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A Computational and Mathematical Model for Device Induced Thrombosis WEI-TAO WU, Carnegie Mellon University, NADINE AUBRY, Northeastern University, MEHRDAD MASSOUDI, National Energy Technology Laboratory, JAMES ANTAKI, Carnegie Mellon University — Based on the Sorenson's model of thrombus formation[1, 2], a new mathematical model describing the process of thrombus growth is developed. In this model the blood is treated as a Newtonian fluid, and the transport and reactions of the chemical and biological species are modeled using CRD (convection-reaction-diffusion) equations. A computational fluid dynamic (CFD) solver for the mathematical model is developed using the libraries of OpenFOAM. Applying the CFD solver, several representative benchmark problems are studied: rapid thrombus growth in vivo by injecting Adenosine diphosphate (ADP) using iontophoretic method and thrombus growth in rectangular microchannel with a crevice which usually appears as a joint between components of devices and often becomes nidus of thrombosis. Very good agreements between the numerical and the experimental results validate the model and indicate its potential to study a host of complex and practical problems in the future, such as thrombosis in blood pumps and artificial lungs. 1. Sorensen, E.N., et al., Computational simulation of platelet deposition and activation: I. Model development and properties. Ann Biomed Eng, 1999. 27(4): p. 436-48. 2. Sorensen, E.N., et al., Computational simulation of platelet deposition and activation: II. Results for Poiseuille flow over collagen. Ann Biomed Eng, 1999. 27(4): p. 449-58.

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