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Modelling of WEDM process for machining ASTM 52100 steel

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Abstract

WEDM process being used for machining harder to machine materials, it is important to streamline the input parameters that controls the production rate and the quality of the product. Hence, an attempt has been made to identify the most significant parameter that controls the mojor part of the outputs and develop a model for predicting the responses. The input parameters such as Pulse ON time, Pulse OFF time and curret has been varied in equal intervals. The impact of these parameters on the responses Machining time and Surface Roughness has been studied. ANOVA analysis and Response surface Methodology has been used for analysis.

Introduction

The need of machining modern materials lead to the invention of advanced machining process. One such machining process is wire electrical discharge machining process [1], [2], [3]. In order to achieve better quality products at reduced cost without compromising the production rate, it is essential to control the process parameters such as pulse ON time, Pulse OFF time, MOA, Current, etc [4], [5], [6]. This control of

process can be implemented through analysis of the experimental results and selection of compatible combination of parameters. The analysis of the experimental results can be done with the help of statistical tools such as ANOVA analysis etc. and optimization can be carried out with methods like GRA, Response surface methodology etc [7], [8], [9]. The WEDM process is widely used in industries to make minute holes, intrinsic profiles etc in dies steel materials such as High Chromium high carbon steel and EN31 alloy steel [10]. In this work, Response Surface methodology is utilized for modeling and study the interaction between the input parameters [11], [12], [13], [14], [15], [16].

Section snippets

Experimentation

The input parameters are varied in equal intervals in 3 levels. L 27 orthogonal array is used to conduct the experiments. The parameters Pulse ON time, Pulse OFF time and Current is varied. The responses Machining time and Surface Roughness is measured. Circular holes are made in the plate by varying the Pulse ON time between the ranges of 8 to 12 sec whereas the Pulse OFF time has been varied form a range of 15 sec to 29 s. The current was varied between the range of 3 to 5 amps. The cutting…

Result discussion

Fig. 1 shows the effect of pulse on time and pulse off time on the surface roughness. The surface roughness remains constant throughout the span of pulse off time. There is a linear increase in surface roughness when pulse on time increases gradually. The maximum surface roughness is obtained in 12 sec in pulse on time and the minimum surface roughness obtained in 15 sec pulse off time. The minimum surface roughness obtained in 8 sec pulse on time. Fig. 2 shows the effect of pulse on time and…

Conclusions

Upon experimentation and analysis, the following inferences are made.

- The surface roughness remains constant throughout the span of pulse off time and there is a linear increase in surface roughness when pulse on time increases gradually. An exponential increase in machining time is found when the current increases gradually.…
- The pulse OFF time is identified as the most influential parameter for MT and Pulse OFF time for SR.…
- The models formed for machining time can be used to predict the MT for…

…

CRediT authorship contribution statement

S. Dinesh: Conduction of Experiments and Result Discussion. **T. Parameswaran Pillai**: Design of experiments and Literature. **A. Parthiban**: Qulaity Check and Language Editing. **K. Rajaguru**: Resources, Writing - review & editing.…

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

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