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Analysis of Red Blood Cell Behavior in a Narrow Tube HARUKI HOSAKA, TOSHIHIRO OMORI, YOHSUKE IMAI, TAKAMI YAMAGUCHI, TAKUJI ISHIKAWA, Tohoku University — Red Blood Cell (RBC) is a main component of blood accounting for 40 percent in volume, and enclosed by a twodimensional hyper elastic membrane. RBCs strongly influence rheological properties and mass transport of blood. The deformation of RBCs in capillary and at narrowing is also important in considering mechano-transduction of RBCs and hemolysis, though it has not been clarified in detail. Thus, in this study, we investigated the behavior of a RBC flowing in a narrow tube. To carry out the fluid-structure interaction analysis, we coupled a boundary element method to analyze the velocity of the internal and external fluid with a finite element method to analyze the deformation of the membrane. The boundary element method has good calculation accuracy and its computational cost is low because three-dimensional flow filed can be calculated by a two-dimensional computational mesh. The background flow in a tube is pressure-driven Poiseuille flow. Additionally, to reduce the computational time, we implemented massive parallel computation by using GPUs. The results show that the deformation of a RBC is strongly affected by the Capillary number, which is the ratio of viscous force to the elastic force, radius of the tube, and the initial orientation.

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