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DNS of turbulent channel flow over hemispherical roughness SICONG WU, University of Illinois at Urbana-Champaign, KENNETH CHRISTENSEN, University of Notre Dame, CARLOS PANTANO, University of Illinois at Urbana-Champaign — Turbulent channel flows over certain rough surfaces have been studied using direct numerical simulation (DNS) in recent years. Most of these previous studies have focused on roughness with closely packed cubic or cylindrical ribs and it is well documented that the near-wall flow is strongly affected by the roughness but the outer region is relatively unaffected, in agreement with previous experiment evidence. In this study, DNS of turbulent channel flow with hexagonally packed hemispheres on a wall is performed. The roughness height k/h is about 10 and the average spacing between hemispheres from center to center is of the order of 6 times of the roughness height. The friction Reynolds number is approximately 400 and the simulation employs the NEK5000 solver, an incompressible Navier-Stokes code based on spectral elements. We will discuss detailed turbulence statistics in the near-wall region and forces on the rough surface, with the aim of improving understanding of flow physics to guide development of reliable LES models.

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