Texas Tech University. Applied Mathematics Seminar.

Splitting Methods In Multigrid Finite Element Incompressible Fluid-Structure Interaction Problems

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ABSTRACT. In the last decades a great attention has been paid to the study of Fluid-Structure Interaction (FSI) problems because of a large number of applications ranging from biology to civil engineering and aeroelasticity. In particular, the numerical solution of the equations of Fluid-Structure Interaction is of great interest because of the increasing demand from the medical community for scientifically rigorous and quantitative investigations of cardiovascular diseases. In this talk we will present the results of Fluid-Structure Interaction computations of an incompressible elastic solid object and a laminar incompressible viscous flow using the Finite Element Method (FEM). The mathematical problem consists of the Navier-Stokes equations in the Arbitrary-Lagrangian-Eulerian (ALE) form coupled with a non-linear incompressible structure model (Neo-Hookean). Since we are interested in solving FSI problem where the added mass effect is significative, the coupling between the structure and the fluid is enforced inside a monolithic framework which computes simultaneously for the fluid and the structure unknowns within a unique solver. This kind of problem can be tackled efficiently by domain decomposition techniques. Our strategy is to solve several small local subproblems over subdomain patches using Vanka-smoothing or Pressure-Schur-Complement-smoothing procedures within a multigrid algorithm.