JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Turning process parameter of optimization by Using Taguchi

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Abstract : The optimization of turning operations based on the Taguchi method. Three cutting parameters namely, cutting speed, feed rate, and depth of cut, are optimized with considerations of multiple performance characteristics such as tool life, cutting force, and surface finish. The optimum turning process parameter are estimated using Taguchi application. In this work we consider three types of Grade of aluminium materials, EN 19, EN 24, WPS. Comparing Taguchi and experimental process we found optimal solution for Turning process parameters.

IndexTerms-Turning, Optimization, Taguchi

I. INTRODUCTION

The Taguchi method is a powerful tool that can help manufacturers find the ideal settings for their machines. This method considers multiple factors [speed, Feed, Depth of Cut etc.] and helps achieve the best possible results, like good surface finish and chip hardness. By using this method, companies can improve their products and make better use of their machine tools.Turning is a form of machining or a material removal process used to shape materials. The turning process requires a CNC turning machine, work piece, fixture, and cutting tool.
grade steels whose chemical composition shown in Table I is used in this study. A carbide cutting tool has been used in this work.

Madhav et al (1) He suggested study shows various results in turning process which is used in manufacturing. It uses taguchi technique for showing optimal process. Tosun &Ozler et al (2) In this research they investigated the effects of surface roughness using iterations like Cutting speeds , Depth of cut , Feed rate. The Taguchi method is used for enhancing the cutting performance. He concluded that optimum parameters combination was obtained by using statistical analysis. Saha &Majumder et al(3) In this study they investigated turning process many shapes such as straight, conical, etc can be produced. They investigated the best settings for Lathe machining to achieve multiple goals low power consumptions , smooth surface , minimum vibrations. Nian , Yang , Trang et al(4) He study design and analyse for improvement of product quality. It also study multi parameters and also cutting surface roughness can be improved. saha et al(5) He Suggested use of process capability index (CPI) to enhance quality and to reduce cost , and productivity. It possible to increase efficiency of machining process and decrease production cost in automated manufacturing environment. Raja et al(6) He investigated and developed empirical models for machining time and surface roughness. There is slight deviation in surface roughness of experimental value from PSO value. Abburi et al(7) He suggested a solution for guessing a sequential quadratic programming code (SQP) and concluded that it minimize the time of production and also reduces the cost of production using SQP.

Gaitonde, Karnik, Davim et al(8) This article talks about improving a metal cutting process. They use the Taguchi method to find the best settings (speed, depth of cut, feed rate) for machining a specific steel with a carbide cutting tool. Their goal is to get a smooth surface (low roughness) while removing material quickly (high metal removal rate).

The study reveals that cutting speed has the biggest impact, followed by depth of cut. They validated their findings with tests, proving the Taguchi method works well. Interestingly, they use a concept called "utility" within Taguchi to find the ideal settings that balance both a smooth surface and fast cutting. This highlights the method's effectiveness for optimizing multiple goals in machining.

Varsha et al(9) She has suggested how to use taguchi method to prepare prediction model and she has concluded that taguchi is best prediction method.

2. METHODOLOGY-By using Taguchi method we provide 9 iterations using L9 Orthogonal array with respect to these we prepare 9 sample of work piece and find out surface roughness by using surface roughness testing method.

PROBLEM DEFINITION FOR WORK-The research done by us with the help of design of experiment to overcome the problem faced by manufacturing industries. The problem definition of turning process parameters optimization using the Taguchi method involves identifying the optimal combination of input variables such as cutting speed, feed rate, and depth of cut, to achieve the desired output characteristics such as surface finish quality, dimensional accuracy, and tool life expectancy.

OBJECTIVES-1**] Performance**:

This is the desired outcome you want from the turning process, like smooth surface finish on your machined part.

2**] Cost effectiveness:**

You want to achieve this performance while minimizing costs. This includes factors like using your cutting tool for as long as possible (tool life) and reducing wasted time and materials.

3] **Reducing Experiments:**

It allows you to test a smaller number of parameter combinations carefully chosen to understand the bigger picture.

2.1EXPERIMENTAL WORK

Roughness measurement has been done using a portable microprocessor based stylus-type profilometer, Talysurf(Taylor Hobson, Surtronie 3+. UK) shown in Figure 2. It is equipped with a diamond stylus having a tip radius 5 gm. The measuring stroke always starts from the extreme outward position. The profilometer has been set to a cut-off length of 0.8 mm, filter 2CR, and traverse speed I min/sec and 4 mm traverse length. Roughness measurements, in the transverse direction, on the work pieces have been repeated four times and average of four measurements of surface roughness parameter values has been recorded. The measured profile has been digitized and processed through the dedicated advanced surface finish analysis software. Hardness measurements were carried out using a Rockwell hardness testing machine. The initial hardness and surface roughness of the three materials is also shown in Table l.

Figure 1. Turning Operation by using CNC Machine

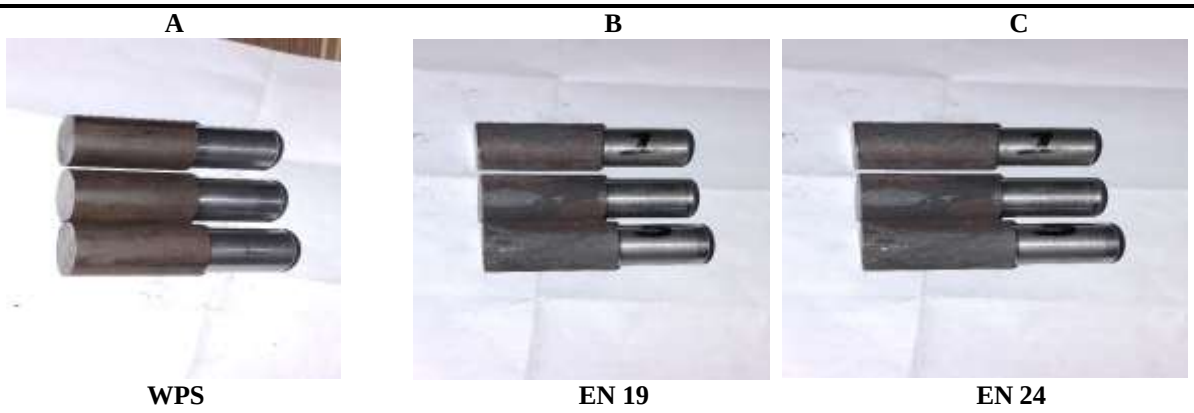

Figure 2. Prepared Work piece sample using materials EN-19, EN-24, WPS

Figure 3. Surface Roughness Measuring instrument

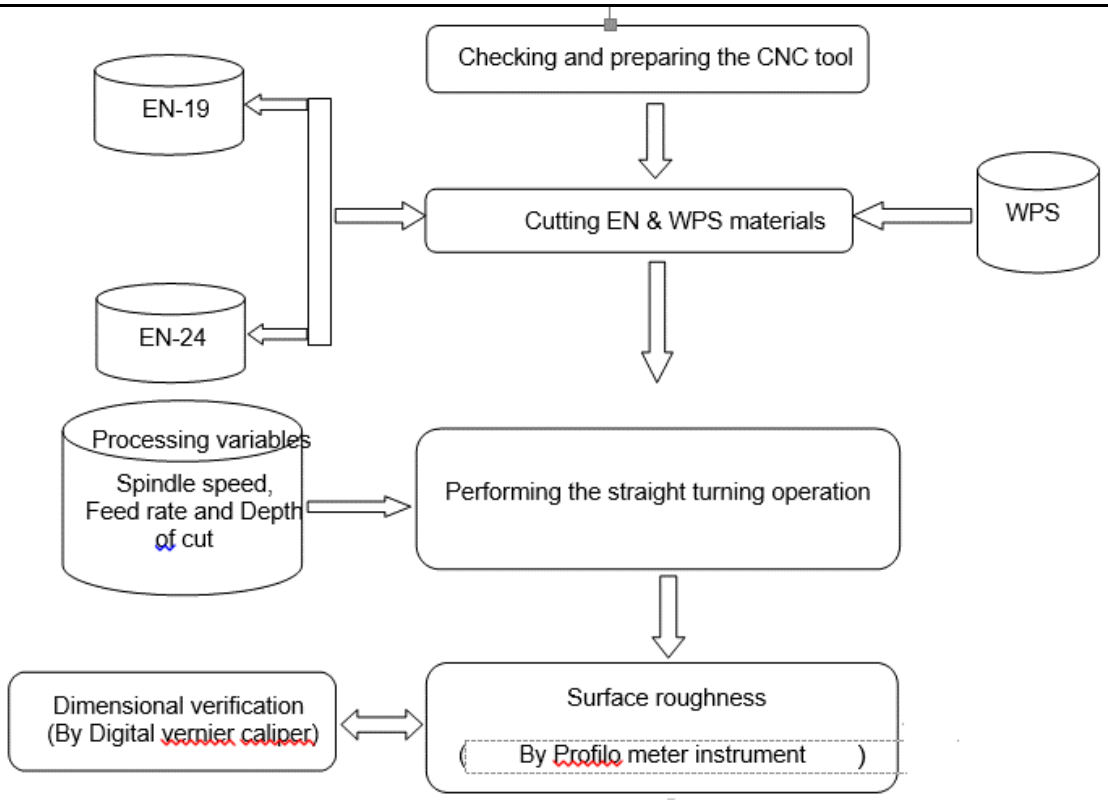

Figure4. Block diagram for process plan

2.1.1Experimental setup-Check the CNC tools and make it ready for performing the machining operation and then cut EN & WPS materials (EN -19, EN -24, WPS) by power saw and performing the initial turning operation on CNC to get desired dimensions of the work piece. Perform the straight turning operation on specimens in various cutting environments involving various combinations of process control parameters like spindle speed, feed and depth of cut. After turning operation check the dimensions of the work pieces by digital Vernier calipers. Measure the surface roughness value and surface profile of the work pieces with the help of a portable stylus type profilometer .

Table No 1: *Turning process parameters and their levels*

Level	Speed (rpm)	Feed(mm/rev)	DOC(mm)	Material
1	800	0.1	0.2	EN -19
2	1000	0.2	0.4	EN -24
3	1200	0.3	0.6	WPS

2.2 Taguchi method

The experiment trial conducted by us carried out with optimal process parameter to conform the result for minimising the surface roughness. We took the different grades of carbon material EN-19, EN-24 and WPS, here we consider three parameters with three levels with respect to design of experiment and we found the optimal solution for turning parameter

Table no 2: Turning process parameters as per DOE Taguchi method and roughness value.

Speed	Feed	Depth of Cut	Roughness	SNRA1
800	**0.1**	**0.2**	**2.3135**	**-7.2854**
800	0.2	0.4	1.1387	-1.1282
800	**0.3**	**0.6**	**1.0853**	**-0.7110**
1000	**0.1**	**0.4**	**0.2393**	**12.4211**
1000	0.2	0.6	2.0047	-6.0410
1000	0.3	0.2	1.4488	-3.2202
1200	0.1	0.6	0.3417	9.3271
1200	0.2	0.2	0.6850	3.2862
1200	0.3	0.4	1.2781	-2.1313

Table No 3: Process parameters as per Taguchi Design.

Trial	Speed (rpm)	Feed (mm/rev)	Depth of cut (mm)	Material	Diameter
1	800	0.1	0.2	EN-19	28
2	1000	0.2	0.4	EN-24	28
3	1200	0.3	0.6	WPS	28
4	800	0.1	0.4	WPS	28
5	1000	0.2	0.6	EN-19	28
6	1200	0.3	0.2	EN-24	28
7	800	0.1	0.6	EN-24	28
8	1000	0.2	0.2	WPS	28
9	1200	0.3	0.4	EN-19	28

analysis of variance (ANOVA) has been conducted to evaluate the response magnitude in (%) of each parameter in the orthogonal experiment. It is used to identify and quantify the sources of different trial results from different trial runs (i.e. Different cutting parameters). Basic property of ANOVA is that the total sum of the squares (total variation) is equal to the sum of the SS (sums of the squares of the deviations) of all the condition parameters and the error components, i.e., adding the variations of each factor (Equation (2)).

3. RESULTS AND DISCUSSION-1. The optimal factor setting becomes material EN-19, feed 0.1 mm/rev, speed 800 rpm and depth of cut 0.4 mm obtained in the Taguchi method. The variation of S/N ratio with overall Taguchi method for four parameters i.e speed (A), feed (B), depth of cut (C) and material (D) has shown in the table No 2.

2. The optimal setting of process parameters to get the maximum mechanical properties will be material EN-24, Feed at 0.2 rev/min, Speed is at 1000 rpm and depth of cut is at 0.2 mm and the optimal levels for each process parameters of Taguchi has shown in Table 2.

3. The optimal setting of process parameters to get the maximum mechanical properties will be material WPS, Feed at 0.3 rev/min, Speed is at 800 rpm and depth of cut is at 0.6 mm and the optimal levels for each process parameters of Taguchi has shown in Table 2.

Response Table for Signal to Noise Ratios

Smaller is better

Level	Speed	Feed	Depth of Cut
1	-3.0415	4.8210	-2.4065
2	1.0533	-1.2943	3.0539
3	3.4940	-2.0208	0.8584
Delta	6.5355	6.8418	5.4603
Rank	2	1	3

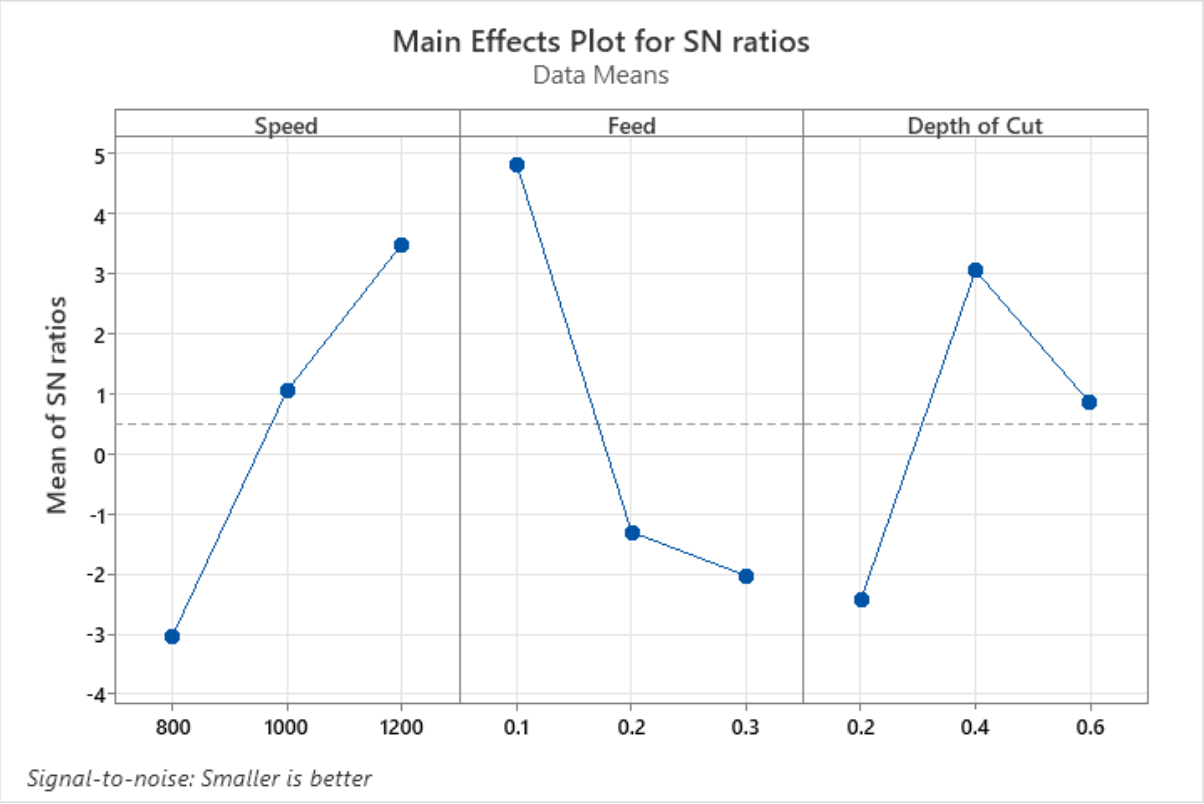

Figure 3. S/N Ratio plot for overall Parameters & Roughness

4. CONCLUSION

1. By comparing result obtain by experimental method we have concluded that the iteration of speed, feed and depth of cut we have found out the optimal solution.

2. The smaller the better S\N ratio was used to determine the optimal process parameter for three different materials

5.REFERENCES

1.Madhav et al. Optimization of turning process parameters by using grey-Taguchi

.2. Tosun N, Ozler L (2002) A study of tool life in hot machining using artificial neural networks and regression analysis method. J Mater Process Technology.

3.Abhijit Saha and Himadri Majumder et al In this paper process capability study is performed for turning operation, keeping in mind the end goal to check the process performance within specific limits. Three process input like spindle speed, feed and depth of cut

4.Nian CY, Yang WH, Tarng YS (1999) Optimization of turning operations with multiple performance characteristics. J Mater Process Technology

5.Abhijit Saha and Himadri Majumder et al In this paper process capability study is performed for turning operation, keeping in mind the end goal to check the process performance within specific limits. Three process input like spindle speed, feed and depth of cut

6.S.Bharathi Raja & N. Baskar et al Empirical models for machining time and surface roughness are described for exploring optimized machining parameters in turning operation.

7.N.R. Abburi and U. S. Dixit et al In this paper, a methodology is proposed for the multi-objective optimization of a multi pass turning process. A real-parameter genetic algorithm (RGA) is used for minimizing the production time, which provides a nearly optimum solution.

8. Gaitonde et al They use the Taguchi method to find the best settings (speed, depth of cut, feed rate) for machining a specific steel with a carbide cutting tool.

9. Varsha Magar et al Process parameter optimization for spring back in steel grade sheet materials under V-bending using FEM and ANN approach