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Vascular growth and remodeling coupled with fluid simulation in patient specific geometry JIACHENG WU, SHAWN C. SHADDEN, University of California, Berkeley — In this talk, we propose a computational framework to couple vascular growth and remodeling (G&R) with fluid simulation in 3D patient specific geometry. Hyperelastic and anisotropic properties are considered for the vessel wall material. A constrained mixture model is used to represent multiple constituents in the vessel wall. The coupled simulation is divided into two time scales, the longer time scale for G&R and the shorter time scale for fluid dynamics simulation. G&R is simulated to determine the boundary of the fluid domain, the fluid simulation in turn generates wall shear stress and transmural pressure data that regulates G&R. To minimize required computation cost, fluid is only simulated when G&R causes significant vascular geometric change. This coupled model can be used to study the influence of the stress-mediated law parameters on the stability of the vascular tissue growth, and predict progression of vascular diseases such as aneurysm expansion.

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