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A Discrete-Element Approach for Blood Cell Adhesion JENNIFER CHESNUTT, The University of Iowa, JEFFREY MARSHALL, University of Vermont — An efficient computational model for simulation of the individual dynamics of adhering blood cells is discussed. Each cell is represented as a discrete particle so that the model can extend existing discrete-element approaches for dense particulate fluid flows to account for receptor-ligand binding of particles, elliptical particle shape, and deformation of the particles due to shear forces. Capabilities of the method in simulating large numbers of particles are illustrated through simulations of the formation of red blood cell rouleaux in shear flow. The effects of several factors, such as aspect ratio of the elliptical particle, shear rate, strength of the cell adhesion force, and hematocrit are investigated. Comparison of the discrete-element results with results of a level-set approach which computes the entire flow field about a small number of cells is used to develop an improved model of the effect of nearby red blood cells on the cell drag force expression. The method is also being applied to examine the influence of red blood cells on other components of the blood, such as platelet dispersion and activation in high shear regions.

Jennifer Chesnutt
The University of Iowa

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