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A nested-LES wall-modelling approach for high Reynolds number wall-bounded turbulence YIFENG TANG, RAYHANEH AKHAVAN, University of Michigan, Ann Arbor, MI 48109-2125 — A new wall-modelling approach for LES of high Reynolds number wall-bounded turbulence is proposed. The method couples coarse-grained LES in a full-size channel with nested fine-grained LES in a minimal channel. At each iteration, the fluctuating velocity field in both channels is rescaled to match the TKE components to that of the minimal channel in the near-wall region ($z^+ < 100$), to that of the full-size channel in the core ($z^+ > 300$), and to a weighted average of the two in between. Results were insensitive to the details and width of the weighting function. Simulations were performed for $1000 \leq Re_\tau \leq 10,000$ in full channels of size $2\pi h \times \pi h \times 2h$ and minimal channels of size $3000 \times 1500 \times 2Re_\tau$ wall units in the streamwise, spanwise and wall-normal directions, respectively. At all Re_τ, resolutions of $64 \times 64 \times 65$ in the full-size channel and $32 \times 64 \times 65$ in the minimal channel were employed, rendering the cost of computations independent of Re_τ. The Dynamic Smagorinsky model was used as the SGS model. The results show that the nested-LES approach can predict a friction coefficient within 5% of Dean's correlation, and one-point statistics in good agreement with available DNS and experimental data.

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