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The impact of surfactant on the drag reduction of superhydrophobic surfaces

Abstract

Superhydrophobic surfaces (SHSs) have the potential to achieve large drag reduction for internal and external flow applications. This could reduce energy consumption in maritime transport or liquid transport in pipes such as pipelines. However, experiments have shown inconsistent results, with many studies reporting significantly reduced performance. Recently, it has been proposed that surfactants could be responsible for this reduced performance, by creating adverse Marangoni stresses under flow conditions. In this talk, I will present experimental and numerical work which reveal the negative impact of surfactant on the drag reduction of SHSs made with parallel grating. I will also present a 2D scaling model to describe the effect of surfactants on SHSs. The model simplifies a complex nonlinear coupled problem governed by 9 non-dimensional parameters. The scaling prediction shows good agreement with numerical simulations across several orders of magnitude in the slip length.