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DNS of homogeneous turbulent shear flow using a hybrid Pseudospectral-WENO Method PARVEZ SUKHESWALLA, T. VAITHIANATHAN, LANCE COLLINS, Cornell University — Pseudospectral-based direct numerical simulations (DNS) of homogeneous turbulent shear flow (HTSF) have been shown to inevitably suffer from numerical resolution problems that become more severe with increasing Reynolds number [Sukheswalla et al., in review]. The resulting Gibbs oscillations can be removed using low-pass spectral filters that stabilize the simulations and enable attainment of higher asymptotic Reynolds numbers. However, while low-pass filtering does not appear to impact large-scale statistics, it does compromise small-scale statistics such as vorticity, with unclear consequences on the overall dynamics over time. In this presentation, we put forth an alternative approach based on a hybrid DNS method, wherein a Weighted Essentially Non-oscillatory (WENO) scheme is used to compute the nonlinear convective term that is the primary source of the Gibbs oscillations, while a pseudospectral method is used for the other terms. The resulting hybrid scheme yields large- and small-scale statistics in good agreement with the experiments of Isaza et al. [*Phys. Fluids* 21(6), 2009] and Gylfason et al. [*J. Fluid Mech.* 501:213–229, 2004]. The effectiveness of the new scheme for the fluid velocity lays the groundwork for future DNS of inertial particles in HTSF.

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