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Computational Complexity of Coherent Vortex and Adaptive Large Eddy Simulations of Three-Dimensional Homogeneous Turbulence at High Reynolds Numbers[1] ALIREZA NEJADMALAYERI, ALEXEI VEZOLAINEN, OLEG V. VASILYEV, University of Colorado at Boulder — With the recent development of parallel adaptive wavelet collocation method, adaptive numerical simulations of high Reynolds number turbulent flows have become feasible. The integration of turbulence modeling of different fidelity with adaptive wavelet methods results in a hierarchical approach for modeling and simulating turbulent flows in which all or most energetic parts of coherent eddies are dynamically resolved on self-adaptive computational grids, while modeling the effect of the unresolved incoherent or less energetic modes. This talk is the first attempt to estimate how spatial modes of both Coherent Vortex Simulations (CVS) and Stochastic Coherent Adaptive Large Eddy Simulations (SCALES) scale with Reynolds number. The computational complexity studies for both CVS and SCALES of linearly forced homogeneous turbulence are performed at effective non-adaptive resolutions of 256^3, 512^3, 1024^3, and 2048^3 corresponding to approximate Re_λ of 70, 120, 190, 320. The details of the simulations are discussed and the results of compression achieved by CVS and SCALES as well as scalability studies of the parallel algorithm for the aforementioned Taylor micro-scale Reynolds numbers are presented.

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