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Transport of nonaparticles flowing past a patterned substrate[1]
RUI ZHANG, JOEL KOPLIK, City College of CUNY — We consider the defection of suspended particle trajectories due to flow past a patterned surface using complimentary Langevin numerical simulations and theoretical analyses based on the Fokker-Planck equation. The intended application is to vector particle separation in a nanofluidic channel. The simulations of flow past an alternating periodic striped pattern of attractive and repelling regions generally show that particles are deflected away from the imposed flow direction, to a degree that depends on the particle's size and the details of the substrate interaction. Both van der Waals and Coulomb interactions are studied, and in the latter case we explore the effects of the spatial distribution of bounding surface charge. Theoretically, both exactly in two dimensions and within the Fick-Jacobs approximation in three, we show that the effect of a periodic potential on the particle motion is always to impede the mean transport velocity in the orthogonal direction and deflect the trajectory, or equivalently reduce the effective diffusivity. Upper and lower bounds are found for the deflection angle, and explicit estimates are obtained in the limit of a weakly varying interaction.

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