Dynamic Simulation of Magneto Rheological Fluid

Thanikachalam J.[1] & Dr .P. Nagaraj[1]

1. Mepco Schlenk Engineering College, Sivakasi, Tamilnadu, India

Introduction: The present work deals with dynamic simulation of magnetic particles present in the carrier fluid when subjected to external magnetic field. Magneto rheological fluid comes under classification of smart materials, which contain pure CI iron particles, silicon oil as carrier fluid and additives. The yield stress of the magneto rheological fluid can be controlled by varying the external magnetic field.
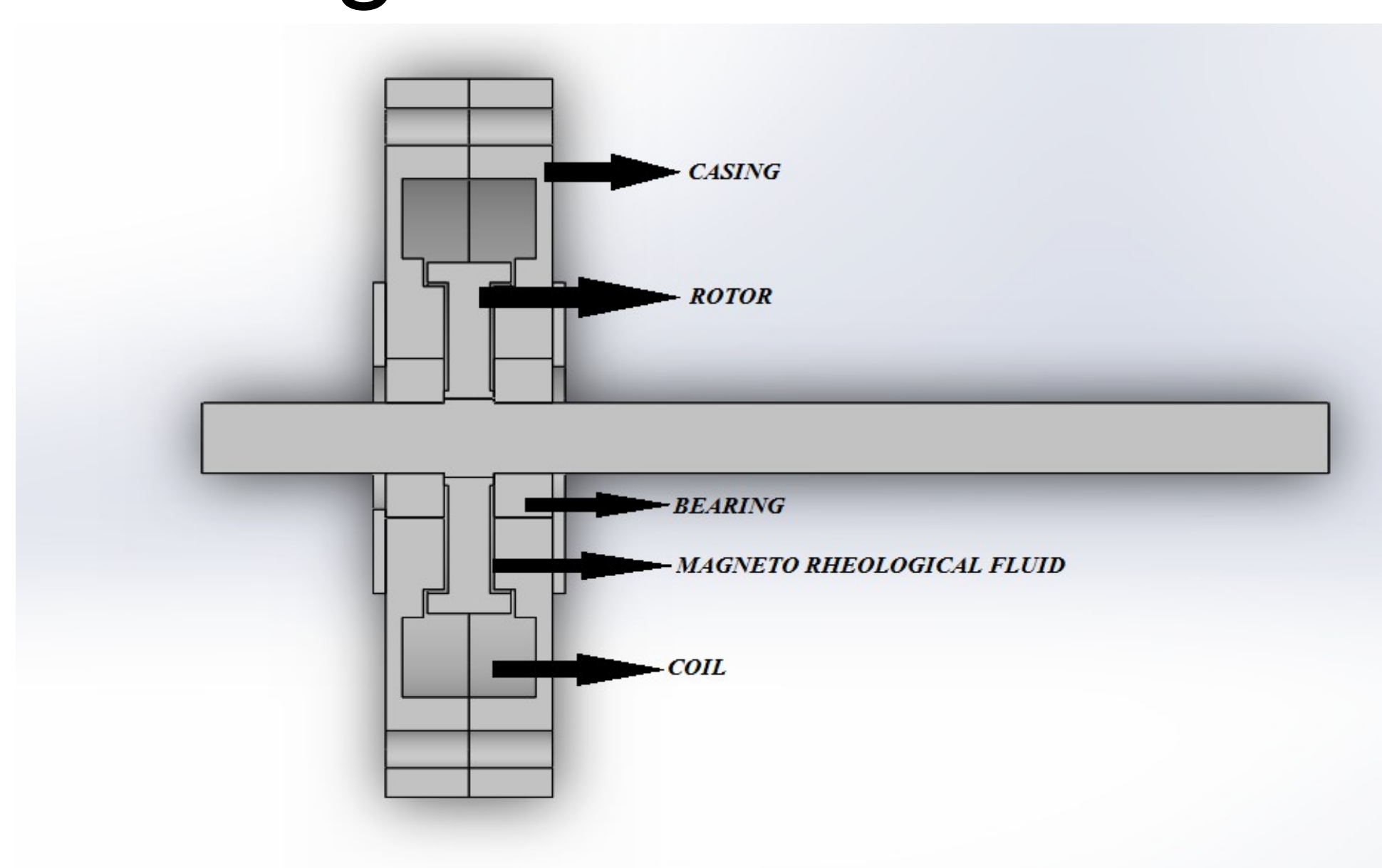

Figure 1. 3D model of MR BRake

Computational Methods: The calculation approach of interaction between carrier fluid and magnetic particles in a non-steady magnetic field, based on Stoke's and Maxwell's equation model was considered for this work. Concentration of solid particles varied by 10-50% of its weight in the carrier fluid.

The Interaction between the fluid particles are based on the particle size and shape. By applying and varying the magnetic filed the magnetic flux density was varied.
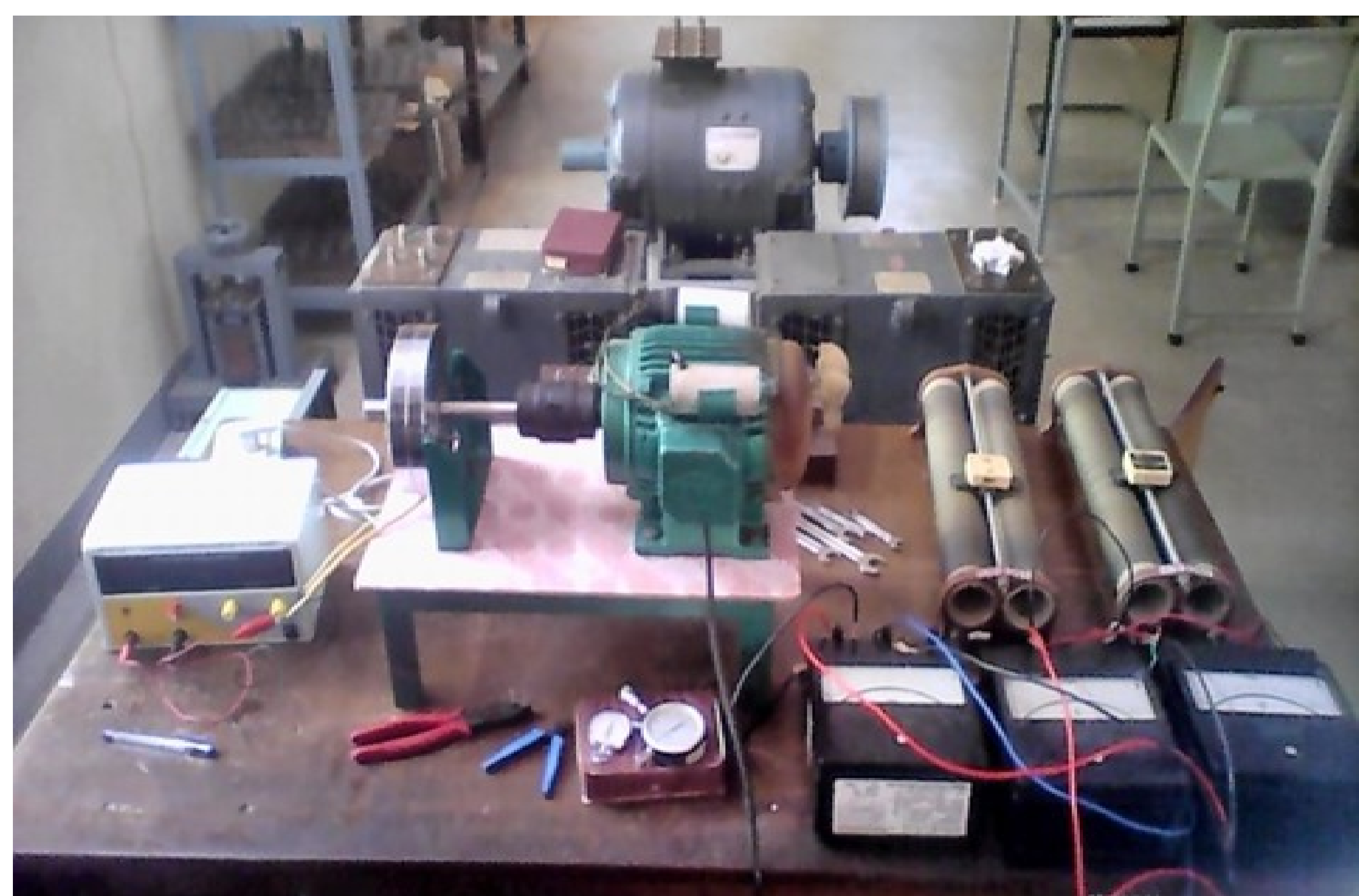

Figure 2. Magnetorheological Brake

Results: The characteristics of dynamic simulation of MR fluid was studied using COMSOL ®. In the COMSOL AC/DC module was used for the present analysis. The numerical result shows that formation of chain like structure for different concentration of solid particles (in milliseconds) present in the carrier fluid.
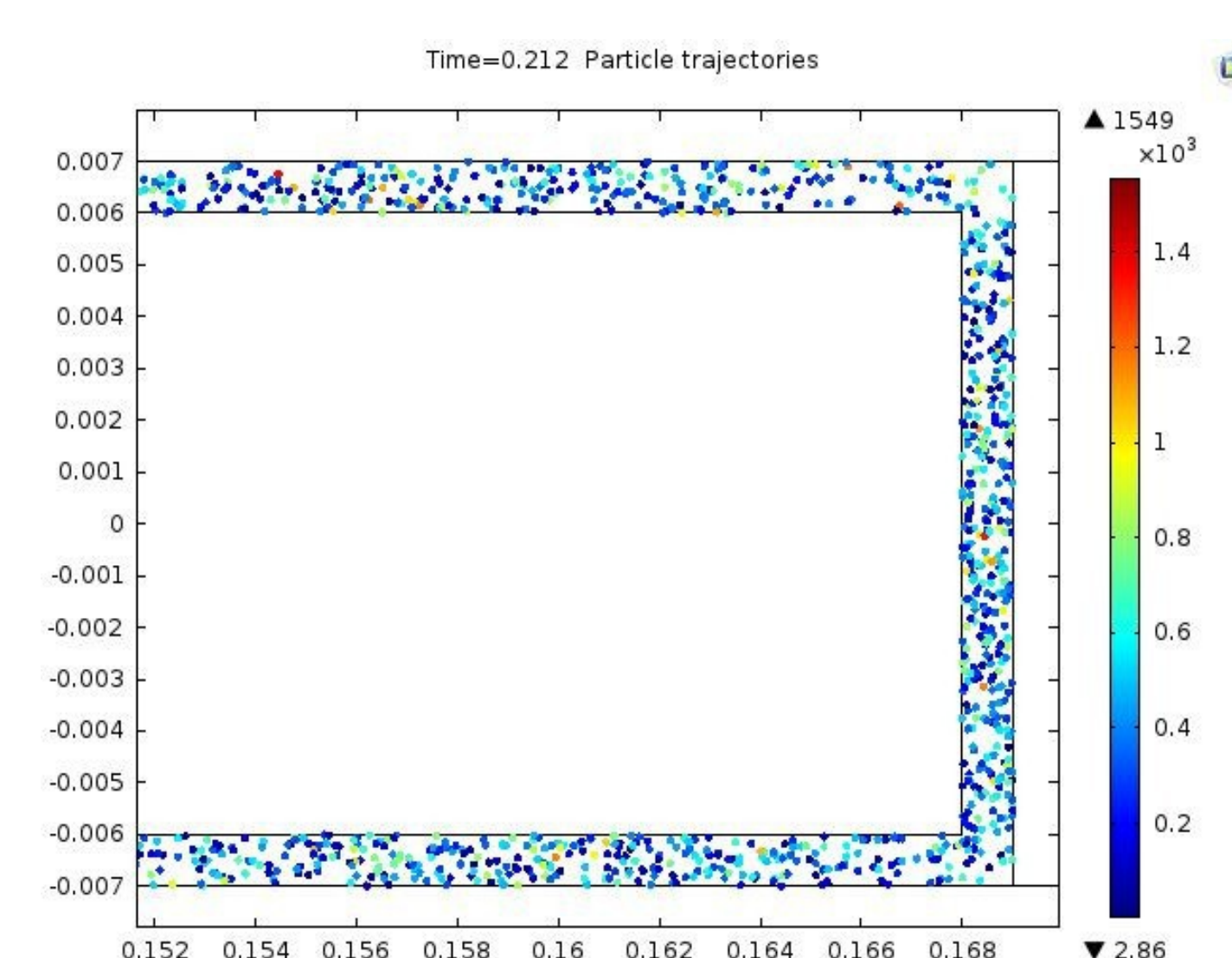

Figure 3. Simulation of MR Fluids

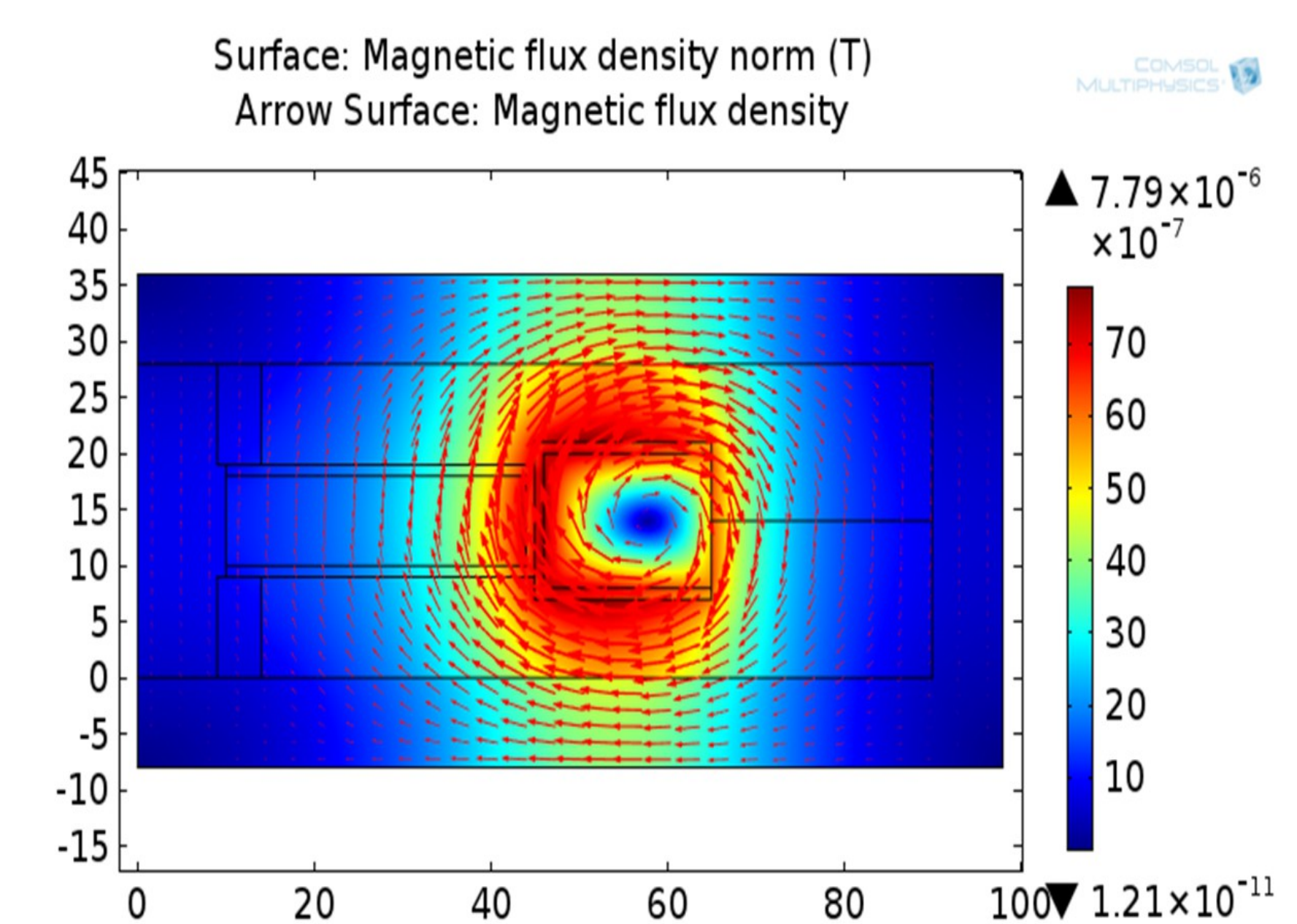| Current in coil (Ampere)	Magnetic Flux density (Tesla)
0.5	0.76
1	0.97
1.5	1.69
2	2.05

Table 1. Magnetic Flux Density   Figure 4. Magnetic Flux Density

Conclusions: The simulations of magneto rheological fluids shows the time scale and flux created under the magnetic filed. From the above simulation results , we can produce the correct proportion of magneto rheological fluid.

References:

1.Edward J.Park et All, Design Considerations for an automotive magnetorheological brake, Mechatronics, 18, 434-447, 2008

2.Engin Gedik, Hüseyin Kurt, Ziyaddin Recebli, Corneliu Balan "Two-dimensional CFD simulation of magneto rheologacal fluid between two fixed parallel plates applied external magnetic field", *Computers & Fluids* 63 (2012) 128–134.