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Three-dimensional numerical simulation of cell deformation SAI DODDI, PROSENJIT BAGCHI, Mechanical and Aerospace Engineering, Rutgers University — Blood is a multiphase suspension of various deformable cells. The particulate nature of blood is absent in large blood vessels making a numerical/theoretical analysis somewhat easier. The analysis is also simplified for the flow through small capillaries, where blood cells flow in an ordered, 'single-file' fashion. The main difficulty arises for the vessels of ∼10–500 micron diameter, where the cells move in a 'multi-file' fashion. The Casson fluid model, used to describe blood flow in such vessels, often fails to elucidate many microrheological events. In order to perform accurate and detailed numerical simulations of blood flow at microscales, we are developing 3D simulation techniques for multiple deformable cells using immersed boundary method. In this method, the cells are modeled as capsules, that is, liquid drops surrounded by elastic membranes. The model allows us to include various constitutive laws for the cell membrane, as well as the rheological properties of the liquid inside the cell. It also allows inclusion of the cell nucleus, as in case of a white blood cell or a neonatal red blood cell. In this talk we will describe the numerical techniques, and then explore the deformation dynamics of a nucleated/non-nucleated cell in a shear flow.

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