Graduate Student Research Seminar

Spring 2022

Development of Mathematical Model and Characterization of Internal Surface obtained by Elasto-Abrasives Magneto-spiral Finishing (EAMSF)

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3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

The implantation of stents and instruments with capillary action demands super-finished internal surfaces of the manufactured product. Elasto-abrasives magneto-spiral finishing (EAMSF) is the attempt made in this paper to enhance the productivity of finishing by incorporating the abrasive flow in spiral motion due to the presence of the magnetic field. Here, a novel impregnated elasto-magnetic abrasive particles (IMPs) are used in a magnetic field-assisted environment to polish the inner walls of the workpiece. In EAMSF, magnetic force provides excess finishing pressure to the abrasives whereas the elasticity of the high impact polystyrene (HIPS) absorbs excess force of the IMPs on the finishing surface. An indigenous mathematical relation taking into account physics of this super-finishing process indicating material removal shows a close resemblance to the experimental results with an error percentage of 1.03 has been developed. The results of experimentation reveal that with 50% concentration of abrasives and a magnetic field density of 18mT yields, a superior surface finish with a R_a value equal to 0.053 µm and maximum material removal of 6.9 mg; while in the absence of a magnetic field, superior surface finish with a R_a = 0.266µm and maximum material removal of 5.4 mg is achieved. In the presence of magnetic field density, significant enhancement of material removal, surface finish, and burr removal is observed. Finishing of the surface at 50% abrasive concentration with a magnetic field represents regular finishing and the trench marks present in the original surface are removed after finishing.

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