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A parallel implicitly coupled fluid-structure interaction algorithm for blood flow in arteries.

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We develop a scalable parallel finite element solver for the simulation of blood flow in compliant arteries. The incompressible Navier-Stokes equations are solved for the fluid and coupled to a linear elastic model for the blood vessel walls. Our solver features an unstructured dynamic mesh capable of modeling complicated geometries, an arbitrary Lagrangian-Eulerian framework that allows for large displacements of the fluid domain, and fully implicit monolithic coupling between the fluid and structure equations. A scalable and robust parallel Newton-Krylov-Schwarz method is used to solve the resulting systems of coupled nonlinear equations.