Abstract Submitted
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Nanoparticle motion near a blood vessel wall in targeted drug delivery[1] HELENA VITOSHKIN, HSIU-YU YU, DAVID M. ECKMANN, RAVI RADHAKRISHNAN, PORTONOVO S. AYYASWAMY, Univ of Pennsylvania — A computational study of the motion of a spherical nanoparticle close to the bounding wall of a blood vessel in targeted drug delivery is presented. An arbitrary Lagrangian-Eulerian algorithm has been carried out, taking into account both the Brownian and the hydrodynamic effects. Pertinent to targeted drug delivery, we focus on the condition when the particle is in the lubrication layer. The velocity auto-correlation function (VACF) is seen to initially decay faster by a factor of particle radius divided by the fluid gap thickness compared to that in an unbounded medium. Long time decay is found to be algebraic. Focusing on hydrodynamic interaction between the particle and the wall, effects of wall curvature, particle size, and variations in density of the particle are investigated. We also study adhesive interactions of a nanoparticle with an endothelial cell located on the vessel wall by the modeling the nanoparticle tethered by a harmonic spring with varying spring constants. It is shown that the particle velocity is affected by hydrodynamic and harmonic spring forces leading to VACF oscillations which decay algebraically at long times. The results agree with those predicted by earlier theories for particle VACF near a wall. These findings have applications in medication administration and in the colloidal sciences.

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