Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Direct Numerical Simulation of two superposed viscous fluids in a rough channel: effect of the position of the interface[1] ISNARDO ARENAS, STEFANO LEONARDI, The University of Texas at Dallas — Direct Numerical Simulations of two superposed fluids in a turbulent channel with cavities on one wall have been performed. Three different cases have been considered with either square cavities, longitudinal riblets or staggered cubes on the lower wall, the upper wall being smooth. Two viscosity ratios between the two fluids have been used, $m = 0.1$ (a fluid of lower viscosity inside the cavities), and $m = 10$. The interface between the two fluids is flat mimicking the case of an infinite surface tension. The Reynolds number based on the bulk velocity is $Re = 2,800$ and it corresponds to a turbulent Reynolds number $Re_\tau = 180$ when both walls are smooth. The height is approximately $h^+ = 9$. The position of the interface between the two fluids has been varied in the vertical direction. Two cases have been considered, one where interface is above the crests plane, and one where the interface is below the crests plane. When a thin film of low viscosity fluid is above the crests, the stagnation point on the leading edge of the roughness elements moves upward and the form drag decreases thus leading to a drag reduction of up to 30%. Drag reduction can be achieved even for $m > 1$ due to the damping of wall normal velocity fluctuations.

[1]Numerical simulations were performed on XSEDE TACC under Grant CTS070066. This work was supported by ONR MURI grants N00014-12-01-0875 and N00014-12-01-0962

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Date submitted: 31 Jul 2015 Electronic form version 1.4