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Study on the lateral migration of a ferrofluid droplet in a plane Poiseuille flow under uniform magnetic fields MD. RIFAT HASSAN, CHENG WANG, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology — Droplet dispersion in another immiscible fluid is important in a variety of technological processes that involve liquid-liquid extraction where phase separation is crucial to the purification of the product. In this study, we investigate the lateral migration of a ferrofluid droplet in a plane Poiseuille flow under uniform magnetic fields by means of a numerical simulation, which uses a level set method to track the droplet interface between the two phases. Focusing on low droplet Reynolds number (i.e.,$Re_d \leq 0.05$), the results indicate that the magnetic field plays a pivotal role in the motion trajectory of the droplet and the final equilibrium position in the channel. When the magnetic field acts in a direction parallel to the flow direction (i.e., $\alpha = 0^\circ$), the droplet settles closer to the bottom wall with increasing magnetic field strength, while at $\alpha = 45^\circ$ the droplet settles closer to the center. Also, variation of initial droplet sizes results in different equilibrium positions along the channel. Furthermore, at $\alpha = 90^\circ$ the droplet finds its equilibrium position at the channel center irrespective of different magnetic field strengths and droplet sizes.

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