Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Simulating underwater propulsion using an immersed boundary method based open-source solver[1] UTKU SENTURK, Ege University, ARMAN HEMMATI, ALEXANDER J. SMITS, Princeton University — The performance of a newly developed Immersed Boundary Method (IBM) incorporated into a finite volume solver is examined using foam-extend-3.2. IBM uses a discrete forcing approach based on the weighted least squares interpolation to preserve the sharpness of the boundary, which decreases the computational complexity of the problem. Initially, four case studies with gradually increasing complexities are considered to verify the accuracy of the IBM approach. These include the flow past 2D stationary and transversely oscillating cylinders and 3D wake of stationary and pitching flat plates with aspect ratio 1.0 at Re=2000. The primary objective of this study, which is pursued by an ongoing simulation of the wake formed behind a pitching deformable 3D flat plate, is to investigate the underwater locomotion of a fish at Re=10000. The results of the IBM based solver are compared to the experimental results, which suggest that the force computations are accurate in general. Spurious oscillations in the forces are observed for problems with moving bodies which change based on spatial and temporal grid resolutions. Although it still has the full advantage of the main code features, the IBM-based solver in foam-extend-3.2 requires further development to be exploited for complex grids.

[1]The work was supported by ONR under MURI Grant N00014-14-1-0533.

Utku Senturk
Ege University

Date submitted: 28 Jul 2016 Electronic form version 1.4