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Magnetophoretic interaction of ferrofluid droplets in a rotating magnetic field MINGFENG QIU, Department of Mathematics, University of British Columbia, SHAHRIAR AFKHAMI, Department of Mathematical Sciences, New Jersey Institute of Technology, CHING-YAO CHEN, Department of Mechanical Engineering, National Chiao Tung University, JAMES FENG, Departments of Chemical Biological Engineering and Mathematics, University of British Columbia
— Recent experiments have discovered a mode of planetary motion of a pair of ferrofluid droplets in a rotating magnetic field. It consists of the self-spin of individual droplets and the global revolution of the pair with a phase lag from the rotating field. This talk describes a volume-of-fluid simulation that explores this phenomenon. By studying the magnetic and hydrodynamic interactions between the droplets, we determine the time scale of the planetary motion under different operating conditions. The numerical results are compared to predictions using a simple dipole interaction model and the experiments. Finally we simulate the motion of a multiple-droplet chain in a rotating field, and compare the results to experimental observations that the drops assemble into a regular and compact array that rotates with the field with a phase lag.

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