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Prediction and Optimization of Parameter in Wire EDM of SS316L

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***Abstract*-Wire EDM is a non-conventional machining process which has high accuracy and precision with low surface roughness. Whereas conventional machining process cannot achieve the target of low surface roughness. Conventional machining process will distort the material when thickness increases. To determine optimum parameters of wire edm. These optimum parameters will be the one which will give the lowest surface roughness for the cut.**

***Keywords*— EDM(Electrical discharge machining), SS316(Stainless Steel 316), SVM (Support Vector Machine**)

I.INTRODUCTION

SS316L stainless steel is being widely used in orthopedic implants, dental implant and cardiovascular stents in biomedical and engineering applications In the recent years many attempts have been made to improve the surface properties of metals and alloys used in bio medical applicationsWire EDM is one of the most extensively used non- conventional material removal process as it provides an effective solution for machining of hard materials with complex shapes.The methods of optimization are gray wolf, And ColonyGenetic Algorithms particle swarm, cuckoo search, Teaching Learning Based Optimization (TLBO) etcWe will be predicting the surface roughness by using machine learning modelThe models for prediction are liner regression, ANNKNN, random forest, SVM (Support Vector Machine), Decision tree etc.

LITERATURE REVIEW

S.r	Authors	Title of Paper	Methodology	Outcome
1	John Kechagias etal.	Optimization of cut surface quality during CNC Plasma Arc Cutting process	Optimization by using ANOMAand ANOVA Analysis	Analysis of means and analysis of variances show that all parameters affect about equal the surface roughness of the cut surface.
2	Sahil Sharma et al.	experimental Analysis and Optimization of Process Parameters in Plasma Arc Cutting Machine of EN-45A Material Using Taguchi and ANOVAMethod	The aim of this paper was to investigate the effect of machining parameters on MRR and to obtain the optimal conditions for maximizing the response variable, i.e. MRR in PAC of EN4SA steel using Taguchi OA with ANOVA method.	The comparison between predicted value and the confirmation test result value shows an improvement of 4.04% in the MRR, which indicates that the experiments in this study possess excellent repetitiveness and has a great potential
3	P.P. Badgujar and M. G. Rathi	Analysis Of Surface Roughness In Abrasive Waterjet Cutting Of Stainless Steel	OVAT analysis is very much important tool utilized widely in engineering analysis. This work is a part of ongoing research project and the preliminary results are presented in this articl	Through this analysis it is concluded that the higher stand-off distances result in a constant increase in the surface roughness. In case of the water pressure, higher water pressure increases the kinetic energy of the individual particles Inside the jet and enhances their capability for the material removal. Surface roughness decrease

WORKING THEORY

Wire EDM machining (Electrical Discharge Machining) is an electro thermal production process where a thin single strand metal wire, along with de-ionised water (used to conduct electricity) allows the wire to cut through metal by the use of heatfrom electrical sparks, while preventing rust

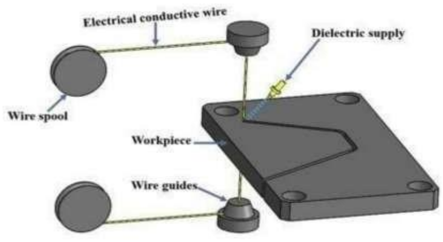


Fig. 1 Working Principle of WEDM

Wire EDM machining works by creating an electrical discharge between the wire of the electrode and the work piece As the spark jumps across the gap, material is then removed from the work piece and the clectrode. Due to the inherent properties of the process, Wire EDM can easily machine complex parts and precision components out of hard conductive materials.

IV.Implementation Methodology

Experimental layout

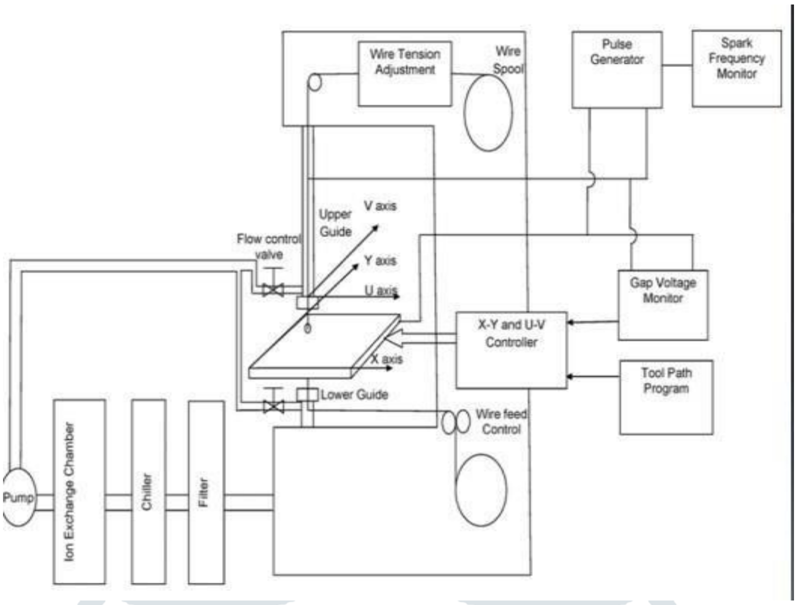


Fig.no -2 Experimental layout

Future Scope

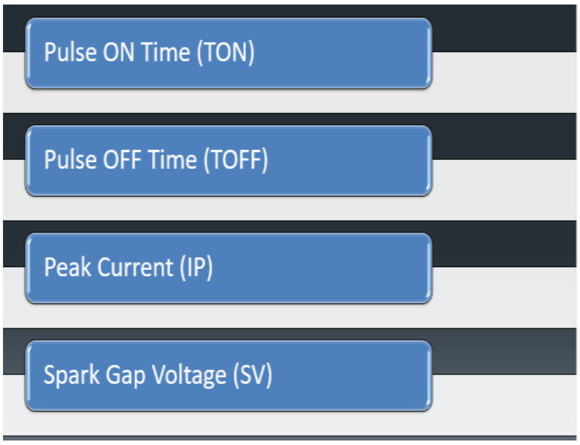
The prediction model we created using ANN Regression can be further used for future purpose with different dataWe also used Surface Roughness equation for prediction which we got by using the RSM statistical method that equation can also be used for prediction in future but for that we required same input parameters with different levels or valuesWe know that our aim is to minimize the surface roughness and to find optimum parameters of WIRE EDM which will give lower Surface RoughnessFor optimization we used TLBO algorithm which has given three optimum combination which will give minimum surface roughnessIn future if anyone wants to work on the SS316L and wants to achieve minimum surface roughness he can used our optimum parameters which we got with the help of TLBO.

Conclusion

We predicted surface roughness by two methods. First we predicted the surface roughness by using the RSM equation of surface roughness, that was the manual method. to predict the surface roughness but, for more efficient results we also used ANN regression model.That model can be used in future for prediction with different data. After doing the prediction by both ways we compared both the methods and conclude that the ANN Regression model is performing better than our manual prediction method which we have done by using RSM equation -

- ANN Regression given the error up to 0.224 and our manual prediction given error up to 0.9021Sowe can conclude that ANN regression is best model and we can used it for 6.future purposeBut both the errors we got are acceptable.

IX. Parameters considered for this project



X. Design calculation

IX. I Experiment layout values

Experiment No.	Voltage (V)	Pulse on Time (Ton)	Pulse off Time (Toff)	Peak Current (IP)
1	20	116	56	110
2	10	114	56	110
3	20	114	58	110
4	10	114	58	230
5	20	112	54	230
6	10	114	56	110
7	10	114	54	230
8	20	114	56	230
9	20	114	56	230
10	10	114	56	110
11	20	114	58	110
12	20	114	56	230
13	20	112	56	110
14	20	114	56	230
15	20	116	56	110
16	20	114	56	230
17	10	114	58	110
18	20	116	54	110

IX. II Experimental Layout Process Parameters

Process Parameters	Levels		
	-1	0	1
Pulse on Time (Ton)	112	114	116
Pulse off Time (Toff)	54	56	58
Spark gap Voltage (V)	10	20	10
Peak Current (IP)	110	230	110

XI. References

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