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Modelling and numerical simulation of blood flow, non-homogeneous tube flow

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Abstract

Realistic simulations of blood flow in smaller vessels (such as arterioles) require that wall effects be adequately taken into account in the constitutive modelling. As in arterial flow, red cell aggregates typically vary in size depending upon the local flow conditions. However, in smaller tubes the number density of erythrocytes can no longer be considered constant. Furthermore, the cells typically migrate away from vessel walls leaving a cell-depleted region there. Our results for non-homogeneous tube flows will demonstrate the decrease in the apparent viscosity of blood and the dynamic (tube) hematocrit that are observed when the tube radius is reduced: respectively, the Fahraeus-Lindqvist (1931) and Fahraeus (1929) effects. Comparisons are made with results from the experimental literature and demonstrate that our predictions are in close conformity with the available data.