62b Three-Dimensional Simulation of a Single Bubble in a Rectangular Gas-Solid Fluidized Bed with a Central Jet

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Bubbling Gas-Solid fluidized beds with a jet have found applications in many industrial processes such as bioprocesses, particle coating, granulation, combustion and gasification of fossil fuels. As a reactor, a bubbling fluidized bed offers a rapid and efficient mixing of solids mainly due to the stirring action of the gas bubbles. To obtain fundamental understanding of such systems, we studied numerical simulation of the hydrodynamics of a three-dimensional rectangular gas-solid bubbling fluidized bed with a central gas jet. A commercially available Computational Fluid-Dynamics code, FLUENT 6.1, was used to simulate bubbling behavior in gas-solid fluidized beds. Using Eulerian approach, 3-Dimensional transient two-phase numerical simulation model was performed to simulate bubbling phenomena in a fluidized bed with a central jet using four different size particles. We studied the difference of flow behavior in case of 2-D and 3-D beds and the effect of “no-slip” and “specified-shear” wall boundary conditions on the bubble behavior. We also addressed the issue of solid viscosity to obtain continuous bubbling phenomena in the case of smaller particles. Our simulations were well compared with the already available experimental data in the literature. From our simulation results, it can be concluded that the granular kinetic theory model approach, which is based on the particle collision domination is only capable of describing the fluidization characteristics of beds containing large particles. In the case of smaller particles, inter-particle friction plays a dominant role in describing the bubbling characteristics in the fluidized beds.