
Yuqi Wu
**A Domain Decomposition Based ALE Framework for
Three-dimensional Fluid-structure Interaction with
Application in Blood Flow Computation**

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We introduce and study a parallel scalable domain decomposition method for the simulation of blood flows in three-dimensional compliant arteries, by using a fully coupled system of linear elasticity equation and incompressible Navier-Stokes equations in an arbitrary Lagrangian-Eulerian framework. The system is discretized with a fully-implicit finite element method on unstructured moving meshes and solved by a Newton-Krylov algorithm preconditioned with an overlapping additive Schwarz method. The investigation focuses on the accuracy and parallel scalability of the algorithm. Simulations based on the patient-specific pulmonary artery geometries are performed on a supercomputer with thousands of processors. Our algorithm is shown to be scalable with a large number of processors and for problems with millions of unknowns.