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Numerical Simulations of Turbulence Subjected to a Straining and De-Straining Cycle PAOLO GUALTIERI, Dip. di Meccanica e Aeronautica Universita' di Roma La Sapienza, CHARLES MENEVEAU, Dep. of Mechanical Engineering, Johns Hopkins University — In most applications turbulent flows develop in geometrically complex devices where interactions between fluctuations and mean velocity gradients occur in non equilibrium conditions, i.e. turbulence is subjected to a significant large-scale deformation. The simplest flow which retains this physical aspect is turbulence subjected to homogenous straining flow. Non-equilibrium effects may be studied by varying the applied straining as function of time. To simulate such a flow numerically, a spectral code with the Rogallo transformation and stochastic forcing is employed. Direct and Large-Eddy Simulations of initially isotropic turbulence subjected to a straining and destraining cycle are performed. Numerical results are compared with experimental data obtained in similar conditions [Chen, Meneveau & Katz, J. Fluid Mech.562 (2006)]. The role played by the initial energy spectra is discussed in relation with the position of the random forcing within the inertial range. The response of the system is characterized both in terms of velocity variances and turbulent kinetic energy production. In agreement with experimental data, numerical simulations provide significant backscatter of turbulent kinetic energy during the destraining phase explained in terms of anisotropy persistency in the Reynolds stresses.

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