Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

A 3D method for modeling the fluid-structure interaction of heart valves PATRICK ANDERSON, Eindhoven University of Technology, RAOUL VAN LOON, FRANS VAN DE VOSSE — The behaviour of heart valves, which should cause no resistance to the flow during systole (ejection), but need to sustain transvalvular pressure gradients during diastole, is not easily captured. Therefore, a new approach for computing the fluid-structure interaction (FSI) problems associated with flow past heart valves is developed. The primary motivation for the development of this model is to capture the large movements and deformations of the valve leaflet. Using a finite element method, an Eulerian and Lagrangian description were adopted for the constituent blood and valve, respectively, the former modeled by the instationary Navier-Stokes equation, the latter by an incompressible Neo-Hookean solid. Both domains are coupled at the boundary of the solid domain by means of a Lagrange multiplier and the resulting set of equations is fully coupled Since a closed valve separates a fluid domain into two subparts, velocity fields at either side of the valve can differ considerably. The proposed method is therefore able to compute the shear stresses along both sides of the valve.

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Date submitted: 10 Aug 2005 Electronic form version 1.4