

Evaluation of Effectual Input Parameters and MOOAs in the Context of Electrical Discharge Machining for tool steel DIN 1.2379

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Abstract –In today’s era, Electrical Discharge Machining (EDM) process has been found as a momentous machine tool in purpose to performance the intricate tasks in regards to production i.e. dies shrinking, cavity forming in forging die, produce hole in micrometer etc. Recently, it has been investigated by past researchers that synergy amongst input process parameters i.e. spark time, peak current, pulse off time, pulse on time, gap voltage, duty cycle, power, gap voltage, duty cycle and gap between tool and work part, etc broadly leverage the quality of work part/to be machined goods and also influence the performance of EDM machine. Therefore, it indeed imperative in order to evaluation the synergy between input parameters and approaches (which can evaluate the alternative ‘steady with the best combination of parameters’) in the context of EDM for alloys metal. The present research has been conducted the prior sate of arts in empire of EDM process parameters, which provided an assistance towards forthcoming researchers to order to opt the effectual input parameters and MOO approaches (can evaluate the alternative ‘study with the best combination of parameters’), for tool steel DIN 1.2379. Moreover, the channel to augment the quality to be machine goods has been discussed.

Keywords-Electro Discharge Machining (EDM); Optimization; Input Parameters, Alloy Material, Multi-Objective Optimization Approaches (MOOAs).

1. INTRODUCTION & PRIOR STATE OF ARTS

Electrical Discharge Machining (EDM) has been considered as foremost process for the dies shrinking, cavity forming in forging die, produce hole in micrometer, punches and also tool making in manufacturing firms. EDM has been found as an effectual machining process, which is being explored in perspective to perform the machining operations upon so hard material, where others traditional cum few non-tradition machining process realized to non-effective as well as productive. Moreover, it has been found more effectual for creating the intricate geometry in parts incorporating to produce quality in goods.

Recently, it has been examined by past researchers that the process parameters pertaining to EDM i.e. spark time, peak current, pulse off time, pulse on time, gap voltage, duty cycle, power, gap voltage, duty cycle and gap between tool and

work part, etc are answerable performance of EDM process (Datta and Landolt, 1981; Kozak and Rajurkar 1994; Rebelo, 1998; Ahmet et al., 2004). Moreover, same researchers also found out that the synergy between said input parameters are major responsible towards managing the quality to be manufactured products. EDM process figure has been depicted in figure 1.

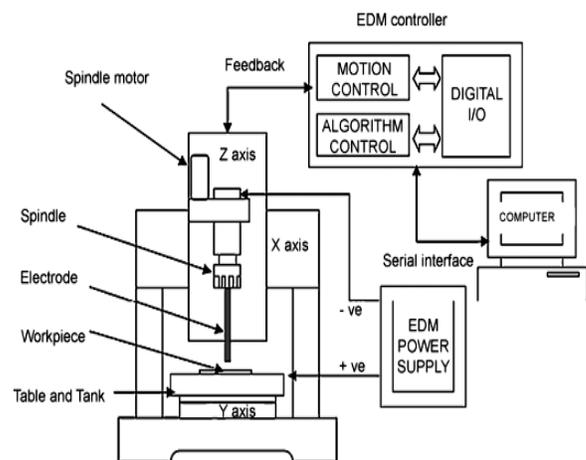


Figure 1: Depicted the sketch of Electrical Discharge Machining (EDM) process

Hereby, it motivated the authors to carry out the research works to evaluation the synergy between effectual input parameters in the context of EDM for alloys metal. Furthermore, the research has been extended their work to resolve the effectual approaches amongst existent approaches, which could be explored in future in perspective to evaluate the synergy between parameters with respect to output objective (*objective can be subjected to maximization and minimization*). So, in purpose to propagate the research work, the authors conducted the massive literature review in the context of EDM for alloys metal. The organized literature review is articulated blow:

(Yanetal. et al., 1999) investigated the micro-hole machining of carbide with a copper electrode tool to reveal the leverages of polarity, tool electrode shape and rotational speed on the micro-hole machining. (Parija, 1993) investigated the process in determining the optimal synergy between the process parameters for obtaining excellent welds. (Haykin 1999) applied neural networks and appealed towards a wide range of applications, which include functional approximation, pattern recognition, time series forecasting and others. (Tsai and Wang 2001) built a semi empirical model in which parameters influencing the surface roughness have been recognized such as spark time, maximum current, polarity, input power, material density, conductivity of the material, specific heat capacity, heat conductivity, melting point, and boiling point of the material. (Marafona and Wykes, 2000; Khan and Mridha 2006) the chief output parameters such as the material removal rate (MRR), wear ratio (WR), EW, and job surface have been investigated for receiving high finish Ra during EDM. (Khan, 2008) suggested that a high current-limiting resistance results in a decrease of discharge current in EDM process. (Huang et al., 1999) investigated experimentally the effect of machining parameters on the gap width, the surface roughness, and the depth of white layer on the machined work piece surface. (Rozenek et al 2001) used a metal matrix composite as work piece material and investigated the variation of machining feed rate and surface roughness with machining parameters. (Sahu et al., 2013; Sahu et al., 2014) the authors suggested the TOPSIS, VIKOR, MOORA, PROMETHEE, ELECTRE, GRA are the best methods to solve the optimization problems in entire realms. The author applied hybrid (MOORA) method accompanied with grey number to benchmark CNC machine tool. (Sahu et al., 2015a,b) the authors suggested the TOPSIS, VIKOR, MOORA, PROMETHEE, ELECTRE, Genetic Algorithms, Particle Swam Optimization, Artificial Neural Network (ANN) and Grey Rational Analysis (GRA), etc are the best approaches to tackle the optimization problems in entire realms. The author applied hybrid (TOPSIS) method accompanied with fuzzy to benchmark CNC machine tool.

2. RESEARCH GAPS & OBJECTIVE, APPROACHES and PARAMETER EVALUATION:

After conducted the literature review, the authors found that an earliest researchers paid their attention individual upon the evaluation of parameters excluding optimization techniques cum parameters evaluation Tsai and Wang 2001; Rozenek et al 2001; Ahmet et al., 2004; Khan and Mridha 2006; Khan, 2008. The authors found the so many input process parameters of EDM such as spark time, peak current, pulse off time, pulse on time, gap voltage, duty cycle, power, gap voltage, duty cycle and gap between tool and work part and multi-objective optimization techniques by literature surveys (Datta and Landolt, 1981; Parija, 1993; Kozak and Rajurkar 1994; Haykin 1999; Yanetal. et al., 1999; Rebelo, 1998;

Huang et al., 1999; Marafona and Wykes, 2000; Tsai and Wang 2001; Rozenek et al 2001; Ahmet et al., 2004; Khan and Mridha 2006; Khan, 2008; Sahu et al., 2014; Sahu et al., 2015a,b). This issue considered by the authors as their research gaps. Next, the authors made the endeavors in order to compensate this research gaps

3. APPLICATION & LIMITATION OF CONDUCTED RESEARCH WORK:

The conducted research possesses the applications in manufacturing firms, as it direct the researchers to take into account several momentous input parameters pertaining to EDM machining process (variation in process parameters fuzzle the quality to be machined goods). Furthermore, it also encompasses the identity of several MOO techniques, which could be applied in order to find the best synergy between inputs considered parameters. The limitation of research is that it individual dealt with the EDM process parameter, but exposed techniques can be applied for solving other real life machining problem.

4. CONCLUSIONS:

The conducted research work produced the several vice-consequences, which provide a memorandum towards forthcoming research for opting the best multi-objective optimization approaches and also assisted to evaluate effectual process parameters in the context of EDM. In order that, to be conducted experiments on EDM with minimum effort by novel researchers could receive the praiseful consequences for preserving the quality in goods. Moreover, the further consequence pertaining to conducted research works have been articulated in below section.

1. The conducted literature surveys in extent of EDM machining process depicted that spark time, gap voltage, duty cycle and gap between tool and work part have been resolved to be considered as momentous process parameters. The competition between the found parameters have revealed by the bar chart, shown in Figure.2.

2. The feasible MOO techniques have been found in accordance with their applications and competency amongst (MOOAs) in order to solve the multi-objective optimization dilemmas with respect to output responses. The competition between the found Multi-Objective Optimization Approaches/techniques (MOOAs/Ts) have revealed by the radar, shown in Figure. 3.

3. The authors provided a wonderful corridor towards the academicians, researchers and experiment conductors to choose the prominent process parameters of EDM, in order that, fewer efforts (which could mitigate the experiments 'material saving') could deliver the best results.

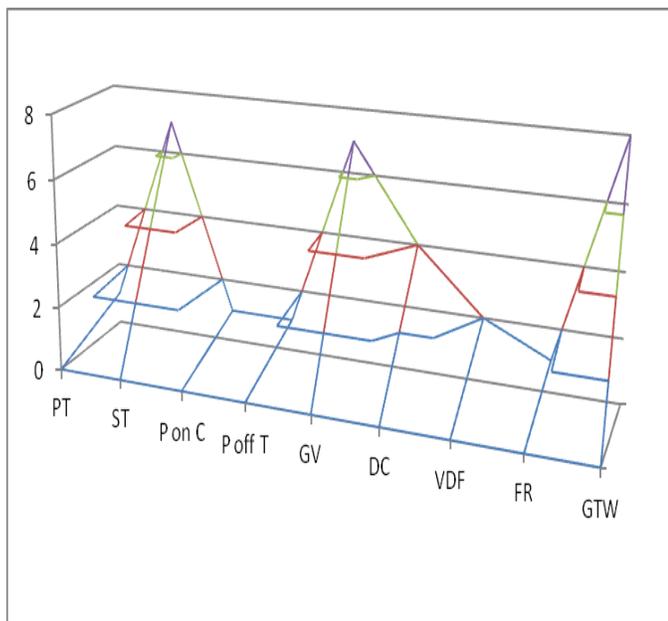


Figure 2. The competition between the found parameters have revealed by the surface chart.

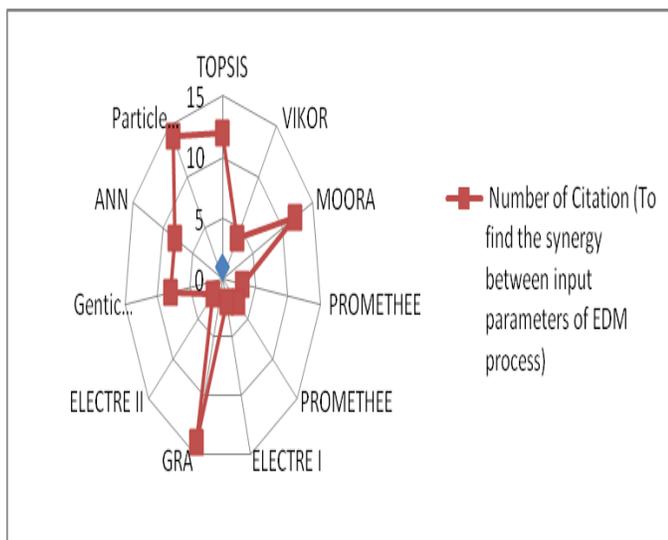


Figure 3. The competition between the found p have revealed by the Radar as well as Bar chart

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Dr. Anoop Kumar Sahu embraced the post of **Assistant Professor** in the **Department of Mechanical Engineering**, J.K.I.E, Bilaspur, Chhattisgarh, India. He published **14** manuscripts in **Scopus Index** and more than **12** in other leading academic journals. Moreover, attended as well as presented more than **16** manuscripts in conducted national and international conferences. His current

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