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Characterization of Blood Flow in Capillaries by Numerical Simulation TONG WANG, Department of Mathematics, Nanjing University of Aeronautics and Astronautics, Nanjing, Jiangsu, 210016, China, ZHONGWEN XING, Department of Materials Science and Engineering, Nanjing University, Nanjing, Jiangsu, 210093, China — We presents a numerical investigation of the axisymmetric, pressure driven motion of single file erythrocyte (i.e., red blood cell) suspensions flowing in capillaries of diameter 8-11μm. The governing Navier-Stokes equations are discretized using the operator splitting technique and solved by the finite element method. The study takes consideration the particulate nature of the blood. The red blood cell (RBC) is modeled as a closed membrane filled with a Newtonian fluid which has the same viscosity as the surrounding plasma. The cell membrane is described by a spring model so that the deformability of the cells can be considered. An immersed boundary method is also developed for dealing with the cell/fluid interaction in the flow. Our study successfully recreates several important in vivo hemodynamic and hemorheological properties of microscopic blood flow, such as parachute shape of the cells, blunt velocity profile, and the Fahraeus effect, and they have been shown to have strong dependence on cell deformability, hematocrit and vessel size.

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