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A Computational Model for Thrombus Formation in Response to Cardiovascular Implantable Devices JOHN HORN, Lawrence Livermore National Laboratory, Texas A&M University, JASON ORTEGA, Lawrence Livermore National Laboratory, DUNCAN MAITLAND, Texas A&M University — Cardiovascular implantable devices elicit complex physiological responses within blood. Notably, alterations in blood flow dynamics and interactions between blood proteins and biomaterial surface chemistry may lead to the formation of thrombus. For some devices, such as stents and heart valves, this is an adverse outcome. For other devices, such as embolic aneurysm treatments, efficient blood clot formation is desired. Thus a method to study how biomedical devices induce thrombosis is paramount to device development and optimization. A multiscale, multiphysics computational model is developed to predict thrombus formation within the vasculature. The model consists of a set of convection-diffusion-reaction partial differential equations for blood protein constituents involved in the progression of the clotting cascades. This model is used to study thrombus production from endovascular devices with the goal of optimizing the device design to generate the desired clotting response. This work was performed in part under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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