A parallel domain decomposition method for computational biomechanics

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We discuss a highly scalable parallel domain decomposition algorithm for the simulation of blood flows in compliant human arteries by solving a system of nonlinear partial differential equations consisting of an elasticity equation for the artery and an incompressible Navier-Stokes system for the blood flow. The system is discretized with a fully implicit finite element method on unstructured moving meshes in 3D and solved by a Newton-Krylov algorithm preconditioned with an overlapping Schwarz method. Several mathematical, bio-mechanical, and supercomputing issues will be discussed in detail, and some numerical experiments for the cerebral and pulmonary arteries will be presented. We will also report the parallel performance of the method on a supercomputer with a large number of processors.