Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

An immersed boundary method for two-phase fluids and gels and the swimming of Caenorhabditis elegans through viscoelastic fluids[1] PILHWA LEE, University of Michigan, CHARLES WOLGEMUTH, University of Arizona — While swimming in Newtonian fluids has been examined extensively, only recently have investigations into microorganism swimming through non-Newtonian fluids and gels been explored. The equations that govern these more complex media are often nonlinear and require computational algorithms to study moderate to large amplitude motions of the swimmer. Here we develop an immersed boundary method for handling fluid-structure interactions in a general two-phase medium, where one phase is a Newtonian fluid and the other phase is viscoelastic. We use this algorithm to investigate the swimming of an undulating, filamentary swimmer in 2D. A novel aspect of our method is that it allows one to specify how forces produced by the swimmer are distributed between the two phases of the fluid. The algorithm is validated by comparison to theoretical predictions for small amplitude swimming in gels and viscoelastic fluids. We show how the swimming velocity depends on material parameters of the fluid and the interaction between the fluid and swimmer. In addition, we simulate the swimming of *Caenorhabditis elegans* in viscoelastic fluids and find good agreement between the swimming speeds and fluid flows in our simulations and previous experimental measurements.

[1]NIH R01 GM072004, NIH P50GM094503

Pilhwa Lee
University of Michigan

Date submitted: 06 Sep 2016 Electronic form version 1.4