A Statistical Description of Two and Three-Dimensional Turbulence

John Bowman
bowman@math.ualberta.ca
University of Alberta, Canada

A new statistical description of turbulence known as spectral reduction [Bowman et al., Phys. Rev. Lett. 83, 5491 (1999)] implements a coarse-graining in wavenumber space to greatly reduce the number of modes required to simulate incompressible homogeneous turbulence. In the absence of forcing or dissipation, a Liouville theorem leads to statistical equipartition solutions. Excellent agreement is obtained with two-dimensional forced-dissipative pseudospectral simulations. In the enstrophy cascade, logarithmic corrections to the high-order structure functions are observed. Spectral reduction may provide a useful tool for developing a subgrid model for large-eddy simulations. We describe the extension of the method from two- to three-dimensional turbulence. This is joint work with B. A. Shadwick and P. J. Morrison.