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Towards A Large Eddy Simulation of Supercritical CO_2 Pipe Flow: High-Reynolds-Flow Simulation XIAOHANG WANG, Iowa State University — Studies on the numerical simulation of high-Reynolds-number flows encounter difficulties due to the wide range of characteristic length and time scales existing in the flow field, which are often smaller than the computational grid size. Besides, the near-wall region contains small vortical structures dynamically important to the flow, which have dimensions that scale with the viscous scale, making it impractical to resolve them in numerical simulations at very high Reynolds numbers. A thorough numerical investigation of high Reynolds number (Re_D=28666) supercritical CO_2 pipe flow was performed by using the large eddy simulation (LES), where a dynamic subgrid-scale model was used to account for the subgrid scale effects. The objective was to investigate the influence of subgrid scale modeling, filter size, domain size, grid resolution and initial condition on the quality of the predicted results. Certain resolution requirements in LES proposed by J. S. Baggett and J. Jimenez were studied. The simulation indicates that grid refinements in spanwise direction may cause the divergence, as the mean streak spacing is much smaller than 100 wall units, which is assumed to be consistent with near-wall streamwise vortices optimally configured to gain the most energy over an appropriate turbulent eddy turnover time.

Xiaohang Wang
Iowa State University

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