Abstract Submitted
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Stability Limits of Liquid-Infused Surfaces and Their Effects on Turbulent Drag[1] JOHAN SUNDIN, KTH Royal Institute of Technology, STEPHANE ZALESKI, d'Alembert, Sorbonne Universite and CNRS, UMR 7190, SHERVIN BAGHERI, KTH Royal Institute of Technology — Liquid-infused surfaces (LIS) have shown great potential in decreasing drag for turbulent flows. They consist of surface structures infused with another liquid, and are relatively robust against failure due to turbulent pressure fluctuations, in contrast to superhydrophobic surfaces. However, their stability depends on the surface tension and the surface chemistry of the surface. We investigate the stability limits for the case of square longitudinal grooves with infused liquid, using direct numerical simulations at friction Reynolds numbers around $Re_\tau = 180$. The interface is described using a volume-of-fluid (VOF) framework, allowing large interface deformations as well as moving contact lines. The viscosity ratio is kept at the order of 1, representing realistic values of oil-water systems. A large contact angle causes the contact line to depin and move into the groove. For our geometry, however, mass conservation is a stabilizing effect, because if the interface depins on one position, it is raised elsewhere. Due to the finite surface tension, the surface creates an apparent slip, but damps only parts of the wall-normal velocity fluctuations. A too low surface tension causes large capillary waves to form, increasing drag dramatically.

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