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Direct numerical simulation of dense particle-laden flows - Investigation of the forces acting on the particles PERRINE PEPIOT, National Renewable Energy Laboratory, OLIVIER DESJARDINS, University of Colorado at Boulder — Resolved particle direct numerical simulation of dense particulate flows is used to investigate gas-particle interactions in the case of moving and colliding particles. Numerics are based on an immersed boundary implementation that discretely conserves mass and momentum (Meyer et al., JCP 2010). Geometry is accounted for through fictitious cut cell algorithm. Fluxes are rescaled based on gas face and gas cell fractions, while second order accurate volume and surface calculations are obtained through marching tetrahedra reconstruction of the interface. This approach relaxes flow blockage due to the immersed boundaries and is consistent with the soft sphere model used for particle collisions. A Lagrangian solver describes the particle motion. Conservation of momentum across phases is ensured since the forces applied to the particles are directly derived from the Navier-Stokes source terms. This new tool allows investigating the accuracy of existing drag models for freely moving particles (finite Stokes) and colliding particles (sudden and frequent direction changes).

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