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Direct Numerical Simulations of Whole Blood[1] ROBERT MACMECCAN, JONATHAN CLAUSEN, PAUL NEITZEL, CYRUS AIDUN, Georgia Institute of Technology — Hundreds of three-dimensional, deformable red blood cells and platelets are simulated at physiologic hematocrit using the recently developed lattice-Boltzmann–finite-element method. This method provides the efficiency and versatility to simulate large suspensions while accurately modeling biconcave red blood cells as elastic membranes with bending stiffness and an internal solution of hemoglobin. Bulk rheology of whole blood at continuum-level scales is quantitatively described with effective viscosity and shear-thinning behavior. Suspension microstructure and red-blood-cell deformation compares well with experimental measures. The local stress environment that platelets experience in whole blood is described as it pertains to shear-mediated platelet adhesion with 25% of platelets experiencing a surface shear stress greater than twice the effective suspension stress.

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