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**Direct and Large Eddy Simulation of non-equilibrium wall-bounded turbulent flows** HEE-JUN PARK, RAYHANEH AKHAVAN, University of Michigan — The performance of several existing SGS models in non-equilibrium wall-bounded turbulent flows is investigated through comparisons of LES and DNS. The test problem is a shear-driven three-dimensional turbulent channel flow at base $Re_\tau \sim 210$ established by impulsive motion of one of the channel walls in the spanwise direction with a spanwise velocity equal to 3/4 of the bulk mean velocity in the channel. The DNS and LES are performed using pseudo-spectral methods with resolutions of $128\times128\times129$ and $32\times64\times65$, respectively. The SGS models tested include the nonlinear Interactions Approximation model (NIA) [Haliloglu and Akhavan (2004)], the Dynamic Smagorinsky model (DSM) [Germano et al. (1991)], and the Dynamic Mixed Model (DMM) [Zang et al. (1993)]. The results show that NIA gives the best overall agreement with DNS. Both DMM and DSM over-predict the decay of the mean streamwise wall shear stress on the moving wall, while NIA gives results in close agreements with DNS. Similarly, NIA gives the best agreement with DNS in the prediction of the mean velocity, the higher-order turbulence statistics, and the lag angle between the mean shear and the turbulent shear stress. These results suggest that non-equilibrium wall-bounded turbulent flows can be accurately computed by LES with NIA as the SGS model.

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