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LES of turbulent boundary layer flow over irregular and multiscale topographies, and comparison with experimental data WILLIAM ANDERSON, Mechanical Engineering Dept., Baylor University, KENNETH CHRISTENSEN, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Topographies featuring an irregular distribution of obstacles occur frequently in fluid machinery applications. Moreover, the distribution of characteristic size of these obstacles may also be broad. The hydrodynamic response of turbulence to such topographies is complicated, since both the flow and topography are composed of multiple length scales and identification of dominant scale is not obvious. Mejia-Alvarez and Christensen, 2010: Phys. Fluids, 22 015106 presented comprehensive experiments of developing and developed turbulent boundary layer flow over multiscale gas turbine blade topography. In the present work, results of large-eddy simulation of turbulent boundary layer flow over the topography considered by the experimentalists is presented. The topography is resolved with an immersed boundary method. The numerical and experimental results show reasonable agreement. The results are also used to make a posteriori evaluation of parameters used in classical relations linking the hydrodynamic roughness length to other statistics of the topography.

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