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Three-dimentional simulation of flow-induced platelet activation in artificial heart valves MOHAMMADALI HEDAYAT, HAFEZ ASGHARZADEH, IMAN BORAZJANI, University at Buffalo SUNY — Since the advent of heart valve, several valve types such as mechanical and bio-prosthetic valves have been designed. Mechanical Heart Valves (MHV) are durable but suffer from thromboembolic complications that caused by shear-induced platelet activation near the valve region. Bio-prosthetic Heart Valves (BHV) are known for better hemodynamics. However, they usually have a short average life time. Realistic simulations of heart valves in combination with platelet activation models can lead to a better understanding of the potential risk of thrombus formation in such devices. In this study, an Eulerian approach is developed to calculate the platelet activation in three-dimensional simulations of flow through MHV and BHV using a parallel overset-curvilinear immersed boundary technique. A curvilinear body-fitted grid is used for the flow simulation through the anatomic aorta, while the sharp-interface immersed boundary method is used for simulation of the Left Ventricle (LV) with prescribed motion. In addition, dynamics of valves were calculated numerically using under-relaxed strong-coupling algorithm. Finally, the platelet activation results for BMV and MHV are compared with each other.

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