Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

A Fluid-Structure Interaction Model for Artificial Tissue Heart Valves Using a Sharp Interface Fixed Grid Method SARAH VIGMOSTAD, BRIAN JEFFREY, SAIKRISHNA MARELLA, JIA LU, H.S. UDAYKUMAR, KRISHNAN B. CHANDRAN, The University of Iowa — A tissue heart valve can be described as a deformable hyperelastic structure surrounded by a viscous fluid. The modeling of this complex system requires a fluid-structure interaction approach. A sharp interface, fixed Cartesian grid method is presented which accurately computes the motion and stresses of both the valve and the surrounding fluid. The fluid-structure interaction model couples the fluid and leaflet motions and stresses. This model has been developed to incorporate the normal and shear stresses developed in the leaflet as jumps in the pressure and shear stresses of the surrounding fluid. Stresses in the leaflet result from deformation, where the motion of the leaflet takes into account its experimentally derived material properties. A finite element solver calculates the leaflet deformation and stresses based on the conditions of surrounding fluid. Validations of the fluid-structure interaction model have been performed, and this method is currently being extended to three dimensions.

Sarah Vigmostad
The University of Iowa

Date submitted: 10 Aug 2005 Electronic form version 1.4