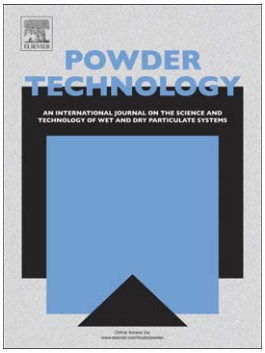

Convergence study of the Immersed Domain method for periodic particle configurations

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Convergence study of the Immersed Domain method for periodic particle configurations

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Abstract

For large-scale discrete element (DEM) simulations, particles sizes are often scaled up to reduce the computational effort. This coarse graining is incompatible with certain types of coupling to computational fluid dynamics (CFD) simulations usually used for large-scale simulations, as they require the fluid cells to be even larger than the particles, leading to unacceptably badly resolved flows. We investigate the possibility of using an immersed domain method with a large cell size to perform coupled DEM-CFD simulations of dense granular flows. To this end, we calculate the drag force on a single particle of an infinite simple cubic array of spherical particles suspended in a driven flow. We consider three packing fractions and compare the results for multiple resolutions to those obtained from conformal mesh CFD. While a number of flow characteristics suffer badly from coarse resolutions, the total drag force on the particle proves surprisingly accurate even for resolutions lower than 10 cells per particle diameter.

Keywords: immersed domain, immersed boundary, particle drag force, computational fluid dynamics

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