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Large eddy simulation of zero-pressure-gradient turbulent boundary layer based on different scaling laws[1] WAN CHENG, RAVI SAMTANEY, King Abdullah University of Science and Technology — We present results of large eddy simulation (LES) for a smooth-wall, zero-pressure-gradient turbulent boundary layer. We employ the stretched vortex sub-grid-scale model in the simulations augmented by a wall model. Our wall model is based on the virtual-wall model introduced by Chung & Pullin (J. Fluid Mech 2009). An essential component of their wall model is an ODE governing the local wall-normal velocity gradient obtained using inner-scaling ansatz. We test two variants of the wall model based on different similarity laws: one is based on a log-law and the other on a power-law. The specific form of the power law scaling utilized is that proposed by George & Castillo (Appl. Mech. Rev. 1997), dubbed the "GC Law". Turbulent inflow conditions are generated by a recycling method, and applying scaling laws corresponding to the two variants of the wall model, and a uniform way to determine the inlet friction velocity. For Reynolds number based on momentum thickness, Re_θ, ranging from 10^4 to 10^{12} it is found that the velocity profiles generally follow the log law form rather than the power law. For large Reynolds number asymptotic behavior, LES based on different scaling laws the boundary layer thickness and turbulent intensities do not show much difference.

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