Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A Parallel Monolithic Approach for Fluid-Structure Interaction in a Cerebral Aneurysm[1] MEHMET SAHIN, ALI EKEN, Istanbul Technical University — A parallel fully-coupled approach has been developed for the fluid-structure interaction problem in a cerebral artery with aneurysm. An Arbitrary Lagrangian-Eulerian formulation based on the side-centered unstructured finite volume method is employed for the governing incompressible Navier-Stokes equations and the classical Galerkin finite element formulation is used to discretize the constitutive law for the Saint Venant-Kirchhoff material in a Lagrangian frame for the solid domain. The time integration method for the structure domain is based on the energy conserving mid-point method while the second-order backward difference is used within the fluid domain. The resulting large-scale algebraic linear equations are solved using a one-level restricted additive Schwarz preconditioner with a block-incomplete factorization within each partitioned sub-domains. The parallel implementation of the present fully coupled unstructured fluid-structure solver is based on the PETSc library. The proposed numerical algorithm is initially validated for several classical benchmark problems and then applied to a more complicated problem involving unsteady pulsatile blood flow in a cerebral artery with aneurysm as a realistic fluid-structure interaction problem encountered in biomechanics.

[1]The authors acknowledge financial support from Turkish National Scientific and Technical Research Council through project number 112M107.

Mehmet Sahin
Istanbul Technical University

Date submitted: 24 Jul 2014 Electronic form version 1.4