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On a turbulent wall model to predict hemolysis numerically in medical devices. SEUNGHUN LEE, MINWOOK CHANG, SEONGWON KANG[1], NAHMKEON HUR, WONJUNG KIM, Sogang Univ — Analyzing degradation of red blood cells is very important for medical devices with blood flows. The blood shear stress has been recognized as the most dominant factor for hemolysis in medical devices. Compared to laminar flows, turbulent flows have higher shear stress values in the regions near the wall. In case of predicting hemolysis numerically, this phenomenon can require a very fine mesh and large computational resources. In order to resolve this issue, the purpose of this study is to develop a turbulent wall model to predict the hemolysis more efficiently. In order to decrease the numerical error of hemolysis prediction in a coarse grid resolution, we divided the computational domain into two regions and applied different approaches to each region. In the near-wall region with a steep velocity gradient, an analytic approach using modeled velocity profile is applied to reduce a numerical error to allow a coarse grid resolution. We adopt the Van Driest law as a model for the mean velocity profile. In a region far from the wall, a regular numerical discretization is applied. The proposed turbulent wall model is evaluated for a few turbulent flows inside a cannula and centrifugal pumps. The results present that the proposed turbulent wall model for hemolysis improves the computational efficiency significantly for engineering applications.

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