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An efficient immersed boundary method for fluid flow simulations with moving boundaries.

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Summary: An efficient immersed boundary (IB) method is presented for the direct numerical simulation of fluid flow past a pair of circular cylinders and rigid particulate flows. The cylinders are settled in either a tandem or side-by-side arrangement. The grid applied in this paper involves an uneven Cartesian grid, and local differential quadrature (LDQ) is employed to discretize the governing equations. Specifically, a solid in a target region is embedded into the Cartesian grid, and linear interpolation is adopted to calculate the IB and the virtual force on the cell center. The virtual force is substituted into the governing equations to determine the effect of the solid in the IB. The parameters for numerical calculation are the Reynolds number (10-200) and the Prandtl number of air (0.7). The spacing intervals of the tandem arrangement and side-by-side arrangement are $g^* = 1.5-4$ and $s^* = 1.5-4$, respectively. According to the aforementioned conditions, the local Nusselt number and average Nusselt number of the cylinder surface in each arrangement are calculated to investigate how dissimilar flow conditions and spacing intervals between the cylinders influence the effect of heat transfer enhancement. In addition, the present model is applied to simulate the sedimentation of one particle and two particles in a box. Related changes in the flow field of fluid-particles interaction are also discussed.

MSC:

76M99 Basic methods in fluid mechanics
65M99 Numerical methods for partial differential equations, initial value and time-dependent initial-boundary value problems
76D05 Navier-Stokes equations for incompressible viscous fluids

Cited in **2** Documents

Keywords:

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