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Particle-resolved DNS (PR-DNS) to study the effect of flow and collisions in a monodispersed fluidized bed reactor[1] YINUO YAO, OLIVER FRINGER, CRAIG CRIDDLE, Stanford University — We study the effects of fluid-particle and particle-particle interactions in a two-dimensional monodispersed fluidized bed reactor. The simulations were conducted using the Immersed Boundary Method (IBM) with direct forcing for periodic and wall-bounded cases and with particle Reynolds numbers of 10-50. Three different flow regimes were identified as a function of the particle Reynolds number. For low particle Reynolds numbers, the porosity of the particles in the fluidized bed is relatively low and the particle dynamics are dominated by interparticle collisions which leads to relatively isotropic fluctuating particle velocities. For high particle Reynolds numbers, the particle dynamics is dominated by flow-induced forces, leading to moderate isotropic fluctuating particle velocities. The most anisotropic fluctuating particle velocities occur in the intermediate Reynolds number regime where both flow and collision forces are equally important. By comparing wall-bounded and periodic cases, we show that the flow-dominant regime is absent for the particle Reynolds numbers we study because the walls reduce inter-particle collisions. This work is supported by California Energy Commission.

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