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Addition of Isotropic Free-stream Turbulence Promotes Anisotropy in a Turbulent Boundary Layer[1] SHEILLA TORRES-NIEVES, BRIAN BRZEK, JOSE LEBRON, LUCIANO CASTILLO, Rensselaer Polytechnic Institute, RAUL CAL, CHARLES MENEVEAU, The Johns Hopkins University
— The effects of nearly isotropic free-stream turbulence in transitionally rough zero pressure gradient turbulent boundary layers are studied using data obtained from Laser Doppler Anemometry measurements. Measurements are carried out at $\mathrm{Re}_\theta \leq 11{,}300$ with up to 6.2% free-stream turbulence generated with an active grid. Remarkably, there is a large portion of the boundary layer in which the addition of nearly isotropic turbulence in the free-stream results in significant increases in anisotropy of the turbulence. In order to quantify which turbulence length-scales contribute mostly to creating this trend, second order structure functions for velocity components u or v are examined at various distances to the wall. Results show that the anisotropy created by adding nearly isotropic turbulence in the free-stream resides mostly in the larger scales of the flow.

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