

Abstract Submitted
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Cube-roughened surfaces at high and extreme packing densities

HAOSEN XU, XIANG YANG, The Penn State University — We study turbulent channel flows with rough walls comprised of aligned arrays of cubical roughness elements at high surface coverage densities (λ). Specifically, we carry out direct numerical simulations (DNS) at $\lambda = 0.5 \sim 0.9$. Fluid motions in the narrow slits between the cubical roughness elements are resolved. We find pairs of relatively small-sized counter rotating vortices in between and above the cubes at moderately high packing densities, i.e. $\lambda = 0.5 \sim 0.7$. These vortices are replaced by large ones above each cube when surface coverage is high ($\lambda \leq 0.8$). Last, we will compare our DNS to wall-modeled LES, which is a more affordable tool than DNS at high Reynolds numbers. For the flows considered, WMLES compare reasonably well with the DNS, although noticeable differences in the roughness occupied layer is found.

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