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Rheology of Poly Dispersed Particles under the Influence of Varying Magnetic Field and Applied Stress

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Extended Abstract

MRFs (Magneto rheological fluids) are special rheological fluids made of a base fluid and suspended magnetic particles that have smart features. When a magnetic field is applied, this fluid behaves like a non-Newtonian fluid; otherwise, it is a typical Newtonian fluid. The fluid flow is resisted by the powerful particle chains created by the magnetic field [1-3]. These fluids serve as intelligent fluids that regulate the motion of mechanical parts in a wide range of applications, including the automobile industry, dampers, clutches, prosthetic knees, aerospace brakes, and many more. Thus, it is crucial to comprehend the dynamics of particle chain creation, which provides information on yield stress, flow behavior, viscosity, strain rates upon yielding, etc [4-6].

This abstract provides an extended discrete element method (XDEM) based influence of varying magnetic field for poly dispersed nano-sized magnetic particles in a base fluid which is simulated using a modified version of foam extend. This foam extend version and XDEM are coupled for the analysis of MRFs having poly dispersed particles. Ferro magnetic particles of different magnetic properties and variations in size are dispersed freely initially, and then under the influence of magnetic field in single direction to multi-directions are explored. The effect of applied stress to the particle chain formation and analysis of yield stress is performed. The dynamics of chain formation in a stationary fluid and under the application of stress is analyzed. The computational time of each simulation case purely depends on the type of material properties and the base medium. The strain rates obtained for different applied stress are analyzed for linear and non-linear magnetic field. The presence of different size of particles enhances the yield stress specially when the additional dispersion are smaller than the base particle size.

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