Particle dynamics in a ploy-dispersed particle laden turbulent flows: fluctuating force model

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Fluctuating force model can capture the effect of turbulent fluid velocity fluctuations on the dynamics of particle for a turbulent gas-solid suspensions with high Stokes number. In the model turbulent velocity fluctuation is considered to a anisotropic Gaussian white noise. The amplitude of the noise depends on the statistics of the fluid phase velocity fluctuations. The noise amplitude is determined from the time correlations of the spatially varying inhomogeneous fluid velocity fluctuations computed using Direct Numerical Simulations (DNS). From the direct numerical simulation (DNS), integral time scales are obtained in fixed and moving Eulerian reference frame and then we obtain the velocity space diffusion coefficient for the turbulent phase. This velocity space diffusion coefficient is embedded in the particle equation of motion to simulate the dynamical behavior of the particle phase.

The particle velocity distribution for ploy-dispersed system is analyses using 'fluctuating force model' the results are compared with DNS simulations considering one-way coupling (the force due to turbulent velocity fluctuations on the particle is incorporated, but not the reverse force due to the particle on the fluid turbulence). Particle concentration distribution and second moment of the particle velocity fluctuations inside the channel has also been investigated.