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An Immersed Interface Method for Biomedical Fluid Structure Interaction EBRAHIM KOLAHDOUZ, University of North Carolina at Chapel Hill, BRENT CRAVEN, United States Food and Drug Administration, BOYCE GRIFFITH, University of North Carolina at Chapel Hill — The mechanical interaction of incompressible viscous flows with immersed bodies is ubiquitously found in medicine and biology. A fluid structure interaction (FSI) coupling strategy is presented within the framework of the immersed interface method that allows fluid and solid subproblems to be solved in a partitioned manner and coupled through interface conditions. The present FSI approach allows for general complex geometries with discrete surfaces while retaining sharp resolution of stresses at the fluid-solid interface. In the coupling of the fluid to the solid, the interfacial fluid stresses drive the solid motion, and a penalty method is used to ensure that the fluid satisfies the no-slip condition along the fluid-solid interface. This approach enables the use of unstructured finite element discretizations of the solid domain while making use of structured-grid solvers for the incompressible Navier-Stokes equations. The algorithm is systematically verified and validated through comparisons with numerical and experimental benchmarks of increasing complexity. Applications of this method to biomedical applications, including the dynamics of bileaflet mechanical heart valves and dynamics of deformable blood clots inside IVC filter will be presented.

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