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The Effect of Surface Roughness on a Zero Pressure Gradient Turbulent Boundary Layer. BRIAN BRZEK, Rensselaer Polytechnic Institute, RAUL BAYOAN CAL, Johns Hopkins University, GUNNAR JOHANSSON, Chalmers University of Technology, LUCIANO CASTILLO, Rensselaer Polytechnic Institue, RPI/CHALMERS COLLABORATION — A new set of experiments have been performed in order to study the effects of surface roughness on a zero pressure gradient turbulent boundary layer. The effect of roughness on the velocity deficit profiles and Reynolds stresses in outer variables is presented. It will be shown that for fixed experimental conditions (i.e., fixed upstream wind tunnel speed, trip wire, etc), the velocity deficit profiles collapse leading to self similar solutions. In addition, the Reynolds stresses show self similarity for fixed experimental conditions and are increasingly affected by the roughness as the roughness parameter, k^+, increased. Moreover, it is found that the shape of the Reynolds stress profiles are very different throughout the entire boundary layer, particularly for the $<u^2>$ component due to roughness. This is likely the result of the flow becoming more isotropic for increased k^+ and it will be seen in the analysis of the anisotropy tensor and the anisotropy invariant map. Moreover, increased production of $<u^2>$ and $<uv>$ due to roughness is also seen throughout the entire boundary layer although its overall role in the changing shape of the $<u^2>$ profiles still needs to be determined.

Brian Brzek
Rensselaer Polytechnic Institute

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