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A Stochastic Wall Model for Large-Eddy Simulation of Rough Channel Flows[1] LIVIA S FREIRE, University of Sao Paulo, MARCELO CHAMECKI, University of California Los Angeles — In Large-Eddy Simulation (LES) of high-Reynolds number channel flows, the near-wall parameterization remains a challenge due to computational cost. In this study, a stochastic wall model consisting of vertical lines within each wall-adjacent LES grid cell is tested. Each line corresponds to a one-dimensional turbulence (ODT) model, where the vertical diffusion equation is solved and the effect of turbulence is provided by stochastic eddies, which correspond to a mapping function that mixes the variables and redistributes energy. This approach provides two options for modeling the effects of roughness within the ODT: (i) via equilibrium assumption by imposing a log-law with a bulk roughness height parameter between the ODT lowest grid point and the wall, and (ii) via drag model represented as a body force resolved within the ODT domain. The first approach moves the log-law parameterization closer to the wall compared to its use in the LES directly, improving the LES near-wall spectra. The second approach provides canopy-flow statistics within the wall model, reproducing important features such as skewed velocity field. Both options provide an alternative for studies focused on near-wall turbulence, refining the flow field information and improving flow statistics in the LES.

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