Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A single-sided direct-forcing diffused immersed boundary method for correct local velocity gradient computation CHENG PENG, Pennsylvania State University, LIAN-PING WANG, Southern U of Sci and Tech and U of Delaware — Current algorithms of the immersed boundary method (IBM) based on diffused interfaces are not able to correctly calculate the velocity gradients within the diffused solid-fluid interfaces. This is because the non-zero boundary forcing creates a difference in the actual momentum equation solved in IBM from the physical one described by the Navier-Stokes equations with a sharp fluid-solid no-slip interface. A single-sided direct-forcing IBM algorithm is proposed to remove the boundary forcing from the fluid region. The capability of the proposed algorithm in correctly computing velocity gradients within all fluid region is validated in both laminar and turbulent flows. A technique to speed up the convergence of no-slip enforcement via force iteration is also introduced. This technique works for the proposed algorithm and other IBM algorithms.

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Date submitted: 01 Aug 2019 Electronic form version 1.4