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Effects of external disturbances on turbulent boundary layers EDA DOGAN, RONALD HANSON, BHARATHRAM GANAPATHISUBRAMANI, University of Southampton — The state of a turbulent boundary layer that develops under the influence of different types of freestream turbulence is examined. The freestream turbulence conditions with different length-scale and turbulence intensity are generated using active and passive grids. Downstream of the grid, a flat plate is placed to establish a zero-pressure gradient turbulent boundary layer. The interaction between the freestream and the turbulent boundary layer is investigated using simultaneous measurements of the boundary layer and freestream using single component hot-wire anemometry and multi-camera Particle Image Velocimetry (PIV). Results from the hot-wire measurements of different cases show that the near-wall peak turbulence intensity increases with increasing levels of free stream turbulence indicating the level and extent of penetration by free stream turbulence into the boundary layer. It is also observed that for different level of freestream perturbations to the flow, the momentum loss in the turbulent boundary layer could be similar. The data from these cases will be investigated further using spectral analysis to examine the energetic scales of the flow. The PIV data will be analysed to elucidate the coherent structures associated with these interactions.

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