

Turbulent Boundary Layer over 3D Sinusoidal Roughness

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Abstract : Measurements of a turbulent boundary layer over 3D sinusoidal roughness are performed for friction Reynolds numbers ranging from $650 < Re\tau < 2700$. This surface was fabricated by a Multicam CNC Router machine of an acrylic sheet to have an amplitude of $k/2 = 0.8$ mm and an equal wavelength of $8k$ in both streamwise and spanwise directions, a 0.6 mm stepover and 12 mm ball nose cutter was used. Single hotwire anemometry measurements are done at one location $x=1.5$ m downstream at different freestream velocities under zero-pressure gradient conditions. As expected, the roughness causes a downward shift on the wall-unit normalised streamwise mean velocity profile when compared to the smooth wall profile. The shift is increasing with increasing $Re\tau$, $1.8 < \Delta U^+ < 6.2$. The coefficient of friction is almost constant at all cases $C_f = 0.0042 \pm 0.0002$. The results show a gradual reduction in the inner peak of profiles with increasing $Re\tau$ until fully destruction at $Re\tau$ of 2700.

Keywords : hotwire, roughness, TBL, ZPG

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