Numerical simulation of dense gas-solid flow with large particle size difference by fictitious particle method

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ABSTRACT

Fluidized bed is widely used in industries from energy to food. It is typical that the size of solid materials in the bed is not uniform and large solids coexist with small solids. The large size difference significantly influences the mixing and segregation phenomena in the beds while these behaviours have been poorly understood. In the present study, Eulerian-Lagrangian simulation for a pseudo-2D bubbling fluidized bed consists of binary particles with large size difference is performed by Fictitious particle method [1]. Fluid motion is obtained in Eulerian way, in the meanwhile, large and small particle motions are obtained in Lagrangian way. Two spherical particles with 1 mm and 19.05 mm diameter are used respectively. Density of the large particle is varied as ρ_{large}/ρ_{bed} =0.62, 0.96 and 1.49 where ρ_{bed} shows the apparent density of the bed. Particles are in a completely separated state at initial and the mixing process of particles depending on ρ_{large}/ρ_{bed} is investigated. The results are compared with experimental results we performed in parallel. The present numerical results reproduce the experimental results very well. We observed that bubbles spontaneously formed in the bed give major effects on the mixing of large and small particles.

REFERENCES

[1] T. Tsuji, K. Higashida, Y. Okuyama and T. Tanaka. “Fictitious particle method: A numerical model for flows including dense solids with large size difference”, AIChE Journal, **60** (5), 1606-1620 (2014).