Abstract Submitted
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Mean flow and turbulence characteristics of a spatially-developing pressure-driven 3D turbulent boundary layer[1] XIAOHAN HU, GEORGE PARK, University of Pennsylvania — Statistically three-dimensional turbulent boundary layers (TBLs) are found commonly in nature and engineering applications. We conduct WMLES of a thin 3DTBL developing on the floor of a bent square duct to study the mean flow and turbulence characteristics in the outer portion of pressure-driven 3DTBLs. The simulations agree reasonably well with the experiment by Schwarz & Bradshow (*J. Fluid Mech.* (1994), vol. 272, pp. 183210). The inviscid skewing mechanism which generates the mean three dimensionality in the outer part of the boundary layer is discussed based on the vorticity equation and the Johnston triangular plot. These characteristics are shown to be not found in the shear-driven 3D channel flow (Lozano-Durn *et al. J. Fluid Mech.* (2020), vol. 883, pp. A20). The anisotropy of turbulence are discussed using the Lumley triangle. In contrast to canonical 2D wall turbulence, the 3DTBL has a non-monotonic increase of anisotropy in the log layer, which corresponds to a sharp corner in the Lumley triangle.

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