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Effect of Interface Curvature on Super-Hydrophobic Drag Reduction AMIRREZA RASTEGARI, RAYHANEH AKHAVAN, The University of Michigan, Ann Arbor — The effect of interface curvature on Super-Hydrophobic (SH) Drag Reduction (DR) has been investigated using DNS with lattice Boltzmann methods in laminar ($Re_{bulk} = 50$) and turbulent ($Re_{bulk} = 3600$, $Re_{\tau_0} \approx 223$) channel flows. SH surfaces with longitudinal arrays of micro-grooves (MG) of size $0.1 \leq g/h \leq 0.47$ & $g/w = 1, 7$ were investigated, where g and w denote the width of the MG and the separation in between them, respectively, and h denotes the channel half-height. The liquid/gas interfaces on the SH MG were modeled as 'idealized', stationary, curved, shear-free boundaries, with the interface curvatures determined from the Young-Laplace equation. The presence of interface curvature leads to enhancements of DR by up to 10% in laminar flow, and more modest enhancements or even decreases in DR in turbulent flow, compared to flat, shear-free interfaces. These enhancements or decreases in DR, relative to flat, shear-free interfaces, in both laminar and turbulent flow, are shown to arise primarily from the modified shape of the cross section of the channel in the presence of the curved interface.

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