Effect of Magnetic Field on MR-Fluid in Ball End Magnetorheological Finishing

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Abstract

Magnetorheological Finishing (MRF) is one of the precision finishing processes in which magnetic field is used to drive abrading forces for Finishing 2D and complex 3D surfaces. In this paper, Ball End Magnetorheological Finishing (BEMRF) has been analyzed for fluid behaviors under the influence of strong magnetic field. Polishing action in MR-fluid depends on magnetization, magnetic intensity, fluid composition and relative motion between fluid and surface to be finished. Here, fluid stiffness is the key functionality which is determined in terms of magnetorheology effect. In most precision optics, this behavior plays a predominant role in obtaining very high precision of the order of 70nm or even less. In this context, viscosity of fluid has been analyzed in the presence of a magnetic field produced by the electromagnet. As fluid viscosity is a function of magnetization, volume fraction and magnetic intensity, they have been described to generate the magnetorheological effect in fluid.

Figures used in the abstract

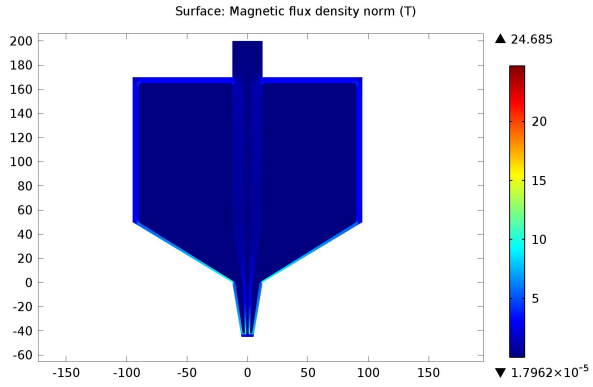

Figure 1: Ball end magnetorheological finishing tool.

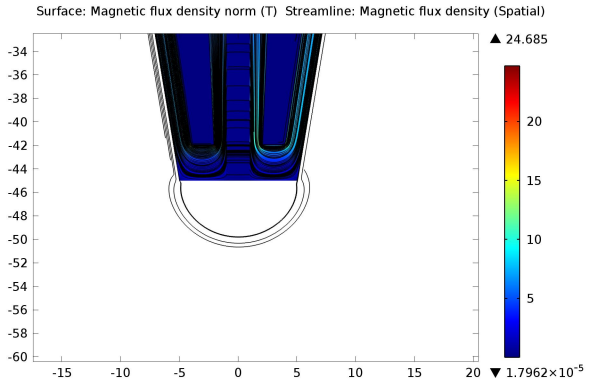

Figure 2: Magnetic field near the tip of the tool forming hemispherical field distribution (ball end).