Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Turbulent wall jets over rough surfaces RAYHANEH BANYASSADY, UGO PIOMELLI, Queen's University, Kingston (ON), Canada — The effects of surface roughness on plane and radial turbulent wall jets have been studied using large-eddy simulation. The Reynolds number is $18,800$ (based on the bulk velocity and diameter of the impinging jet) for the radial case, and $7,500$ (based on the jet velocity and height) for the plane one. To represent the random roughness elements a virtual sandpaper model and an immersed-boundary method (IBM) based on the volume-of-fluid (VOF) approach are used. The roughness Reynolds numbers in both simulations are in the transitionally rough regime, $5 < k^+ < 70$. The grid refinement study showed that the plane and radial wall jet simulations require 15 and 22 million grid points, respectively. The results are validated with available literature. The mean flow shows that surface roughness decreases maximum velocity of the wall jet and increases the wall jet characteristics length (distance from the wall where the velocity decreases to half of the maximum velocity). The rate of decay of maximum velocity and growth rate of the wall jet are not significantly affected by the surface roughness. An analysis of the effect of surface roughness on the magnitude and shape of the Reynolds stresses profiles is being carried out.

Ugo Piomelli
Queen's University, Kingston (ON), Canada

Date submitted: 26 Jul 2012 Electronic form version 1.4