Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

An implicit ghost-cell immersed boundary method with mass source and sink for simulations of moving-body problems with control of spurious pressure oscillations[1] JINMO LEE, DONGHYUN YOU, Department of Mechanical Engineering, Carnegie Mellon University — For moving body problems where the conventional immersed-boundary methods are employed, the simulation results are often contaminated by spurious pressure oscillations. The spurious pressure oscillations are known to be produced by the violation of mass conservation across interfaces between fluid and moving bodies and to be a function of mainly the grid spacing and time-step size. In the present work, we develop a new immersed boundary method which can control and significantly reduce the spurious pressure oscillations. A ghost-cell immersed boundary method is coupled with a mass source and sink algorithm to better conserve mass around boundary interfaces. A fully-implicit time integration scheme is employed for enhanced control of the time- step size thereby allowing better control of the spurious force oscillations on given mesh resolution. A novel method for treating multiple fresh and dead cells due to the use of a large time-step size is also developed. The present fully-implicit ghost-cell immersed boundary method coupled with a mass source/sink algorithm is demonstrated to significantly reduce spurious pressure oscillations thereby providing accurate and stable solutions for moving body problems.

[1]Supported by the Office of Naval Research Grant N000141110652.

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Date submitted: 26 Jul 2011 Electronic form version 1.4