Application of Leith's Diffusion Approximation to Homogeneous Isotropic Turbulence

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L. F. Richardson[1] (1926) considered first that small-scale disturbances in a turbulent flow with sufficiently large Reynolds number may reduce to an isotropic turbulence state. The idea was extended by A N. Kolmogorov[2] (1941) who introduced turbulence energy cascade and proposed several similarity hypotheses at sufficiently high Reynolds number. Kolmogorov termed this turbulence which comprises of various length and velocity scales as "locally isotropic turbulence".

In this paper, we shall apply a general type of self-similar scheme for the decaying homogeneous isotropic turbulence under the condition that Reynold's number is very high. It is shown here that, the diffusion approximation due to Leith[3] (1967) can be applied straightforwardly and Kolmogorof's 5/3rd law is obeyed. Applicability of this problem is discussed with respect to similar other models. We would limit our attention here closely to the Leith's model of evergy transfer only following the thoughts of Richardson-Kolmogorov cascade and equilibrium hypothesis.