A combined DEM-CFD approach to the simulation of blood flow

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Abstract

Blood is a typical non-Newtonian fluid that consists of a Newtonian plasma fluid and a discrete particulate phase in which red blood cells are the main component. A fully coupled Lagrangian-Eulerian code previously applied to simulations of gas-fluidised beds has been adapted to simulate blood flow in microchannels. In this preliminary study, the red blood cells are modelled as elastic spheres with or without adhesion. The results presented focus on the fluid velocity profile and show that with adhesive particles the power law index varies significantly with the average fluid velocity specified. With non-adhesive particles the power law index is relatively insensitive to the flow rate. Visualisations show that particles cluster/agglomerate during flow and that there is a possible correlation between the power law index and the size of the largest cluster.