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Stochastic modeling of the subgrid fluid velocity fluctuations along inertial particle trajectories. PASCAL FEDE, ONERA and IMFT, Toulouse, France, PHILIPPE VILLEDIEU, ONERA, Toulouse, France, OLIVIER SIMONIN, IMFT, Toulouse, France , KYLE SQUIRES, MAE Department, Arizona State University, Tempe, Arizona — Large Eddy Simulation (LES) coupled with Discrete Particle Simulation (DPS) is a powerful approach for the prediction of particle behavior in turbulent flows. To further advance the technique, several issues should be clarified for the fluid phase (such as the effect of the particles on modeling the subgrid fluid turbulence) and for the particulate phase (such as the effect of the subgrid fluid turbulence on particle dispersion and inter-particle collision rates). The present study focuses on the modeling of the subgrid fluid velocity fluctuation along solid inertial particle trajectories with relaxation times close to the fluid subgrid turbulent time scale. A Langevin model has been derived which ensures that the resulting equation for the variance of the subgrid velocity along the particle path is coherent with the subgrid mean kinetic energy equation derived from the filtered Navier-Stokes system. To assess the model, one- and two-point statistics measured using fluid velocity fields computed using DNS of homogenous, isotropic turbulence and Lagrangian particle tracking for the dispersed phase have been compared with results obtained using filtered velocity fields (issued from the DNS case) and the stochastic Langevin equation for the subgrid velocity reconstruction.

Kyle Squires
MAE Department, Arizona State University, Tempe, Arizona

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