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**FIELD-INDUCED MOTION OF A FERROFLUID DROPLET
THROUGH IMMISCIBLE VISCOUS MEDIA**

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Ferrofluids consist of magnetic nanoparticles in a colloidal solution. Recent developments in the synthesis and characterization of ferrofluids are motivated by biomedical applications, where the treatment of retinal detachment is one example. A small amount of ferrofluid is injected into the vitreous cavity of the eye and guided by a permanent magnet inserted outside the scleral wall of the eye. The drop travels toward the side of the eye, until it can seal a retinal hole. The time taken for the drop to migrate is an important quantity which needs to be predicted, and which must be relatively short for the feasibility of this procedure. Here, the motion of a hydrophobic ferrofluid droplet placed in a viscous medium and driven by an externally applied magnetic field is investigated numerically in an axisymmetric geometry. Initially, the drop is spherical and placed at a distance away from the magnet. The governing equations are the Maxwell equations for a non-conducting flow, momentum equation and incompressibility. A numerical algorithm is derived to model the interface between a magnetized fluid and a non-magnetic fluid via a volume-of-fluid framework. The time taken by the droplet to travel through the medium and the deformations in the drop are investigated and compared with experimental studies.

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