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Three-dimensional simulation of red blood cells in microcirculation HONG ZHAO, JONATHAN FREUND, University of Illinois — The hydrodynamic interactions between blood cells are critical for understanding the hemodynamics in microcirculations. We perform a three-dimensional simulation based on the Stokes-flow boundary integral equations to study such systems. The red blood cells are modeled as three-dimensional elastic shells, being highly resistant to any surface dilatation but compliant to bending. The cell shape is approximated by truncated series of spherical harmonics; this spectral representation results in high numerical accuracy and rigorous dealiasing without adding any numerical dissipation. The moving velocities of cell surfaces are solved from a boundary integral equation. The periodic Stokes-flow Green's function is decomposed into a short-range point-to-point-interaction part and a long-range smooth Fourier part; the computational cost is made $O(N \log N)$ by using a P^3M method. The no-slip boundary condition on the vessel wall is imposed by a penalty method, which enables simulating complex geometries with simple periodic Green's functions. Preliminary results include the deformation of a single cell in a shear flow and multiple cells through a blood vessel.

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