Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

A discrete-forcing immersed boundary method with a semi-implicit predictor for weakly-coupled fluid-structure interaction[1] WOOJIN KIM, INJAE LEE, HAECHEON CHOI, Seoul National University — We present a weak coupling approach for the fluid-structure interaction using a discrete-forcing immersed boundary method. The incompressible Navier-Stokes equations and the motion of a solid body are based on the Eulerian and Lagrangian coordinates, respectively. A semi-implicit Euler method is applied to the governing equation of a solid body for obtaining provisional position and velocity of a solid body prior to implicitly solving each governing equation. Then, both equations are implicitly solved to obtain a sufficiently large computational time step size. The present weak-coupling approach shows a second-order temporal accuracy and stable solutions for the problems with a low density ratio (fluid to solid) without requiring an iterative method. With the present method, we simulate several fluid-structure interaction problems including the flows around a freely vibrating circular cylinder, a flexible beam attached to a circular cylinder, a flapping flag, a flexible plate, and an elastic vocal fold. The results obtained agree well with those from previous studies. All the simulations are conducted at maximum CFL numbers of 1.0-1.5.

[1]Supported by NRF-2012M2A8A4055647 and NRF-2014M3C1B1033848

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Date submitted: 30 Jul 2015 Electronic form version 1.4