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Stochastic Coherent Adaptive Large Eddy Simulation

Stochastic Coherent Adaptive Large Eddy Simulation (SCALES) is an extension of Large Eddy Simulation that uses a wavelet-based dynamic grid adaptation strategy to solve for the most energetic coherent structures in a turbulent flow field, while modelling the effect of the less energetic ones. A localized dynamic subgrid scale model is needed to fully exploit the ability of the method to track coherent structures. In this paper, new local Lagrangian models based on a modified Germano dynamic procedure, redefined in terms of wavelet thresholding filters, are proposed. These models extend the original path-line formulation of Meneveau *et al.* (J. Fluid Mech. **319**, 1996) in two ways: as Lagrangian path-line diffusive and Lagrangian path-tube averaging procedures. The proposed models are tested for freely decaying homogeneous turbulence with initial $Re_\lambda = 72$. It is shown that the SCALES results, obtained with fewer than 0.4% of the total non-adaptive nodes required for a DNS with the same wavelet solver, closely match reference DNS data. In contrast to classical LES, this agreement holds not only for large scale global statistical quantities, but also for energy and, more importantly, enstrophy spectra up to the dissipative wavenumber range.