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Direct Numerical Simulation of Red Blood Cell Flow and Aggregation

Cyrus K. Aidun, E-Jiang Ding

Georgia Institute of Technology, Atlanta, USA

The rheology of blood and its transport have physiological significance in blood circulation. The aggregation of red blood cells (RBC) plays a significant role in the rheology and flow characteristics of blood. Furthermore, RBC aggregation has clinical significance as it is used diagnostically to evaluate blood plasma concentration of certain macromolecules such as immunoglobulin and fibrogen (Fung, 1997). The aggregation of RBC is being studied using direct numerical simulation based on the lattice-Boltzmann (LB) computational approach (Aidun et al., 1998, Ding and Aidun 2003). Results show that it is possible to develop “universal” scales that can be used to predict aggregation size distribution. Because of the high concentration of the RBC and the deformability of the membrane, a number of modifications are made to the LB method. Most significant is the capability to impose cell-cell and cell-wall interaction forces at the link-to-link level. The computational approach and the scale for aggregation distribution function will be presented.

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