Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Drag and Turbulence Production by Random Roughness
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— The effects of roughness in an incompressible turbulent boundary layer include the increased production of turbulence kinetic energy (TKE) and altered the nature and distribution of the skin drag. By formulating the exact Reynolds-averaged Navier-Stokes turbulence kinetic energy equations in a manner that includes an arbitrary roughness, the averaged terms representing the roughness production of TKE and the roughness drag can be written explicitly. Similar transport equations for TKE can be formulated wherein the roughness geometry is represented using the immersed boundary methodology. These terms are calculated from a collection of direct numerical simulations (DNS). The roughness geometry employed is based on both real turbine blade roughness and a set of spectrally defined random roughness with varying amounts of skew. The primary results include an examination of thr distribution of the roughness drag and the partitioning of the production of TKE into canonical shear production and into production by roughness, and the partitioning of drag into form drag and viscous shear drag.

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None

Date submitted: 03 Aug 2012 Electronic form version 1.4