Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Multiphase unsteady Stokes flow over longitudinal grooved surface: an analytical study[1] KRISHNAN MAHESH, YIXUAN LI, KARIM ALAME, University of Minnesota, Twin Cities — Motivated by recent interest in superhydrophobic technology, we study the effect of grooved multiphase textures exposed to turbulent channel flow of one fluid, while being infused with a second fluid. An analytical solution of unsteady Stokes flow in the presence of spanwise periodic grooves is derived. Comparison with volume of fluid (VOF) simulation data shows good agreement. The solution scales with $\omega L^2/\nu$, where ω is the frequency of the oscillatory slip velocity, L is the characteristic length of the groove, and ν is the kinematic viscosity of the external fluid. A parametric study of the viscosity ratio between the two types of fluid, the penetration of the outside flow, and the frequency of the oscillatory slip velocity is presented. Our theoretical analysis shows that the multiphase grooved surface produces a high-pass filter effect on turbulent flow.

[1]Supported by Office of Naval Research

Yixuan Li
University of Minnesota, Twin Cities

Date submitted: 27 Jul 2017 Electronic form version 1.4