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Evolution of viscous conducting drops subject to rotation and electric fields

Many industrial applications such as electrospinning and electrospraying depend fundamentally on the behavoir of fluid droplets subject to electric fields. In this talk we will present a Boundary Element Method implemented to study the evolution of a conducting drop rotating about a fixed axis with constant angular momentum and under the influence of an external electric field parallel to its axis of rotation. When the drop is uncharged, oblate and prolate spheroidal equilibrium solutions are obtained in accordance with theoretical works by Sozou and Rosenkilde. For charged rotating drops in the absence of electric fields, we develop a theoretical framework to approximate equilibrium solutions and compare these solutions with numerical experiments. Our results point to a rupture of the bifurcation point attained by non-rotating charged drops. Concerning stability, numerical evidence shows the existence of non-axisymmetric ellipsoidal figures of equilibrium and the formation of Taylor cone-like singularities for sufficiently large values of the charge.