Abstract Submitted
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Evaluation Of Hemolysis Models Using A High Fidelity Blood Model[1] HUSSEIN EZZELDIN, The George Washington University, MARCO DE TULLIO, Politecnico di Bari, Italy, SANTIAGO SOLARES, University of Maryland, ELIAS BALARAS, The George Washington University — Red blood cell (RBC) hemolysis is a critical concern in the design of heart assisted devices, such as prosthetic heart valves (PHVs). To date a few analytical and numerical models have been proposed to relate either hydrodynamic stresses or RBC strains, resulting from the external hydrodynamic loading, to the expected degree of hemolysis as a function of time. Such models are based on either "lumped" descriptions of fluid stresses or an abstract analytical-numerical representation of the RBC relying on simple geometrical assumptions. We introduce two new approaches based on an existing coarse grained (CG) RBC structural model, which is utilized to explore the physics underlying each hemolysis model whereby applying a set of devised computational experiments. Then, all the models are subjected to pathlines calculated for a realistic PHVs to predict the level of RBC trauma. Our results highlight the strengths and weaknesses of each approach and identify the key gaps that should be addressed in the development of new models. Finally, a two-layer CG model, coupling the spectrin network and the lipid bilayer, which provides invaluable information pertaining to RBC local strains and hence hemolysis.

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