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Progress in the Multi-scale, Multi-domain Approach to Wall Modelling in LES M.U. HALILOGLU, R. AKHAVAN, University of Michigan — The Multi-Scale, Multi-Domain (MSMD) method is an approach to wall-modelling based on the solution of the near-wall region in a minimal flow unit at fine resolution, repeating this unit periodically or quasi-periodically, and coupling this solution to a full domain solution in the core at coarse resolution. In this talk, we review the details of the MSMD approach and the progress made to date on the topic. We will discuss issues such as the minimum required size for the near- wall unit, effect of interface boundary conditions and scaling of the computational cost with Reynolds number. It will be shown that the near-wall unit needs to have minimum dimensions of ~ 5000 wall units in the streamwise direction, ~ 2000 wall units in the spanwise direction, and ~ 250 wall units in the wall-normal direction in order to accommodate the near- wall hairpin vortex packets. The interface boundary conditions need to be specified such that they break the periodicity on the core side of the interface. With these conditions, simulations can be performed with a resolution of $32 \times 32 \times 17$ in the near-wall layer and $32 \times 64 \times 33$ in the core for up to $\mathrm{Re}_\tau \approx 10000$. For higher Re_τ, larger near-wall units are required to provide some overlap between the grid spacing in the core and the overall size of the near-wall region. The results obtained in a turbulent channel flow based on application of the above concepts will be discussed.

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