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Lipid Bilayer Vesicle Dynamics in DC Electric Fields LANE MCCONNELL, Northwestern University, PETIA VLAHOVSKA, Brown University, MICHAEL MIKSIS, Northwestern University — Vesicles, which are closed lipid bilayers, provide a valuable model to study the dynamics of the biomembranes that surround cells. Recent small deformation analysis of vesicles exposed to a DC electric field has revealed several interesting phenomena, including transitions from oblate to prolate ellipsoidal shapes and damped tumbling in the case of combined electric field and shear flow. Here we investigate the behavior and stability of a vesicle in a uniform DC electric field numerically using the boundary integral method. The vesicle membrane is modeled as an infinitely thin, capacitive, area-incompressible interface, with the surrounding fluids presumed to act as leaky dielectrics. Vesicle dynamics are determined by balancing the hydrodynamic, bending, tension, and electric stresses on the membrane. Our investigation compares the full nonlinear numerical results to the small deformation theory and to recent experimental data, and presents a thorough analysis of the relevant parameter space.

Lane McConnell
Northwestern University

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