Large data analysis for the Kolmogorov two-equation model of turbulence

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Abstract

A.N. Kolmogorov seems to have been the first to recognize that a two-equation model of tubulence might be used as the basis of turbulent flow prediction. Although his model has so far been almost unnoticed, it exhibits interesting features. First of all, its structure is similar to the Navier–Stokes(–Fourier) equations for incompressible fluid flow; the only difference is that the viscosity is not constant but depends on the fraction of two scalar quantities that measure the effect of turbulence: the average of the kinetic energy of velocity fluctuations and the measure related to the length scales of turbulence. The dependence is such that the material coefficients such as viscosity and turbulent diffusivities may degenerate, and thus the a priori control of the derivatives of the quantities involved is unclear. Furthermore, the system includes the dissipation of the energy, which is merely an L^1 quantity, appearing on the right-hand side of the equation for turbulent kinetic energy. We establish large data existence of a suitable weak solution to such a system completed by the initial and generalized Navier's slip and stick-slip boundary conditions.

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