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Fluid-particle drag in binary suspensions under Stokes flow condition[1] XIAOLONG YIN, SANKARAN SUNDARESAN, Chemical Engineering, Princeton University — In multi-fluid models for fluid-particle suspensions, the details of the fluid-particle interactions are supplied through various constitutive relations, among which the one for drag is particularly important. Drag correlations for binary suspensions with no mean relative motion between the two solid phases have been well established. However, multi-fluid models for flowing binary suspensions require more general drag correlations, where different types of particles can have different local averaged velocities relative to the interstitial fluid. The goal of this study is to construct such drag correlations from direct numerical simulations. We assumed that the particles have high St and small Re. The drag force is then related to the fluid-particle relative velocities by a proportionality matrix, the off-diagonal components of which represent the particle-particle drag due to hydrodynamic interactions and were found to give important contributions to the net drag force. The total particle volume fraction in our study ranged from 0.1 to 0.4. The size ratios of particles were varied from 1:1 to 1:4.

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