Eulerian gas-solid CFD model combined with meso-scale drag forces in fluidized-bed

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The interphase momentum transfer between phases has been known as one of the most significant terms in the momentum equations of gas and solid phases in fluidized-beds. Effects of mesoscale solid clusters on hydrodynamics by means of drag energy consumption minimization (DECM) model are taken into account in an Eulerian-Eulerian gas-solid two-fluid model. Assuming steady momentum transport equations in mesoscale for dense, dilute and interfacial interaction phases, the drag forces are immediately calculated by the DECM model for every time step of computational fluid dynamics (CFD) scale in the transient state. A stability condition as the extreme of energy consumed by drag forces in dense, dilute and interfacial interaction phases represents the minimum of fluid resistance to upward path. The DECM model could predict the mesoscale structures of gas-solid flows in fluidized-beds in terms of solid and gas superficial velocities in dilute, dense and interfacial interaction phases, cluster diameter, and dense phase fraction. The mesoscale structure-dependent drag coefficient is applied to the CFD simulation to predict the solid distribution in the fluidized-bed.