Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Numerical Study of Electrolytic Flow Instabilities Driven by an Azimuthal Lorentz Force in a Cylindrical Geometry[1] JAMES PÉREZ-BARRERA, JOSÉ ENRIQUE PÉREZ-ESPINOZA, ALEJANDRO ORTÍZ, SERGIO CUEVAS, EDUARDO RAMOS, Universidad Nacional Autónoma de México — We present numerical simulations of the flow produced by an azimuthal Lorentz force in an electromagnetic stirrer. The stirrer consists of a cylindrical cavity with two copper concentric cylindrical electrodes, filled with an electrolytic solution. Underneath the cavity, a permanent magnet creates an almost uniform magnetic field, perpendicular to the circular section of the stirrer. An electric potential difference between the electrodes produces a radial D.C. current that passes through the fluid and interacts with the axial magnetic field, generating an azimuthal Lorentz force that drives the fluid. Experiments have shown the appearance of a flow instability that gives rise to a varying number of anticyclonic vortices for given values of the current intensity and fluid layer thickness. The MHD governing equations are expressed in terms of the velocity, pressure and electric potential. Numerical simulations are carried out using a hybrid Finite volume-Fourier method to ensure periodicity in the azimuthal direction. Numerical results show the formation of different modes of perturbation in the velocity field, which give rise to a varying number of traveling vortical structures.

[1]Work supported by CONACYT, Mexico under Project 131399. JPB acknowledges a grant from CONACYT.

James Pérez-Barrera
Universidad Nacional Autónoma de México

Date submitted: 31 Jul 2014 Electronic form version 1.4