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Where is the wall? RICARDO GARCIA-MAYORAL, JOSEPH IBRAHIM, GARAZI GOMEZ-DE-SEGURA, University of Cambridge — Textured surfaces with small texture size can increase or reduce turbulent drag, compared to a smooth wall, by imposing different virtual origins for the different velocity components, as proposed by Luchini et al. (1991) for the streamwise and spanwise components. We extend this idea by imposing different virtual origins for all three velocities using Robin, slip-length-like boundary conditions in direct numerical simulations. We show that the change in drag depends only on the offset between the virtual origin for the mean velocity profile, typically set by the streamwise slip length, and the virtual origin for turbulence (embodied by the quasi-streamwise vortices of the near-wall cycle), set by the wall-normal and spanwise slip lengths. We demonstrate that, other than by the offset between these origins, turbulence remains essentially smooth-wall-like, and show how to obtain the position of the virtual origins for the mean velocity and for turbulence from the three slip-length coefficients, and from them the change in drag.

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