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A nested-LES wall-modeling approach for computation of high Reynolds number equilibrium and non-equilibrium wall-bounded turbulent flows YIFENG TANG, RAYHANEH AKHAVAN, The University of Michigan, Ann Arbor — A nested-LES wall-modeling approach for high Reynolds number, wall-bounded turbulence is presented. In this approach, a coarse-grained LES is performed in the full-domain, along with a nested, fine-resolution LES in a minimal flow unit. The coupling between the two domains is achieved by renormalizing the instantaneous LES velocity fields to match the profiles of kinetic energies of components of the mean velocity and velocity fluctuations in both domains to those of the minimal flow unit in the near-wall region, and to those of the full-domain in the outer region. The method is of fixed computational cost, independent of Re_τ, in homogenous flows, and is $O(Re_\tau)$ in strongly non-homogenous flows. The method has been applied to equilibrium turbulent channel flows at $1000 \leq Re_\tau \leq 10000$ and to non-equilibrium, shear-driven, 3D turbulent channel flow at $Re_\tau \approx 2000$. In equilibrium channel flow, the friction coefficient and the one-point turbulence statistics are predicted in agreement with Dean's correlation and available DNS and experimental data. In shear-driven, 3D channel flow, the evolution of turbulence statistics is predicted in agreement with experimental data of Driver & Hebbar (1991) in shear-driven, 3D boundary layer flow.

Rayhaneh Akhavan
The University of Michigan, Ann Arbor

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