IBM analysis of a particle motion in near-wall region

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Numerical simulations of gravitational settling of a submerged spherical particle along a wall were performed using a fixed Cartesian grid and "Body-force type Immersed Boundary Method (IBM)".The effect of the space resolution of fluid-flow calculation was studied. It is known that the space resolution required to resolve the flow around an isolated sphere depends only on the particle Reynolds number. However, when a solid boundary exists in the neighborhood of the particle, higher space resolution is required to resolve the flow in the gap between the particle and solid boundary. As a result of the present study, it was found that the calculated motion of the particle along the wall is more sensitive to the space resolution than that for an isolated particle and higher space resolution is required for the case with solid boundaries. Moreover, a lubrication force model was examined to reduce the space resolution for the fluid calculation.

Keywords: Immersed Boundary Method, Direct Numerical Simulation, Lubrication force, Space resolution