A new explicit immersed boundary method for simulation of fluid-solid interactions. (English) [Zbl 07409114]

Summary: A new Explicit Immersed Boundary method (IBM) is presented in this work by analyzing and simplifying the system of equations developed from the implicit boundary condition-enforced immersed boundary method. By this way, the requirement to solve the matrix system has been bypassed. It makes the solver be computationally less expensive, especially when large number of Lagrangian points are used to represent the solid boundary. The lattice Boltzmann Flux solver (LBFS) was chosen as the flow solver in this paper as it combines the advantages of both Lattice Boltzmann (LB) solver and Navier-Stokes solver. However, it should be indicated that the new IBM can be incorporated into any flow solver. Comprehensive validations demonstrate that the new explicit scheme bears comparable numerical accuracy as the previous implicit IBM when having a geometry with curvature. The new method is computationally much more efficient than the previous method, especially for moving boundary problems.

MSC:
35Q30 Navier-Stokes equations
76D05 Navier-Stokes equations for incompressible viscous fluids

Keywords:
lattice Boltzmann flux solver; immersed boundary method; explicit; moving boundary; arbitrary Eulerian Lagrangian

Full Text: DOI

References:


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