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Stability limits of superhydrophobic longitudinal microgrooves in high Reynolds number turbulent flows AMIRREZA RASTEGARI, RAYHANEH AKHAVAN, The University of Michigan, Ann Arbor — The stability of the liquid/gas interfaces on SuperHydrophobic (SH) Longitudinal MicroGrooves (LMGs) in high Reynolds number turbulent flows of practical interest is investigated by analytical extrapolation of DNS results in turbulent channel flow at $Re_{\tau_0} \approx 222$ and 442 with SH LMGs at protrusion angle of $\theta = -30^o$. Given that the magnitude of pressure fluctuations in turbulent channel flow scales as $p^+_{rms} \sim \sqrt{\ln(Re_\tau)}$, it is found that the stability limits of SH LMGs diminishes by factors of ~ 4 when the Reynolds number of the base flow increases from $Re_{\tau_0} \sim 200$ of DNS to $Re_{\tau_0} \sim 10^5 - 10^6$ of practical applications. For SH LMGs operating at Weber numbers of $We^{+0} \equiv \mu u_{\tau_0}/\sigma \approx 3 \times 10^{-3} - 1.5 \times 10^{-2}$, corresponding to friction velocities of $u_{\tau_0} \approx 0.2 - 1$ m/s, this limits the size of stable LMGs to $g^{+0} \approx 5 - 30$ at $Re_{\tau_0} \approx 10^5$ and $g^{+0} \approx 4 - 20$ at $Re_{\tau_0} \approx 10^6$, and the maximum drag reductions to $DR_{max} \sim 20 - 30\%$ at $Re_{\tau_0} \sim 10^5$ and $DR_{max} \sim 10 - 20\%$ at $Re_{\tau_0} \sim 10^6$.

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