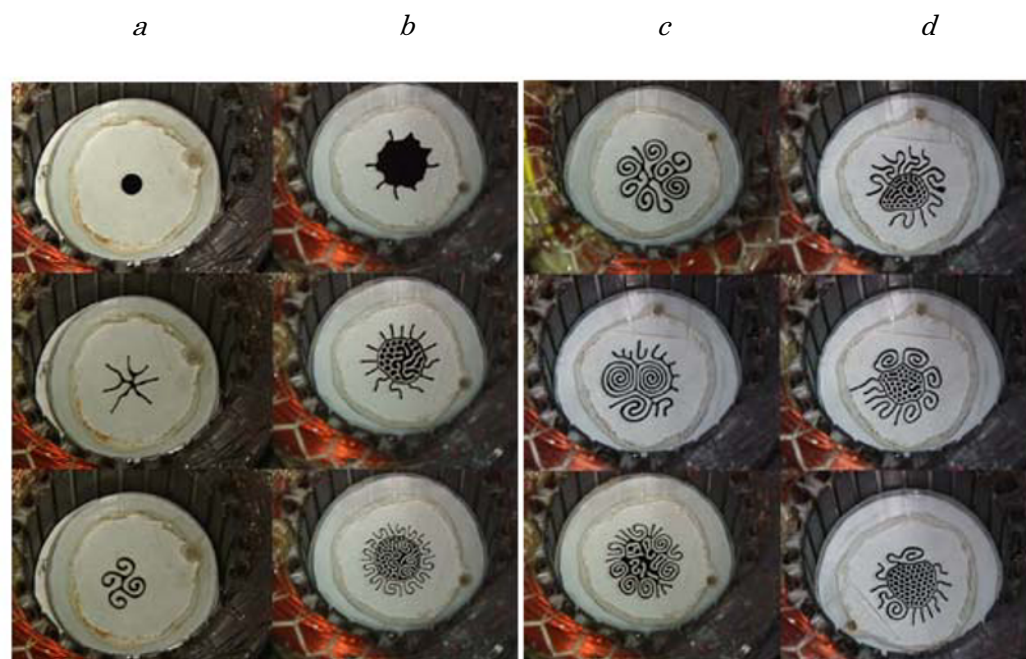


## Hele-Shaw Ferrohydrodynamics for Simultaneous In-plane Rotating and Vertical DC Magnetic Fields

*Lorenz, C.<sup>1)</sup>, Rinaldi, C.<sup>2)</sup> and Zahn, M.<sup>1)</sup>*

*1) Department of Electrical Engineering and Computer Science and Laboratory for Electromagnetic and Electronic Systems, Massachusetts Institute of Technology, Cambridge, MA, U.S.A.*

*2) Department of Chemical Engineering, University of Puerto Rico at Mayagüez, Mayagüez, PR, U.S.A.*



A ferrofluid drop in a glass Hele-Shaw cell of 1.1 mm gap has simultaneously applied in-plane clockwise rotating (20 Gauss rms at 25 Hertz) and vertical DC (0-250 Gauss) magnetic fields. The ferrofluid is surrounded by propanol to prevent glass smearing. a) The vertical DC field is first applied to form the labyrinth pattern and then the rotating field is applied to form a spiral pattern; b) The rotating field is applied first and then as the DC magnetic field is increased to about 100 Gauss, the continuous fluid drop abruptly transitions to discrete droplets; Various end-states of spirals, c) and droplets, d).