# Magnetic Control of Deformation of a Ferrofluid Droplet in Simple Shear Flow

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## Abstract

This study investigates the effect of uniform magnetic field on the deformation of a ferrofluid droplet in a two dimensional (2D) simple shear flow by means of numerical simulation. The magnetic field is applied in a perpendicular direction to the flow direction. A numerical scheme called level set method in combination with laminar two phase flow under fluid flow module is used to solve the flow field both inside and outside of the droplet while level set method is required to track the dynamic motion of the droplet interface which is suspended in another immiscible medium. A constant shear rate is applied by imposing velocities of the same magnitude but in opposite directions on the top and bottom walls respectively. Magnetic field both inside and outside of the droplet is simulated using the AC/DC module and it is applied to the flow domain using the volume force feature under laminar flow module. We found that at a low shear rate with increasing magnetic field strength, the magnetic field plays a dominant role on the deformation of the droplet and also the droplet is found to orient itself more along the direction of magnetic field. On the other hand, at high shear rate the deformation and orientation of the droplet is determined predominantly by shear flow although the magnetic field has a considerable effect at higher strengths. It is also found that the flow field inside and outside of the droplet changes at different conditions.

## Figures used in the abstract

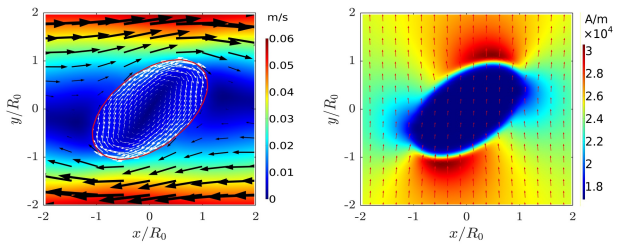


**Figure 1**: Velocity field and magnetic field inside and outside of a deformed ferrofluid droplet.