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A near-wall model from analysis of inner-outer interactions in filtered wall bounded turbulence PRAKASH MOHAN, ROBERT MOSER, University of Texas at Austin — Large Eddy Simulations (LES) directly represent larger scale turbulent motions and model the effects of small scale motions. However in the near-wall region the large dynamically important eddies scale in viscous wall units, which makes resolving them in a high Reynolds number LES very expensive. This motivates the use of wall-modeled LES, in which these near-wall eddies are modeled. To aid in the development of new wall models, we pursue an asymptotic analysis of the filtered Navier-Stokes equations, in the limit in which the horizontal filter scale is large compared to the thickness of the wall layer. We show that in this limit the filtered velocities $\bar{u}$ in the near-wall layer are determined to zeroth order by filtered velocities at the boundary of the wall layer. Further, the asymptotics suggest that there is a scaled universal velocity profile f in the near-wall region. The profile f is evaluated through analysis of DNS data from channel flow at $Re_\tau = 5200$. We use the resulting profile f to formulate a predictive near-wall model. The model depends only on the filtered velocities at the boundary of the near-wall layer and can supply boundary conditions for a wall-modeled LES. We present preliminary results from a coarse LES using this wall model.

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