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Direct numerical simulations in turbulent boundary layers over cube-roughened walls with varying spanwise spacing[1] JUNSUN AHN, JAE HWA LEE, HYUNG JIN SUNG, KAIST — Direct numerical simulations of turbulent boundary layers over three-dimensional cube-roughened walls were performed to investigate the effects of the spanwise spacing (p_z/k) on the turbulent statistics. The spanwise extent between the cubes was varied p_z/k=2, 3, 4 and 6 at the fixed streamwise extent (p_x/k=3), where k is the roughness height. Lee *et al.* (2012) examined by varying the streamwise extent ($2\leq p_x/k \leq 10$) that the roughness function has the maximum contribution at p_x/k=4 and the outer value of the Reynolds stresses at $y/\delta \approx 0.4$ increases with increasing the streamwise pitch (p_x/k). The roughness function has the local maximum at p_z/k=3 and the value of the Reynolds stresses at the same outer location increases linearly with increasing the spanwise pitch (p_z/k). This implies that the wall friction is closely correlated with the roughness density because the roughness function has the maximum at the similar roughness density and there is also a strong interaction between the inner and outer regions at large spacing values of p_z/k. Furthermore, we can understand the roughness effects on the turbulence structures.

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