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A Chracterization of Superhydrophobic Surfaces for Skin-Friction Drag Reduction[1] HYUNWOOK PARK, JOHN KIM, University of California, Los Angeles — A proper characterization of superhydrophobic surfaces (SHSs) was examined using direct numerical simulation of turbulent channel flows. A SHS was modeled through a shear-free boundary condition on the air-water interface. Within the considered Reynolds number range and SHS geometry, it was found that the drag reduction in turbulent channel flows was well correlated with the effective slip length normalized by viscous wall units. A maximum drag reduction was achieved when the effective slip length was on the order of 50 in viscous wall units. It was also shown that near-wall turbulence structures were significantly modified. Since the effective surface slip length can be interpreted as a depth of influence into which SHS affect the flow in the wall-normal direction, this result demonstrated that a SHS achieved its drag reduction by affecting those turbulence structures within the buffer layer of the turbulent channel flow. The present results also showed that the relative size between near-wall turbulence structures and the SHS geometry was an important parameter for drag reduction.

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Hyunwook Park
University of California, Los Angeles

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