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Scaling of rough-wall turbulence by the roughness height and steepness¹ GUOZHEN MA, CHUNXIAO XU, Tsinghua University, HYUNG JIN SUNG, KAIST, WEIXI HUANG, Tsinghua University — A roughness scaling behavior is tested by performing the direct numerical simulation (DNS) of a turbulent channel flow over three-dimensional sinusoidal rough walls. The effects of roughness height (k^+) and roughness steepness (S) on the turbulent instantaneous field and statistics are examined. The results show that the mean velocity and Reynolds stresses are highly dependent on both k^+ and S , and a good scaling behavior is obtained on the roughness function and the peak of the streamwise turbulent intensity by using a coupling scale k^+S . Then we define a rough-wall drag increasing ratio based on the roughness function. Accordingly, the wall resistance can be estimated directly from the coupling scale k^+S for a given rough surface.

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