Abstract Submitted
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The Brownian dynamics of a lipid vesicle HONG ZHAO, ERIC SHAQFEH, Stanford University — We propose a Brownian dynamics simulation method to study the motion of a lipid vesicle in a suspending fluid. The lipid bilayer of the vesicle is modeled as a two-dimensional fluidic membrane with bending resistance and a high local area dilatational modulus. Using a Stokes flow boundary integral equation method, we calculate the grand mobility tensor of the deformable membrane at arbitrary viscosity ratio between the fluid inside and outside the vesicle. The fluctuation–dissipation theorem, as well as the drifting due to the configuration dependence of the diffusivity tensor, are rigorously accounted for. The flow transitions (tank-treading, tumbling and trembling) and the particle stresslet for an athermal vesicle in a simple shear flow calculated by the present method are in good agreement with existing results by a spectral boundary integral equation method. We demonstrate that the effect of Brownian motion is most significant for a tumbling vesicle. The thermal fluctuation tilts the vesicle off the shear plane, and the disruption of the originally two-dimensional tumbling orbit results in a qualitatively different three-dimensional "wobbling" motion. The change to the suspension rheology due to the altered dynamics is discussed.

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