DFD13-2013-000482

Abstract for an Invited Paper
for the DFD13 Meeting of
the American Physical Society

Roughness Effects on Wall-Bounded Turbulent Flows[1]

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The importance of surface roughness is well known for wall-bounded flows. Roughness typically increases drag in turbulent boundary layers due to pressure forces on the roughness elements. While rough-wall flows are ubiquitous in engineering practice, the issues of modeling the roughness in computations and accurately predicting the increase in frictional drag remain elusive goals. In this talk, the effect of roughness on the mean flow, turbulence statistics, and turbulence structure will be discussed. In particular, rough-wall flows will be examined in light of Townsend's Reynolds number similarity hypothesis, which states that the turbulent motions in the outer layer are independent of surface roughness when the Reynolds number is sufficiently high. Additionally, the presentation will include recent work on the estimation of frictional drag due to surface roughness. Detailed experiments have been performed in the transitionally rough and fully rough regimes. This research is part of an effort to determine the relevant predictive scales based solely on the roughness topography.

[1]Work supported by the Office of Naval Research