Evaluation the Effect of Machining Parameters for Surface Finish using Turning of Aluminium 6063

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Abstract— Turning is a basic operation for various industries & surface finish is very essential for the components to be machined therefore to optimize the surface finish various parameters affecting turning for the optimum condition. Surface finish is affected by machining parameters, tool material, tool type and cutting fluids etc. The parameter influence most are cutting speed, depth of cut , feed, geometry of cutting tool like principle cutting edge angle ,rake angle, nose radius etc. In order to optimize the surface finish it is very necessary to control various parameters. In the turning operation the different values of cutting parameters, cutting speed (45, 90,140,330), feed rate (.1, 0.22, 0.44, 0.68 mm/rev), depth of cut (.5, 1, 1.5,2 mm) are selected. Surface finish is largely influenced by Feed then Speed then DOC. Surface finish shows a decreasing trend with increasing Feed. Surface finish is minimum at lowest revolving speed. Surface finish is minimum at lowest depth of cut.

Key words: Taguchi Design, Orthogonal Array, Turning, Cutting Speed, Feed, Ra, Surface Finish

I. INTRODUCTION

The first lathe machine was developed was the two- person lathe machine which was designed by the Egypt in about 1300 BC. Primarily, there are two things that are achieved in this lathe machine tool. The first is the turning of the wood working piece manually by a rope; and the second is the cutting of shapes in the wood by the use of a sharp cutting tool., there have been constant modifications and improvements over the two-person lathe machine, most importantly on the production of the rotary motion. Surface finish, also known as surface texture, is the characteristics of a surface. It has three components: lay, surface roughness, and waviness. Many factors contribute to the surface finish in manufacturing. In forming processes, such as molding or metal forming, surface finish of the die determines the surface finish of the work piece. In machining the interaction of the cutting edges and the microstructure of the material being cut both contribute to the final surface finish. In general, the cost of manufacturing a surface increases as the surface finish improves.

II. LITERATURE REVIEW

P V amsi Krishna, D N Rao, and R R Srikant et al. (1984) carried out study on Predictive modeling of surface roughness and tool wear in solid lubricant assisted turning of AISI 1040 steel. Results indicate that content of solid lubricant in SAE oil and type of solid lubricant affect surface roughness and tool wear. Pradeep L. Menezes , Kishore , Satish V. Kailas et al. (2006) carried out study of Influence of surface texture on coefficient of friction and transfer layer formation during sliding of pure magnesium pin on 080 M40 (EN8) steel plate The conclusions based on the experimental results is that The amplitude of stick–slip motion predominately depends on plowing component of friction. In 2007, N.R. Dhar, M.T. Ahmed, S. Islam et al. carried an experimental investigation on effect of minimum quantity lubrication in machining AISI1040 steel. they concluded that, the cutting performance of mql machining is better than that of dry machining.

III. METHODOLOGY

The Taguchi method is a well-known technique that provides a systematic and efficient methodology for process optimization and this is a powerful tool for the design of high quality systems. Taguchi approach to design of experiments in easy to adopt and apply for users with limited knowledge of statistics, hence gained wide popularity in the engineering and scientific community. This is an engineering methodology for obtaining product and process condition, which are minimally sensitive to the various causes of variation, and which produce high-quality products with low development and manufacturing costs. Signal to noise ratio and orthogonal array are two major tools used in robust design.

The S/N ratio characteristics can be divided into three categories when the characteristic is continuous

1) Nominal is the best
2) Smaller the better
3) Larger is better characteristics.

For the maximum material removal rate, the solution is Larger is better and S/N ratio is determined according to the following equation:

$S/N = -10 * \log (\Sigma(1/Y2)/n)$

Where, S/N = Signal to Noise Ratio,

n = No. of Measurements, y = Measured Value

The influence of each control factor can be more clearly presented with response graphs. Optimal cutting conditions of control factors can be very easily determined from S/N response graphs, too. Parameters design is the key step in Taguchi method to achieve reliable results without increasing the experimental costs.

If there is an experiment having 3 factors which have three values, then total number of experiment is 27. Then results of all experiment will give 100 accurate results. In comparison to above method the Taguchi orthogonal array make list of nine experiments in a particular order which cover all factors. Those nine experiments will give 99.96% accurate result.

By using this method number of experiments reduced to 16 instead of 27 with almost same accuracy.

A. Surface Finish Measurement

The first step of analysis is to filter the raw data to remove very high frequency data since it can often be attributed to vibrations or debris on the surface. Next, the data is

separated into roughness, waviness and form. This can be accomplished using reference lines, envelope methods, digital filters, fractals or other techniques.

B. Profilometer Used

Fig. 1: Mitutoyo Profilometer

- Mitutoyo suftest-4
- Code number: 178111E
- Serial number: 800064

C. Material Used

Aluminium Alloy (Aluminium 6063). AA 6063 is Aluminium Alloy, having elements in the concentrations Al (97.5 %), Cr (0.1 %), Cu (0.1 %) and Fe(0.35%)

D. Cutting Tool Used

The Cutting tool is high speed steel (tip only). A tool bit is a non-rotary cutting tool used in lathes. Such cutters are also often referred to by the set-phrase name of single-point cutting tool, as distinguished. The cutting edge is ground to suit a particular machining operation and may be resharpened or reshaped as needed. The ground tool bit is held rigidly by a tool holder while it is cutting.

IV. Results and Analysis

Experiment No.	RPM	FEED (mm/rev.)	Depth of Cut (mm)	Min Micron	Max Micron	Avg. Micron
1.	45	0.1	0.5	2.3	2.6	2.4
2.	45	0.22	1	3.1	4.0	3.5
3.	45	0.44	1.5	11.6	13.7	12.6
4.	45	0.68	2	10.1	11.7	10.9
5.	90	0.1	1	5.0	5.3	5.2
6.	90	0.22	0.5	9.8	14.3	12.0
7.	90	0.44	2	14.3	14.3	14.3
8.	90	0.68	1.5	13.2	14.3	13.8
9.	140	0.1	1.5	3.4	3.7	3.6
10.	140	0.22	2	4.3	5.0	4.6
11.	140	0.44	0.5	9.6	12.8	11.2
12.	140	0.68	1	13.6	14.4	14.0
13.	330	0.1	2	4.4	6.8	5.6
14.	330	0.22	1.5	4.5	6.6	5.5
15.	330	0.44	1	7.8	8.3	8.0
16.	330	0.68	0.5	13.2	14.3	13.7

Table 1 Observation Table for Surface Finish in Micron

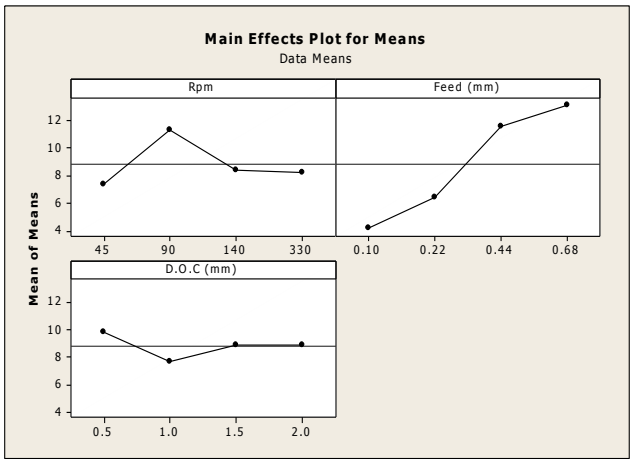

Fig. 2: Effect of process parameters on surface finish

The Value of surface show a increasing trend as the speed increases from 45 to 90 rpm and then it goes diminishing upto 330 rpm. The value of surface finish increases with increase of feed. Also the value of surface finish decreases as the depth of cut increases from 0.5 mm to 1.0 mm then it starts increasing as the depth of cut increases upto 2 mm.

Larger is Better

Level	Rpm	Feed (mm)	DOC (mm)
1	7.381	4.189	9.85
2	11.297	6.426	7.691
3	8.354	11.544	8.873
4	8.232	13.106	8.851
Delta	3.916	8.918	2.159
Rank	2	1	3

Table 2: Response Table for Signal to Noise Ratio

V. Conclusions

From all the above experiments, observations and calculations, following conclusions has

1) Ra is largely influenced by Feed then Speed than Depth of Cut
2) Ra shows a decreasing trend with increasing Feed.
3) Ra is minimum at 90 r.p.m.
4) Ra is minimum at minimum depth of cut.

Physical Requirements	Optimal Combinations		
	Speed (RPM)	Feed (mm)	D.O.C (mm)
Maximum Surface Finish	90	0.68	0.5
	Level-2	Level-4	Level-1

Table 3: Optimal Combination for Surface Finish

REFERENCES

[1] P. Abinesh, Dr. K. Varatharajan, Dr. G. Satheesh Kumar,“ Optimization of Process Parameters Influencing MRR, Surface Roughness & Electrode Wear During Machining of Titanium Alloys by WEDM”, International Journal of Engineering Research & General Science Volume 2, Issue 4, June, 2014, ISSN 2091-2730.

[2] ArjunBiloria& Rupinder Singh,“Optimizing the Parameters Influence the Performance of Wire cut EDM Machining”, International Journal of Current Engineering & Technology Vol.4, No.5 (Oct -2014).

[3] Rishu Gupta &Ashutosh Diwedi, “Optimization of Surface Finish & Material Removal Rate with Different Insert Nose Radius for Turning Operation on CNC Turning Center”, International Journal of Innovative Research in Science Engineering & Technology, Vol. 3, Issue 6, June 2014.

[4] Dhruv H. Gajjar & PROF. Jayesh V. Desai, “Optimization of MRR, Surface Roughness & KERF Width in wire EDM Using Molybdenum Wire”,/ International Journal for Research in Education, Vol. 4, Issue:2,February : 2015.

[5] Rajmohan, T., Prabhu R.,Subba Rao G., Palanikumar K. “optimization of machining parameters in electrical disacharge machining of 304 stainless steel”, International conference on modeling , optimization & computing,1030-1036.

[6] Parashar, Vishal A. Rehman, J.L. Bhagoria, Y.M. Puri “Investigation & Optimization of Surface Roughness for Wire Cut Electro Discharge Machining using Taguchi Dynamic Experiments”, International Journal of Engineering Studies, Volume 1, pp. 257–267.

[7] Vishal Parashar, A. Rehman, J.L. Bhagoria, Y.M. Puri(2010). “Kerfs width analysis for wire cut electro discharge machining using design of experiments”, Indian Journal of Science & Technology, volume 3. PP. 369-373.

[8] Sivakiran, S C. Bhaskar Reddy, C. Eswara Reddy (2012). “Effect of Process Parameters On Mrr in Wire Electrical Discharge Machining Of En31 Steel”, International Journal of Engineering Research & Applications (IJERA), VOLUME 2, pp.1221-1226 .

[9] Singaram, Lakshmanan1, PrakashChinnakutti, Mahesh Kumar Namballa (2013).“Optimization of Surface Roughness using Response Surface Methodology for Tool Steel EDM Machining”, International Journal of Recent Development in Engineering & Technology, volume 1, december, pp. 33-37.

[10] Lodhi, Brajesh Kumar, Sanjay Agarwal (2014). “Optimization of machining parameters in WEDM of AISI D3 Steel using Taguchi Technique”, 6th CIRP International Conference on High Performance Cutting, HPC. PP.194-199

