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Direct numerical simulation of turbulent flows over superhydrophobic surfaces: gas-liquid interface dynamics[1] JONGMIN SEO, RICARDO GARCÍA-MAYORAL, ALI MANI, Stanford University — Superhydrophobic surfaces can induce large slip velocities for liquid flows, reducing the skin friction on walls, by entrapping gas pockets within the surface roughness. This work explores the onset mechanism leading to gas depletion through interface breakage under turbulent conditions. We conduct direct numerical simulations of flows over superhydrophobic walls. The superhydrophobic texture is conventionally modeled as a pattern of slip/no-slip boundary conditions for the wall-parallel velocities but, to take into account the dynamic deformation of the gas-liquid interface, we also introduce non-zero boundary conditions for the wall-normal velocity. These conditions are derived from the deformation of the interface in response to the overlying turbulent pressure fluctuations, following the Young-Laplace equation. Surface protrusions in the form of posts and streamwise-aligned ridges are studied, and results are presented as a function of the "deformability" of the gas-liquid interfaces, expressed as a Weber number. We will also discuss results for misaligned ridges.

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Jongmin Seo
Stanford University

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