Abstract Submitted
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Stability analysis of two immiscible fluids in a shear driven flow: a DNS study[1] EDGARDO J. GARCIA CARTAGENA, The University of Texas at Dallas, MATTEO BERNARDINI, Sapienza University of Rome, ISNARDO ARENAS, The University of Texas at Dallas, ALIREZA MOHAMMADI, Princeton University, G. VALERIO IUNGO, The University of Texas at Dallas, ALEXANDER J. SMITS, Princeton University, STEFANO LEONARDI, The University of Texas at Dallas — Numerical studies of the flow over either super hydrophobic surfaces or liquid infused surfaces have shown that a large drag reduction (>10%) can be obtained if the flow remains in the Cassie state, thus stability of the interface plays a crucial role to achieve drag reduction. Direct Numerical Simulations of two immiscible fluids have been performed to assess how the stability of the interface depends on the viscosity ratio, thickness and Reynolds number of the two-layer flow. The flow is driven by the motion of one plate at constant velocity while the other plate is at rest. A finite difference code, based on a Runge-Kutta and fractional step method, has been combined to a level set method for tracking the interface between the two fluids. Results agree well with the linear theory until the nonlinear saturation. Once the fluctuations become large, a halving of the wavelength in the streamwise direction is observed for the least stable mode. The interaction between Tollmien-Schlichting waves and interfacial instabilities will be discussed at the meeting.

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