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Turbulence structure in non-zero pressure gradient boundary layers JASON MONTY, ZAMBRI HARUN, IVAN MARUSIC, The University of Melbourne — We present an extensive database of single- and multi–probe hot-wire measurements of streamwise velocity acquired in zero, adverse and favourable pressure gradient turbulent boundary layers. The primary aim of this investigation was to characterise the effects of pressure gradient on the structure of turbulence at high Reynolds numbers. Specifically, we examine the changes to turbulence intensity, energy spectra and two-point correlations of streamwise velocity. By systematically varying the pressure gradient (PG) at a fixed Reynolds number (Re) we were able to isolate PG effects from Re effects. Results from the adverse pressure gradient case show a strong contribution to the energy spectra from length-scales of $\sim 3\delta$ (δ is the boundary layer thickness). This contribution is observed throughout the flow, even near the wall. Whether 'superstructures' (of length $\sim 6\delta$) exist or are modified in strong pressure gradients is unclear since the energy spectra indicate the dominance of $\sim 3\delta$–length structures in the logarithmic and outer regions. Two-point correlations indicate similar spanwise width-scales in the log region compared with the zero pressure gradient case, while the average structure becomes wider beyond the logarithmic region. Further results will be presented showing the effect of varying pressure gradient from favourable through zero to adverse at fixed Reynolds number.

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