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A direct numerical simulation study of heat transfer over superhydrophobic and liquid-infused surfaces UMBERTO CIRI, STEFANO LEONARDI, The University of Texas at Dallas — Recently, superhydrophobic (SHS) and liquid-infused surfaces (LIS) have been proposed as a wall treatment to achieve drag reduction in turbulent flows. Conceptually, these surfaces consist of a textured substrate with a secondary fluid filling the texture cavities over which the primary fluid flows. In the case of SHS, water flows over air trapped in the cavities, while for LIS a liquid lubricant is used instead of air. Turbulent drag reduction is possible because the second fluid creates a slippery interface with the primary fluid, thus reducing friction drag. While several studies have shown potential in terms of drag reduction, less attention has been dedicated to the heat transfer. The objective of this work is to study heat transfer characteristics of these surfaces and the correlation between the velocity and thermal fields (Reynolds analogy). Direct numerical simulations of turbulent flow and heat transfer are performed using different textured geometries (modeled with the immersed boundary method) and varying the viscosity ratio and interfacial tension between the two fluids. The level-set method is used to couple the dynamics of the interface between the two fluids to the Navier-Stokes equations.

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