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Multiscale Lagrangian Statistics of Curvature Angle in Pore-Scale Turbulence[1] BRYAN HE, Oregon State University, Corvallis, USA, BENJAMIN KADOCH, Aix-Marseille Université, Marseille, France, SOURABH APTE, Oregon State University, Corvallis, USA, MARIE FARGE, LMD-IPSL-CNRS, Ecole Normale Supérieure, Paris, France, KAI SCHNEIDER, Aix-Marseille Université, Marseille, France — Porescale turbulent flow physics are investigated using Direct Numeric Simulation (DNS) of flow through a periodic face centered cubic (FCC) unit cell at Reynolds numbers of 300, 500 and 1000. The simulations are performed using a fictitious domain approach [Apte et al, J. Comp. Physics 2009], which uses non-body conforming Cartesian grids. Lagrangian statistics of scale dependent curvature angle and acceleration are calculated by tracking a large number of fluid particle trajectories. For isotropic turbulence, it has been shown [Bos et al. 2015, PRL] that the mean curvature angle varies linearly with time initially, reaches an inertial range and asymptotes to a value of $\pi/2$ at long times, corresponding to the decorrelation and equipartition of the cosine of the curvature angle. Similar trends are observed at early times for turbulence in porous medium; however, the mean curvature angle asymptotes to a value larger than $\pi/2$, due to the effect of confinement on the fluid particle trajectories that result in preferred directions at large times. A Monte-Carlo based stochastic model to predict the long-time behavior of curvature angles is developed and shown to correctly predicts an angle larger than $\pi/2$ at large times.

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