Abstract Submitted
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Non-Equilibrium Boundary Layer Development in Response to Changing Pressure Gradients[1] RALPH VOLINO, U.S. Naval Academy — Experiments were conducted in non-equilibrium turbulent boundary layers on a smooth flat wall. The test section included a zero pressure gradient (ZPG) development region, followed by a favorable pressure gradient (FPG) region with constant acceleration parameter $K = (\nu/{U_\infty}^2)(dU_\infty/dx)$, a ZPG recovery, and a constant K adverse pressure gradient (APG) region. Eight cases were included with three different inlet velocities and K in the FPG ranging from 0.125×10^{-6} to 2×10^{-6}. The K magnitude of the APG in each case was half that of the FPG. Velocity profiles were acquired at 12 streamwise stations using a two component LDV, and PIV was used to document velocity fields at the same stations. The mean velocity and turbulence profiles and correlations were observed to change in response to the changing pressure gradients, and changes in various quantities (e.g. wake strength or $u'v'$ at representative y^+) were quantified as functions of streamwise location. Normalizations of streamwise distance were found for the FPG, ZPG, and APG regions that caused the data to collapse, quantifying the non-equilibrium response to the changing pressure gradients.

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