Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Quantification of Laminar Drag Reduction on Liquid-Infused Structured Non-Wetting Surfaces SANDEEP HATTE, KARTHIK NITHYANANDAM, RANGA PITCHUMANI[1], Department of Mechanical Engineering, Virginia Polytechnic Institute and State University —
Liquid-infused structured non-wetting surfaces offer alternating no-slip and finite slip boundary conditions to the fluid flow, resulting in an effective non-zero finite slip at the interface. As a result, liquid-infused structured non-wetting surfaces offer reduced friction (drag reduction) at the interface in comparison to a bare smooth surface offering no-slip boundary condition throughout. In the present work, an analytical model is developed to quantify the effective slip length, drag reduction and friction coefficient on liquid-infused structured non-wetting surfaces under laminar fluid flow conditions. The model takes into consideration a typical structured non-wetting surface as a superposition of periodically patterned longitudinal and transverse striped geometries. The analytical model covers a full range of structural anisotropy and homogeneity and is valid for an entire range of partial slip length in the infused liquid region. Effective non-zero slip length and drag reduction data predicted from the present model show a good agreement when compared with a number of experimental and computational studies from the literature.

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Date submitted: 01 Aug 2019 Electronic form version 1.4