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A Fictitious Domain Method for Resolving the Interaction of Blood Flow with Clot Growth[1] DEBANJAN MUKHERJEE, SHAWN SHADDEN, University of California - Berkeley — Thrombosis and thrombo-embolism cause a range of diseases including heart attack and stroke. Closer understanding of clot and blood flow mechanics provides valuable insights on the etiology, diagnosis, and treatment of thrombotic diseases. Such mechanics are complicated, however, by the discrete and multi-scale phenomena underlying thrombosis, and the complex interactions of unsteady, pulsatile hemodynamics with a clot of arbitrary shape and microstructure. We have developed a computational technique, based on a fictitious domain based finite element method, to study these interactions. The method can resolve arbitrary clot geometries, and dynamically couple fluid flow with static or growing clot boundaries. Macroscopic thrombus-hemodynamics interactions were investigated within idealized vessel geometries representative of the common carotid artery, with realistic unsteady flow profiles as inputs. The method was also employed successfully to resolve micro-scale interactions using a model driven by in-vivo morphology data. The results provide insights into the flow structures and hemodynamic loading around an arbitrarily grown clot at arterial length-scales, as well as flow and transport within the interstices of platelet aggregates composing the clot.

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