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Ferrofluid patterns in a radial magnetic field: Linear stability, nonlinear dynamics, and exact solutions JOSE MIRANDA, RAFAEL OLIVEIRA, Departamento de Fisica, Universidade Federal de Pernambuco, Brazil, EDUARDO LEANDRO, Departamento de Matematica, Universidade Federal de Pernambuco, Brazil — The response of a ferrofluid droplet to a radial magnetic field is investigated, when the droplet is confined in a Hele-Shaw cell. We study how the stability properties of the interface and the shape of the emerging patterns react to the action of the magnetic field. At early linear stages it is found that the radial field is destabilizing and determines the growth of fingering structures at the interface. In the weakly nonlinear regime we have verified that the magnetic field favors the formation of peaked patterned structures that tend to become sharper and sharper as the magnitude of the magnetic effects is increased. A more detailed account of the patterns' morphology is provided by the determination of nontrivial exact stationary solutions for the problem with finite surface tension. These solutions are obtained analytically and reveal the development of interesting polygon-shaped and starfish-like patterns. An interesting connection of this system with the Euler's elastica problem is discussed.

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