Abstract Submitted
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Direct Numerical Simulation of a turbulent channel flow over Slippery Liquid-Infused Porous Surfaces[1] ISNARDO ARENAS, University of Puerto Rico at Mayaguez, PAOLO ORLANDI, Universita di Roma La Sapienza, STEFANO LEONARDI, Dept. Mechanical Engineering, University of Texas at Dallas — Direct Numerical Simulations of two superposed fluids in a turbulent channel have been performed at Re ranging from 180 to 400. With respect to previous studies in the present numerical simulation both the flow inside the porous media and the overlying flow has been resolved. Three different substrates have been considered: longitudinal and transverse square cavities and array of circular cylinders. A tracking interface algorithm has been developed using the level set technique. The velocity profiles at the interface present a kink, which is due to the different viscosity. In fact, at the interface the stress is the same in the two fluids and then to a larger viscosity it corresponds a smaller gradient of velocity. Surface tension decreases the turbulence levels consequently, a drag reduction of about 15% can be observed. The stability of the interface is crucial to achieve drag reduction. Even for higher viscosity near the wall, drag reduction is observed. This should be due to the suppression of wall normal velocity fluctuations and to a decrease of turbulent production at the interface. The value of the viscosity inside the patterned surface appears to be less critical than the stability of the interface to achieve drag reduction.

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