Simulation of Blood Flow with Lattice Boltzmann Method

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Abstract

Understanding blood flow is essential in diagnosing and treating health problems related to blood flow, such as formation of stenosis and blood vessel blockages. Blood contains Red (RBC) and white (WBC) cells beside other constitute floats in plasma and flows in deformable vessels, which is not easy to model and simulate. In general, the flow is unsteady and three dimensional with non-Newtonian behavior. In the literature either blood assumed homogenous fluid with Non-Newtonian flow in small vessels or Newtonian in large vessels behavior. Also, a few authors considered blood non-homogenous with RBC floating in the plasma. However, the blood viscosity is function of hematocrit. Many computational techniques were used to simulate blood flow, such as finite element and finite volume methods. Since, early 90s lattice Boltzmann model (LBM) emerged as an alternative method for simulation of fluid flow and heat and mass transfer. The method has many advantages compared with conventional methods. In this paper simulations of blood flow were reviewed. Detail of using LBM in simulation of blood flow lay out with examples. Also, results of simulations will be presented and discussed.