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Transition and Turbulence Decay in the Taylor-Green Vortex[1]
FERNANDO GRINSTEIN, Los Alamos National Laboratory, DIMITRIS DRIKAKIS, Cranfield Univ., UK, CHRISTER FUREBY, FOI, Sweden, DAVID YOUNGS, AWE, UK — The Taylor-Green Vortex (TGV) is a fundamental case that has been traditionally used as prototype of vortex stretching and consequent production of small-scale eddies, to investigate the basic dynamics of transition to turbulence. As such, it is also a very convenient case in which to test the ability of explicit and implicit subgrid scale (SGS) modeling to simulate the basic laws of turbulence. We report on the performance of Monotone Integrated LES (MILES) in emulating the space/time development of transition to turbulence and self-similar decay in the TGV without resorting to an explicit SGS model. MILES based on various limiting algorithms, including Flux Corrected Transport, characteristics-based Godunov, Lagrange-Remap, and several other hybrid methods is tested and compared with a conventional (mixed) LES method combining one-equation eddy-viscosity and scale-similarity models. The agreement between MILES, mixed-model LES, and the previous DNS by Brachet et al. (1983) is quite good in estimating the time and height of the dissipation peak associated with the TGV inviscid instability.

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