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Fluid-structure Interaction Simulations of Deformable Soft Tissue[1] IMAN BORAZJANI, Mechanical and Aerospace Engineering Department, University at Buffalo SUNY — Soft tissue interacts with the surrounding fluid environment in many biological and biomedical applications. Simulating such an interaction is quite challenging due to the large non-linear deformations of tissue, flow pulsatility, transition to turbulence, and non-linear fluid-structure interaction. We have extended our previous three-dimensional fluid-structure interaction (FSI) framework for rigid bodies (Borazjani, Ge, and Sotiropoulos, Journal of Computational Physics, 2008) to deformable soft tissue by coupling our incompressible Navier-Stokes solver for fluids with a non-linear large deformation finite element method for soft tissue. We use Fung-type constitutive law for the soft tissue that can capture the stress-strain behavior of the tissue. The FSI solver adopts a strongly-coupled partitioned approach that is stabilized with under-relaxation and Aitken acceleration technique. We validate our solvers against the experimental data for tissue valves and elastic tubes. We show the capabilities of our solver by simulating the fluid-structure interaction of tissue valves implanted in the aortic positions and elastic collapsible tubes.

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