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Superhydrophobic Drag Reduction in Various Turbulent Flows[1]
JAMES W. GOSE, ANISH TUTEJA, MARC PERLIN, STEVEN L. CECCIO, Univ of Michigan - Ann Arbor — Superhydrophobic surfaces (SHSs) have been studied exhaustively in laminar flow applications while interest in SHS drag reduction in turbulent flow applications has been increasing steadily. In this discussion, we will highlight recent advances of SHS applications in various high-Reynolds number flows. We will address the application of mechanically robust and scalable spray SHSs in three cases: fully-developed internal flow; a near-zero pressure gradient turbulent boundary layer; and an axisymmetric DARPA SUBOFF model. The model will be towed in the University of Michigan's Physical Model Basin. Experimental measurements of streamwise pressure drop and the near-wall flow via Particle Image Velocimetry and Laser Doppler Velocimetry will be discussed where applicable. Moreover, integral measurement of the total resistance of the SUBOFF model, with and without SHS application, will be examined. The SUBOFF model extends 2.6 m and is 0.3 m in diameter, and will be tested at water depths of three to six model diameters. Previous investigation of these SHSs have proven that skin-friction savings of 20% or more can be attained for friction Reynolds numbers greater than of 1,000.

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