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Drag penalty due to the asperities in the substrate of super-hydrophobic and liquid infused surfaces[1] EDGARDO J. GARCIA CARTAGENA, ISNARDO ARENAS, STEFANO LEONARDI, The University of Texas at Dallas — Direct numerical simulations of two superposed fluids in a turbulent channel with a textured surface made of pinnacles of random height have been performed. The viscosity ratio between the two fluids are $N = \mu_o/\mu_i = 50$ (μ_o and μ_i are the viscosities of outer and inner fluid respectively) mimicking a super-hydrophobic surface (water over air) and N=2.5 (water over heptane) resembling a liquid infused surface. Two set of simulations have been performed varying the Reynolds number, $Re_\tau = 180$ and $Re_\tau = 390$. The interface between the two fluids is flat simulating infinite surface tension. The position of the interface between the two fluids has been varied in the vertical direction from the base of the substrate (what would be a rough wall) to the highest point of the roughness. Drag reduction is very sensitive to the position of the interface between the two fluids. Asperities above the interface induce a large form drag and diminish considerably the drag reduction. When the mean height of the surface measured from the interface in the outer fluid is greater than one wall unit, $k^+ > 1$, the drag increases with respect to a smooth wall. Present results provide a guideline to the accuracy required in manufacturing super-hydrophobic and liquid infused surfaces.

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