Abstract Submitted
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Bio-inspired Gecko Micro-surface for Drag Reduction in Turbulent Flows[1] ISNARDO ARENAS, KENNETH CARRASQUILLO, The University of Texas at Dallas, GUILLERMO ARAYA, LUCIANO CASTILLO, Texas Tech University, STEFANO LEONARDI, The University of Texas at Dallas — Direct Numerical Simulations of a turbulent channel flow with a porous wall inspired from the Gecko lizard were performed at Reynolds number of $Re_\tau = 450$. Two superposed fluids were considered. As initial condition, one fluid fills the microfibrillar surface, the interface with the overlying fluid being flat and corresponding to the crests plane. The code is based on a finite difference scheme with a Runge Kutta and fractional step. The porous wall is modeled with the immersed boundary method, while the dynamic of the interface between the two fluids is solved with a level set method. A parametric study has been performed varying the viscosity ratio between the two fluids. Two cases have been considered, with and without surface tension. Without surface tension the microfibrillar wall acts as a rough wall increasing the drag. However, when the surface tension is large enough to maintain the interface stable, the external fluid cannot enter into the porous wall and an effective slip is produced. When the fluid in the porous wall has a viscosity 100 times smaller than that of the overlying fluid, a drag reduction of about 60% can be observed. In this case, the near wall coherent structures become significantly weaker.

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