

Simulation of Red Blood Cells in Complex Micro-Tubes

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Abstract : In biofluid flow systems, often the flow problems of fluids of complex structures, such as the flow of red blood cells (RBCs) through complex capillary vessels, need to be considered. In this paper, we aim to apply a particle-based method, Smoothed Dissipative Particle Dynamics (SDPD), to simulate the motion and deformation of RBCs in complex micro-tubes. We first present the theoretical models, including SDPD model, RBC-fluid interaction model, RBC deformation model, RBC aggregation model, and boundary treatment model. After that, we show the verification and validation of these models, by comparing our numerical results with the theoretical, experimental and previously-published numerical results. Finally, we provide some simulation cases, such as the motion and deformation of RBCs in rectangular, cylinder, curved, bifurcated, and constricted micro-tubes, respectively.

Keywords : aggregation, deformation, red blood cell, smoothed dissipative particle dynamics

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