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Effects of the pitch length of superhydrophobic surfaces on the effective slip length and skin-friction drag[1] TAEYONG JUNG, HAECHEON CHOI, Seoul National University, JOHN KIM, University of California, Los Angeles — Many numerical studies have been conducted to investigate the effect of the grating parameters of superhydrophobic surfaces, such as the pitch length and gas fraction, on the slip velocity and its effect on skin-friction drag. However, the pitch lengths considered numerically so far are much larger, varying from $p^+ = O\ (10)$ to $O\ (10^2)$ in wall units, than those in experiments ($p^+ = O\ (1)$). In the present study, we perform a direct numerical simulation of turbulent channel flow over superhydrophobic surfaces with longitudinal microgrates having the actual grating parameters of $p^+ = 3.8$. The air layer inside the cavity ($d^+ = 18$; d^+ is the cavity depth) is also solved with the assumption of zero interface curvature. The minimal flow unit by Jimenez & Moin (1991) is adopted to resolve the small pitch length. Since small pitch length is accompanied by small cavity width, the growth of the slip velocity at the air-water interface is inhibited. As a result, the slip velocity (u_s^+) is less than 2 for $p^+ = 3.8$, whereas u_s^+ is greater than 15 for $p^+ = 540$. The effective slip length is an order of the viscous sublayer thickness, and the drag reduction is less than 20%. The detailed results for the cases of $p^+ \sim O\ (1)$ to $O\ (10^2)$ will be presented.

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