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**Predicting Law-of-the-Wall with LES: Role of SFS and Surface Stress Models**[1] JAMES BRASSEUR, TIE WEI, SANJIV RAMACHANDRAN, Penn State Univ. — In previous work we presented a framework in which large-eddy simulation (LES) can be designed to capture the law-of-the-wall (LOTW) in mean velocity gradient when the first grid level is in the inertial layer. A proper combination of grid aspect ratio ($A_R$), subfilter-scale (SFS) stress model constant ($C_t$), and vertical grid resolution is required to suppress a spurious frictional length scale that underlies deviations from LOTW scaling. This occurs when the LES exceeds critical values of: (1) ratio of mean resolved to SFS shear stress ($R$) at the first grid level, (2) an "LES Reynolds number" ($Re_{LES}$), and (3) vertical resolution—the "High Accuracy Zone" (HAZ) on a plot of $R$ vs. $Re_{LES}$. Here we demonstrate this framework for 2 eddy viscosity and one non eddy viscosity SFS models, and we show that for the eddy viscosity models both $R$ and $Re_{LES}$ are inversely proportional to $D_t = C_t^a A_R^b$, where $a$ and $b$ are model-dependent constants. Commonly applied surface shear stress models create a spurious sink in velocity variance and oscillations in mean velocity gradient at the surface. Correcting the spurious sink both reduces these oscillations and increases the predicted value of the Von Kármán constant (VKC). We also show that $C_t$ and $A_R$ must be chosen within certain bounds and that the VKC predicted by LES asymptotes to a value of about 0.37 within these bounds when the LES is within the HAZ.

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