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Numerical study on the onset of electro-convection between planar electrodes caused by unipolar charge injection¹ DOLFRED VIJAY FERNANDES, SURESH ALAPATI, YONG KWEON SUH, Dong-A University — Two-dimensional electrohydrodynamic (EHD) convection in a dielectric liquid between a pair of planar electrodes has been studied numerically considering autonomous unipolar charge injection from the bottom electrode. The steep gradient in the charge-density distribution and its time evolution can be resolved successfully using upwind schemes for the convective terms in the charge conservation equation. The Navier-Stokes equations coupled with the charge conservation equation and the Poisson equation for the potential are solved using the SIMPLE algorithm. We also apply a perturbation method to study the linear stability problem to derive more accurate critical parameter values for the onset of electro-convection. In particular, we are interested in the effect of injection strength and the horizontal length of the domain on the stability characteristics. Our two-dimensional numerical solutions are compared with the linear stability analysis for the validation of the code.

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