Width of a Ferrofluid Finger: Hysteresis and Multiple Energy Minima

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Dickinson College — The theoretical finger width dependence of a ferrofluid on the magnetic field in a Hele-Shaw geometry is investigated. A model of the finger enables the energy to be computed and then minimized to determine the finger width. Calculations predict a hysteresis effect as the applied magnetic field is varied. This results from the existence of two local energy minima for a range of magnetic bond numbers. Hence, for a given magnetic bond number, the stable ferrofluid configuration can be either a circle or a finger, depending on whether the applied field is increasing or decreasing. A comparison with experimental results will be presented.

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