet. Using long samples both the phase-locked variation of the periodic (actuation cycle) and turbulent fluctuations are examined. It is shown that both the mean flow and turbulence characteristics are markedly different across the span, owing to the three dimensionality of the upstream input. Further, the disturbance shape and phase of the phase-locked disturbance varies significantly with forcing level, in part owing to the disruption of the mean velocity. Particular focus is given to the interaction occurring between the near-wall and outer region scales, which vary across the span, with respect to various forcing conditions.

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