Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Dynamics of a pair of elliptical microparticles under a uniform magnetic field JIE ZHANG, Dept of Mech and Aerospace Eng, Missouri Univ of Science and Technology, CHENG WANG, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, THE WANG RESEARCH GROUP TEAM — Under a uniform magnetic field, non-spherical magnetic particles dispersed in a viscous liquid medium show various rheological properties. However, the fundamental mechanism of the particle-particle interactions of non-spherical particles under the uniform magnetic field is still missing. In this work, we creates two-dimensional direct numerical simulations to investigate the particle-particle interactions and relative motions of a pair of paramagnetic elliptical particles. The direct numerical simulations are based on the finite element method, which used an arbitrary Lagrangian-Eulerian approach with a full consideration of particle-fluid-magnetic field interaction. We investigated the effects of initial position and aspect ratio of the particles on particle-particle interactions and relative motions. The results show that the particles spend much more time for the global reorientation than for the local magneto-orientation. It requires more time to form a stable chain for larger initial relative angles and distances, and larger aspect ratios. The results in this work provide insights on the particle alignment and chaining processes under uniform magnetic fields, which are closely related to the performance and behavior of magnetorheological fluids.

Jie Zhang
Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology

Date submitted: 02 Aug 2019 Electronic form version 1.4