Tracking red blood cells in micro-circulation experiments.

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Abstract

Blood is a specialized fluid that transports nutrients, chemical signals, metabolic waste and heat around the body. Whole blood is composed of blood cells suspended in a liquid called the plasma. The blood cells are mainly red blood cells (also called RBCs or erythrocytes) and white blood cells, including leukocytes and platelets. The most abundant of these are the RBCs, which contain hemoglobin that facilitates transportation of oxygen.

RBCs are linked to many diseases such an sickle cell anemia and malaria infection. RBCs are known to be important in transport mechanisms, for example platelet migration to the vessel lumen in the case of thrombus formation or mechanisms for cancer metastasis. Studying RBCs behaviour in blood vessels can tell us much about the normal state of these cells and the diseased states. Furthermore, modelling issues related to rheology can be addressed. One of the physical measures that can be readily monitored is the deformability of the cells.

This study aims to analyse RBC deformation in experimental conduits using image-based techniques. Images are acquired from a micro-channel with a contraction, where the cells experience extensionally-dominated flow near the center-line. RBCs are tracked throughout a digital video sequence and analysed in terms of shape and deformation index at different time frames. Results show that under strong extensional flows, RBC present an extremely deformable behaviour. RBC tracking and image processing techniques are developed and discussed.

Keywords: RBC tracking, image processing, micro-PIV.

References

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