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Inertial Similarity of Velocity Distributions in Homogeneous Isotropic Turbulence

Tomomasa Tatsumi(1), Takahiro Yoshimura(2)

(1) *International Institute for Advanced Studies, Kyoto, Japan*
(2) *Toyota Techno Service Co., Tokyo, Japan*

The Lundgren-Monin (1967) equations for the velocity distributions in homogeneous turbulence are made closed by using the cross-independence hypothesis, which is equivalent to Kolmogorov's premise. The one- and two-point velocity distributions are obtained as the solutions of these equations. The one-point velocity distribution is found to be inertial normal distribution and the velocity-sum distribution and the lateral velocity difference distribution are shown to be another inertial-normal distribution for all non-zero distances between the two points. The longitudinal velocity–difference distribution also takes the inertial-normal distribution at large distances but assumes an asymmetric algebraic distribution at small distances corresponding to Kolmogorov's inertial range. Apart from these inertial similarity, these velocity distribution are shown to obey the viscous similarity at very small distances, which are taken to be zero under the inertial similarity.

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