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Effects of Surface Roughness on Favorable Pressure Gradient Turbulent Boundary Layers RAUL BAYOAN CAL, The Johns Hopkins University, BRIAN BRZEK, R.P.I., GUNNAR JOHANSSON, Chalmers University of Technology, LUCIANO CASTILLO, R.P.I. — Different sets of experiments are carried out in order to investigate the influences of the surface roughness on the favorable pressure gradient (FPG) turbulent boundary layer. Currently, there are no experiments reported on FPG turbulent boundary layer over rough surfaces. This includes the Reynolds stress measurements. The point at hand is to not only understand the interaction between the rough surface and the outer flow, but to also to include the external pressure gradient as the flow evolves in the streamwise direction. These are obtained using Laser Doppler Anemometry technique. It is found that the roughness influences the velocity field in the outer flow. When using the Zagarola and Smits scaling for the mean velocity deficit profiles, a small difference due to the strength of the pressure gradient is observed. In the Reynolds stresses, a significant difference exists due to the rough surface and Reynolds number effect in the rough FPG unlike the smooth FPG data. Furthermore, the shape of the Reynolds stress in the streamwise direction, $< u^2 >$, drastically changes in the rough FPG case and is similar in the other components although the magnitudes are different for the range of $k^+ = 35$. The $< v^2 >$ and $< uv >$ components of the Reynolds stress retain the same shape although the magnitudes change due to the upstream wind-tunnel speed and roughness parameter.

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