Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

An immersed interface vortex method for internal and external 2D flows with moving boundaries[1] JAMES GABBARD, WIM VAN REES, Massachusetts Institute of Technology — We present a novel Immersed Interface Method for 2D viscous incompressible flows. The vorticity-velocity form of the Navier-Stokes equations are discretized using second-order conservative finite differences and third-order explicit time integration. The discretization and interface treatment can handle both internal and external flows, and both stationary and moving boundaries. For external flows, the use of a vorticity-based formulation allows free-space boundary conditions while only discretizing the compact support of the vorticity field. We further show how the sharp treatment of the boundary provides a natural and accurate way to compute pressure and viscous force distributions on stationary and moving obstacles. Our method is ideal for unsteady aero- and hydrodynamic problems, and we demonstrate its utility through simulations of cylinder arrays, heaving/pitching foils, and kinematically-driven internal flows.

[1]Supported by a MathWorks Engineering Fellowship

James Gabbard
Massachusetts Institute of Technology

Date submitted: 03 Aug 2020 Electronic form version 1.4