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LES one-way coupling of nested grids using scale similarity model
KOJIRO NOZAWA, Shimizu Corp., TETSURO TAMURA, Tokyo Institute of Technology — The method for coupling between nested grids with turbulence energy smoothly transferred is proposed for LES turbulent flows. In this method fluctuating velocity simulated in a coarse grid is imposed to a fine grid. As a result, time-sequential data of the grid-scale velocity fluctuation of the fine grid can be obtained utilizing the scale similarity concept [J. Bardina, J. H. Ferziger and W. C. Reynolds, AIAA Paper, No.80-1357, (1980)]. The a-priori test of a turbulent boundary layer flow over a rough surface is conducted to validate this method. In order to fulfill simulations of spatially developing turbulent boundary layer flows we apply the quasi-periodic boundary condition to the streamwise direction [K. Nozawa and T. Tamura, Proc. of the Turbulent Shear Flow Phenomena, vol.2, 443-448.(2001)]. In the test coarsely resolved velocity data which is generated filtering finely resolved LES data are applied for directly reproducing subgrid-scale components of the coarsely resolved LES. The reproduced fluctuation velocity agrees well with the true value which can be derived by subtracting the generated coarsely resolved velocity data from the finely resolved LES data. Also, the spectra of the reproduced streamwise fluctuation velocities at higher wave number range corresponding to the fine mesh size fit to the -5/3 power law for the inertial subrange. This method is expected to appropriately combine the meso-scale meteorological model with the LES model of urban scale.

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