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Stochastic Modeling of Super-Dispersion in Chaotic Flows[1]
EHSAN KHARAZMI, Michigan State University, Department of Mechanical Engineering , MOHSEN ZAYERNOURI, Michigan State University, Department of Computational Mathematics, Science, and Engineering , FARHAD A. JABERI, Michigan State University, Department of Mechanical Engineering — Experimental studies have revealed that the statistical distributions of turbulent variables, even in canonical flows, are often strongly non-Gaussian, asymmetric, heavy-tailed, and sometimes involve sharp peaks. Examples of such anomalies are observed in grid turbulence, atmospheric boundary layers, and dispersion of particles in shear layers. We propose a stochastic distributed-order model for the enhanced dispersion of passive particles in the context of shear layers and an array of planar jets. We establish a physical and statistical link between the power-law behavior obtained for the mean square of particles displacement, in addition to mean square of velocity and vorticity increments to the cascade of turbulent kinetic energy.

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