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BREAK-UP AND COALESCENSE OF ELECTRIFIED DROPLETS USING AN EMBEDED POTENTIAL FLOW MODEL

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The evolution of a perfectly conducting and non-viscous fluid under the action of electric forces is studied numerically. The classical Eulerian-Lagrangian potential flow model can be formulated in a complete Eulerian framework using the Level set techniques, [1]. By doing so, the front position and velocity potential can be evolved in a fixed domain approximating the corresponding hyperbolic equations using first order upwind schemes. The free surface velocity and the electric field force are obtained via axi-symmetric boundary integral calculations, [2]. The main advantage of the embeded potential flow model presented here is that topological changes of the free boundary are automatically included in the formulation. The inclusion of the free boundary curve and free boundary variables in a higher dimension leads to a regularization of singular events, and passing through singular times is computationally possible. Numerical results for the case of an infinite fluid thread subjected to a radial electric field, before and after pinching, are presented. Self similar scaling laws as well as drop size and charge distribution are analized. The case of coalescence of oppositely charged droplets in the presence or absence of an exterior uniform electric field is also addressed.

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