A PERSPECTIVE ON PROCESS PARAMETERS IN EDM USING AHP APPROACH

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Abstract: Electro-discharge machining (EDM) is as a machining process for machining of conducting materials. A number of parameters must be taken into consideration for optimizing the EDM process. Various parameters considered in this study are:Current, Pulse- On, Pulse Off, Material Removal Rate (MRR), Electrode Wear Rate (EWR), Surface finish (Ra). EDMis primarily used for those materials that are difficult to machine with traditional techniques. The present analysis is aimed towards the ranking of various identified parameters of EDM.

Keywords: EDM, Surface Finish (Ra), Pulse-on, Pulse-off, current, MRR, EWR

1. INTRODUCTION

EDM is a non-conventional machining process which is employed for machining hard electrically conductive materials. It works on the principle of repeated electrical discharges.EDM causes erosion of materials to obtain the desired shape of the work piece with closer dimensional tolerances. There is no physical contact between the electrode and work piece.

Review of Literature reveals that there is need for optimizing the process parameters of EDM. The present work is devoted towards the development of a mathematical model using Analytic Hierarchy Process (AHP).

The various parameters selected for the modelling are shown in table1.

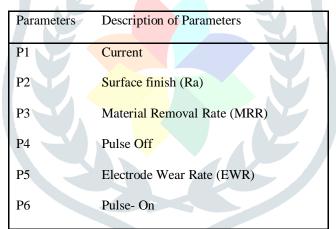


Table 1: Various EDM parameters

2. ANALYTIC HIERARCHY PROCESS (AHP)

AHP is an MCDM technique used by various researchers for because of its wider acceptability and adaptability. AHP method is capable of solving a wide range of decision problems involving pairwise comparison and analysis. The following steps has been used in the AHP analysis:

- a. Developing questionnaire for Pair wise comparison
- b. Formation of Comparison matrix
- c. Normalization
- d. Evaluation and Consistency analysis

The relative importance scale (Saaty & Vargas, 1991) has been used for pairwise comparison. A panel of experts from the field of EDM were involved for the pair wise comparison of identified process parameters. Table 2 shows the Pair-wise comparison matrix.

Parameters	P1	P2	Р3	P4	P5	P6
P1	1	1⁄2	1/3	6	3	6
P2	2	1	1/2	7	4	6
Р3	3	2	1	7	6	8
P4	1/6	1/7	1/7	1	2	3
P5	1/3	1⁄4	1/6	1/2	1	2
P6	1/6	1/6	1/8	1/3	1⁄2	1

Table	2 P	'air-w	zise r	natrix

Table 3a and 3b reflects the steps for Normalization matrix.

Table 3a Normalization matrix (Step-I)							
Parameters	P1	P2	P3	P4	P5	P6	
P1	1.00	0.50	0.33	6.00	3.00	6.00	
P2	2.00	1.00	0.50	7.00	4.00	6.00	
Р3	3.00	2.00	1.00	7.00	6.00	8.00	
P4	0.17	0.14	0.14	1.00	2.00	3.00	
P5	0.33	0.25	0.17	0.50	1.00	2.00	
P6	0.17	0.17	0.13	0.33	0.50	1.00	
Total	6.667	4.060	2.268	21.833	16.500	26.000	

Table 3b Normalization matrix (Step-2)

Parameters	P1	P2	P3	P4	P5	P6
P1	0.150	0.123	0.147	0.275	0.182	0.231
P2	0.300	0.246	0.220	0.321	0.242	0.231
P3	0. <mark>450</mark>	0.493	0.441	0.321	0.364	0.308
P4	0.025	0 <mark>.035</mark>	0.063	0.046	0.121	0.115
P5	0.050	0. <mark>062</mark>	0.073	0.023	0.061	0.077
P6	0.025	0.041	0.055	0.015	0.030	0.038

Table 4 shows the Consistency measure of the process parameters.

Table 4 Consistency analysis									
Parameters	P1	P2	P3	P4	P5	P6	TOTAL	AVERAGE	C. R
						0.2			
P1	0.150	0.123	0.147	0.275	0.182	31	1.108	0.185	6.664
						0.2			
P2	0.300	0.246	0.220	0.321	0.242	31	1.561	0.260	6.674
						0.3			
P3	0.450	0.493	0.441	0.321	0.364	08	2.376	0.396	6.471
						0.1			
P4	0.025	0.035	0.063	0.046	0.121	15	0.406	0.068	6.063
						0.0			
P5	0.050	0.062	0.073	0.023	0.061	77	0.346	0.058	6.118
						0.0			
P6	0.025	0.041	0.055	0.015	0.030	38	0.205	0.034	6.115

Consistency Ratio C. R =CI/RI, where RI = 1.240 (for n=6)

RI is called Random Index and is obtained from RI index chart.

CI= 0.070, C. Ratio= 0.057

Value of CI is <0.10, which reflects judgmental consistency of the analysis.

Table 5 shows the ranking of various parameters of EDM.

Table 5 Rankir	g of identified	parameters	of EDM
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Parameters	Consistency Ratio	Rank
P1	6.664	II
P2	6.674	Ι
Р3	6.471	III
P4	6.063	VI
Р5	6.118	IV
P6	6.115	V

The Ranking obtained from the analysis are: P2>P1>P3 > P5>P6>P4

3. RESULTS AND DISCUSSION

The current work reflects the relative ranking/ importance of the selected parameters in EDM using AHP method. Based on expert's opinion and followed by consistency analysis, the ranking of EDM process parameters arefound as: P2- P1- P3- P5- P6- P4. This reflects that Surface finish (Ra) having highest value of CR= 6.674 is the most important parameter in EDM. Other important parameters are current followed by MRR. In order to optimize the EDM process, these parameters seek due attentionbased on their rankings.

4. CONCLUSIONS

The present work is aimed towards the analysis of selected parameters in EDM based on their relative rankings. The AHP analysis reflects that Surface finish is the most important parameter in EDM process. Managers are expected to put due importance on all EDM parameters based on their relative importance. This will help in improving the process efficiency as well as in optimizing the EDM process. Future research might involve other important parameters for more in-depth analysis using other MCDM techniques like TOPSIS, ANN, GTA etc.

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