Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

A Monolithic Algorithm for High Reynolds Number Fluid-Structure Interaction Simulations[1] ERIKA LIEBERKNECHT, JASON SHELDON, JONATHAN PITT, The Pennsylvania State University — Simulations of fluid-structure interaction problems with high Reynolds number flows are typically approached with partitioned algorithms that leverage the robustness of traditional finite volume method based CFD techniques for flows of this nature. However, such partitioned algorithms are subject to many sub-iterations per simulation time-step, which substantially increases the computational cost when a tightly coupled solution is desired. To address this issue, we present a finite element method based monolithic algorithm for fluid-structure interaction problems with high Reynolds number flow. The use of a monolithic algorithm will potentially reduce the computational cost during each time-step, but requires that all of the governing equations be simultaneously cast in a single Arbitrary Lagrangian-Eulerian (ALE) frame of reference and subjected to the same discretization strategy. The formulation for the fluid solution is stabilized by implementing a Streamline Upwind Galerkin (SUPG) method, and a projection method for equal order interpolation of all of the solution unknowns; numerical and programming details are discussed. Preliminary convergence studies and numerical investigations are presented, to demonstrate the algorithm's robustness and performance.

[1]The authors acknowledge support for this project from the Applied Research Laboratory Eric Walker Graduate Fellowship Program.

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Date submitted: 02 Aug 2013 Electronic form version 1.4