

A Review on Parametric Optimization of Aluminum alloy-1200 & EN-31 in CNC Surface Milling using Taguchi Method

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ABSTRACT

The Present paper outlines an experimental study to optimize the effect of the cutting speed, feed rate and Depth of cut on surface roughness of Aluminum Alloy 1200 & Steel EN 31 by employing Taguchi technique. This paper deals with optimization of the selected Milling Parameter, i.e. cutting speed, Feed rate, Depth of cut and Coolant Flow Rate. Taguchi Orthogonal Array is designed with Three Level of milling parameter & different experiments are done using L9 (34) Orthogonal Array, Containing 4 columns which represent four factors & Nine rows which represents nine experiments to be calculated and value of each parameter was obtained. The nine experiments are performed and surface roughness, MRR, Temperature & Cycle Time of cut is Calculated for both material. The practical result can be used in industry to get the desirable Surface Roughness and Material Removal Rate for the work piece by using suitable parameter combination.

Keywords : Aluminium Alloy 1200 & EN-31, Cycle time cut, cnc end milling, Coolant Flow rate, DOC, Feed rate, SR, MRR, Taguchi Technique, Temperature, Speed of Cutting.

I. INTRODUCTION

CNC milling is a specific form of computer numerical controlled (CNC) machining. Milling itself is a machining process similar to both drilling and cutting, and able to achieve many of the operations performed by cutting and drilling machines. Like drilling, milling uses a rotating cylindrical cutting tool. However, the cutter in a milling machine is able to move along multiple axes, and can create a variety of shapes, slots and holes. Computer numeric controlled machining centers are used to produce a wide range of components, and tooling costs involved have continued to become more affordable. In general, large production runs requiring relatively simple designs are better served by other methods, although CNC machining can now accommodate a wide range of manufacturing needs. CNC milling centers are ideal solutions to everything ranging from prototyping and short-run production of complex parts to the fabrication of unique precision components. Virtually every type of material that can be

drilled or cut can be machined by a CNC mill, although most of the work performed is done in metal. As with drilling and cutting, the proper machine tools must be selected for each material in order to avert potential problems. The hardness of the work-piece material, as well as the rotation of the cutting tool must all be factored before beginning the machining process. Therefore, surface roughness is one of the important quality aspects in milling operations.

Hence, there is a need to optimize the process parameter to achieve the output characteristics by using Taguchi technique. In order to obtain better surface roughness, the proper setting of cutting parameter is crucial before the process take place. The aim of organization of this work is to optimize the process parameters for minimum surface roughness in CNC Milling process for Aluminum alloy 1200 & EN 31.

The rest of the paper is arranged as follows: we describe the overview of related work in section 2. Section 3

gives Taguchi method and input & output parameter conclusion along with future research. Section 4 draw Conclusion.

II. METHODS AND MATERIAL

A. Literature Review

Summary of work done by previous researchers is given in Table 1.

B. Taguchi Method and Input & Output Parameter

Taguchi is a method of conducting the design of experiments which are based on well-defined guidelines. This method uses a special set of arrays called orthogonal arrays. This standard array stipulates the way of conducting the minimal number of experiments which could give the full information of all the factors that affect the performance parameter.

Orthogonal Array:

- 1) Control Factor = 4
- 2) Number of Level for each Control Factor = 3
- 3) Total Degree of Freedom of Factors: $-1+4 \times [3-1] = 9$
- 4) Number of Experiments to be Conducted = 9

Ref No	Year	Authors Name	Material	Input Parameter	Output Parameter	Methodology used
1	2014	Rajesh Kumar, M. K. Pradhan and Rishi Kumar	Aluminum 6061 Alloy	Cutting speed, Feed, Depth of cut & Coolant	MRR& SR	GRA
2	2014	Sanjeev Kumar Pal and Rahul Davis	Al 6061 and Al 6463	Feed and Depth of cut	SR	PCA, Grey relation analysis,
3	2013	D.Bhanuprakash, G.RamaBalaji , etc.	Aluminum Alloy 6082	Cutting speed, Feed and Depth of cut	SR	RSM and Genetic algorithm
4	2012	SurasitRawangwong, JaknarinChatthong, R. Burapa and W. Boonchouytan	Aluminum 7075-T6	Cutting speed, Feed and Depth of cut	SR	Taguchi, ANOVA, Regression Analysis
5	2011	John D. Kechagias, Christos K. Ziogas, etc.	Al Alloy 5083	Core Diameter, Flute Angle, Rake Angle, Peripheral 2nd Relief Angle, Cutting Speed, Feed and Depth of Cut	SR	Analysis of mean
6	2013	Dr. K.G.Durga Prasad, M.V.Prasad,	Aluminum	Cutting speed, Feed and Depth of cut	MRR& SR	DEA based Taguchi method
7	2012	Milon D. Selvam, Dr.A.K.Shaiketc.	Mild Steel	Number of passes, Cutting speed, Feed and Depth of cut	SR	Taguchi technique and Genetic Algorithm
8	2009	T. K. Barman, P. Sahoo	AISI 1040	Cutting speed, Feed and Depth of cut	SR	Taguchi & ANOVA
9	2015	Ranganath M. S. Vipin, R. S. Mishra,	Aluminium KS 1275	Cutting speed, Feed and Depth of cut	SR	Taguchi Techniques
10	2015	K. Siva Kumar, Bathina S	Al Alloy 6082	Cutting speed, Feed and Depth of cut	SR	Taguchi Techniques

11	2015	A.Venkata Vishnu, K.B.G Tilak, G.Guruviah Naidu	Al Alloy 6351	Cutting speed, Feed and Depth of cut, Coolant Flow	SR	Taguchi Techniques
12	2015	Raizwan Anwar, Mira Jahanzaib, Ghulam Asghar, Ahmad Waim	Al Alloy 7075-T	Cutting speed, Feed and Depth of cut	SR	Central Composite Design Technique

TABLE 1 : LITERATURE REVIEW

Sr No	Control Factor	Output Factor
1	Speed in rpm (X1)	Surface Roughness (Ra)
2	Feed Rate in mm/min (X2)	Material Removal rate (MRR)
3	Depth of Cut in mm (X3)	Temperature
4	Coolant Flow Rate lit/min (X4)	Cycle time of cut

TABLE 2 : I/P & O/P PARAMETER

III. CONCLUSION

From reviewed different research paper it has been concluded that

- [1] Most of the research people have taken spindle speed, feed rate and depth of cut as input parameters. Spindle speed, feed rate and depth of cut are the important parameters while studying the effects of process parameters on the required responding characteristics.
- [2] For any manufacturing industries the quality is the most important quality parameters. So, most of the research people have taken surface roughness as the quality parameters.
- [3] Every research people tried to optimize the quality/performance characteristics according to problem taken. All performance characteristics are equally important according to industries problem.
- [4] Taguchi methodology widely used for the single optimization.
- [5] So that, in this research work we want to investigate influences of input machining parameters like cutting speed, feed rate, depth of cut and n Coolant Flow rate on response parameters surface roughness, MRR, Temperature, Cycle Time of cut using Taguchi technique

IV. REFERENCES

[1] Rajesh Kumar, M. K. Pradhan and Rishi kumar, "Modeling and optimization of end milling parameters on aluminum 6061 alloy using GRA based Taguchi method coupled with PCA", 5th International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014) December

12th – 14th December 2014, IIT Guwahati, Assam, India, pp. 90-1 to 90-6.

[2] Sanjeev Kumar Pal and Rahul Davis, "A Design of Experiment Approach to Compare the Machining Performance of CNC End Milling", International Journal of Mechanical Engineering, Volume 2, Issue 7, July 2014, pp. 34-44.

[3] D.Bhanuprakash, G.RamaBalaji, A.Gopichand, V.Ajaykumar and D.V.N.Prabhaker, "Optimization Of Machining Parameters For Aluminum Alloy 6082 In CNC End Milling", International Journal of Engineering Research and Applications, Vol. 3, Issue 1, January -February 2013, pp.505-510.

[4] Surasit Rawangwong, Jaknarin Chatthong, R. Burapa and W. Boonchouytan, "An investigation of optimum cutting conditions in face milling aluminum 7075-t6 using design of experiment", 4th International Conference on Applied Operational Research, Proceedings, Lecture Notes in Management Science, Vol. 4, 2012. pp. 125– 135

[5] John D. Kechagias, Christos K. Ziogas, Menelaos K. Pappas and Ioannis E. Ntziatzias, "Parameter Optimization during Finish End Milling of Al Alloy 5083 using Robust Design", Proceedings of the World Congress on Engineering Vol I, July 6 - 8, 2011.

[6] Dr. K.G.Durga Prasad, M.V.Prasad, A.Chakradhara Rao and P.V.S.C.Manjusha, "DEA based Taguchi method for Optimization of CNC End milling Process parameters", International Journal of Emerging Trends in Engineering and Development, Issue 3, Vol.4, June-July 2013, pp. 202-211.

[7] Milon D. Selvam, Dr.A.K.Shaik Dawood and Dr. G. Karuppusami, "Optimization Of Machining Parameters For Face Milling Operation in a Vertical CNC Milling Machine using Genetic Algorithm", Engineering Science and Technology: An International Journal, Vol.2, No. 4, August 2012, pp. 544-548.

[8] T. K. Barman and P. Sahoo, "Fractal Dimension Modeling in CNC Milling Using Taguchi Method", Proceedings of the International Conference on Mechanical Engineering 2009 (ICME2009) 26- 28th December 2009, Dhaka, Bangladesh, pp. RT 29 1-6

[9] Ranganath M. S., Vipin, R. S. Mishra, Prateek, Nikhil, "Optimization of Surface Roughness in CNC Turning of Aluminium 6061 Using Taguchi Techniques", International of Modern Engineering Research, Vol.5, Iss.5, May 2015 | 42 |

[10] K. Siva Kumar, Bathina Sreenivasulu, "Optimization and Process Parameters of CNC End Milling For Aluminum Alloy 6082", novateur publications international journal of innovations in engineering research and technology, issn: 2394-3696 volume 2, issue 1 jan-2015.

[11] A.Venkata Vishnu, K. B. G. Tilak, G.Guruviah Naidu, Dr.G.Janardhana Raju, "Optimization of Different Process Parameters of Aluminium Alloy 6351 in CNC Milling Using Taguchi Method", International Journal of Engineering Research and General Science Volume 3, Issue 2, Part 2, March-April, 2015 ISSN 2091-2730.

[12] Rizwan Anwar, Mirza Jahanzaib, Ghulam Asghar, Ahmad Wasim Salman Hussain, "Optimization of Surface Roughness for Al-Alloy 7075-T in Milling Process", Technical Journal, University of Engineering and Technology (UET) Taxila, Pakistan, Vol. 20(SI) No.II(S)-2015.