Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Toward a three-dimensional viscous vortex particle method for numerical investigations of bio-inspired locomotion[1] JEFF ELDREDGE, UCLA Mechanical & Aerospace Engineering — Biological mechanics of aerial and aquatic locomotion are characterized by the reaction force generated by the fluid against highly deforming structures and the resultant vortical wake produced by this interaction. These two features should be central to a high-fidelity computational tool devoted to exploration of bio-inspired mechanics. Motivated by such problems, we present the development of a viscous vortex particle method with coupled body dynamics. The previously developed and validated tool for two-dimensional problems is briefly reviewed. The interaction between vorticity generation, reaction force, and body dynamics, which constitutes the fluid-structure coupling in the method, is discussed, and the capabilities of the method are demonstrated on the passive propulsion of a fish-like system in the wake of an obstacle. The method is extended to three-dimensional problems, and the various components of the solver are highlighted. The core routines of the three-dimensional tool make use of the Parallel Particle-Mesh library, developed by Koumoutsakos and co-workers (J. Comput. Phys., 215, 2006). The new method is demonstrated with preliminary results of a simple model for a dolphin tail with flexible flukes.

[1]Supported by the NSF.

Jeff Eldredge
UCLA Mechanical & Aerospace Engineering

Date submitted: 02 Aug 2008 Electronic form version 1.4