



## Optimization the Parameters of Magnetic Abrasive Process Using Taguchi Method to Improve the Surface Roughness

**Shakir M. Mousa**

*Technical Institute of Al-Mussaib / Al-Furat Al-Awsat Technical University*

Email: [shakir.aljabiri\\_89@yahoo.com](mailto:shakir.aljabiri_89@yahoo.com)

(Received 10 August 2016; accepted 15 December 2016)

<https://doi.org/10.22153/kej.2017.12.001>

### Abstract

Magnetic abrasive finishing (MAF) process is one of non-traditional or advanced finishing methods which is suitable for different materials and produces high quality level of surface finish where it uses magnetic force as a machining pressure. A set of experimental tests was planned according to Taguchi orthogonal array (OA) L27 ( $3^6$ ) with three levels and six input parameters. Experimental estimation and optimization of input parameters for MAF process for stainless steel type 316 plate work piece, six input parameters including amplitude of tooth pole, and number of cycle between teeth, current, cutting speed, working gap, and finishing time, were performed by design of experiment (DOE) and response surface methodology (RSM). These six input parameters in this research were optimized for all input parameters to improve the surface layer for work piece by using signal-to-noise ratio technique. The obtained results showed that all six input parameters have an influence on the change in surface roughness ( $\Delta Ra$ ). In addition, the results showed that the surface roughness of the work piece decreased from 1.130 to 0.370  $\mu\text{m}$  that means high level of improvement in the change of surface roughness (0.760)  $\mu\text{m}$ .

**Keywords:** MAF process, MINITAB software, parameters, Signal-to-Noise ratio, surface roughness, Taguchi orthogonal array.

### 1. Introduction

In MAF process, the working gap between the magnet pole (end face) and the work piece is filled of with magnetic abrasive particles MAPs, can be used such as bonded or unbounded powder. In the present work, bonded are prepared from ferromagnetic particles and abrasive particles. Magnetic abrasive finishing MAF techniques used for hard material [1] that because the ability of MAF to remove microchips, help to produce micro-relief layer gives higher surface properties. MAF process was universal, simplicity; improved the quality of surface roughness (Ra) more than 50 %.MAF effective process,gives good economic environment. Ferromagnetic particles' acting such as a multipoint cutting tool, and develops finishing force and pressure, leading to the influence of the magnetic field density in the working gap. The

specialty of MAF process was capability to control the flexibility of tool, ferromagnetic powder sealing by magnetic field, one can control the density and rigidity of the magnetic brush, that help to change the topography of magnetic flux in the working gap, [2-4]. MAF is a modern relatively process of polishing begin in US in 1930s, magnetic abrasive finishing MAF are famous in Russia. This process was developed and growth between 1980-2000. Many advantages of (MAF) process, it is more successful to produce different complex shapes and suitable for finishing flat surface as well as inner and outer cylindrical surfaces. Geeng-Wei Changet et al.[5] have clarified the principle working of MAF process and the finishing characteristics by using abrasive powder consist of a mechanical mixture of ferromagnetic particles and silicon carbide (SiC) abrasive with lubricant as unbounded magnetic abrasive powder. T Moriet et al.[6] have