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NUMERICAL SIMULATIONS FOR A LEAKY DIELECTRIC DROP UNDER DC ELECTRIC FIELD IN NAVIER-STOKES FLOW

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In this talk, we introduce a hybrid immersed boundary (IB) and immersed interface method (IIM) to simulate the dynamics of a drop under an electric field in Navier-Stokes flows. Within the leaky dielectric framework with piecewise constant electric properties in each fluid, the electric stress can be treated as an interfacial force on the drop interface. Thus, both the electric and capillary forces can be formulated in a unified immersed boundary framework. The electric potential satisfies a Laplace equation which is solved numerically by an augmented immersed interface method which incorporates the jump conditions naturally along the normal direction. The incompressible Navier-Stokes equations for the fluids are solved using a projection method on a staggered MAC grid and the potential is solved at the cell center. The interface is tracked in a Lagrangian manner with mesh control by adding an artificial tangential velocity to transport the Lagrangian markers to ensure that the spacing between markers is uniform throughout the computations. A series of numerical tests for the present scheme have been conducted to illustrate the accuracy and applicability of the method.