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Turning Process Parameter for Lathe Machine Optimization By Using Taguchi Method

Manish Kumar[1], Swapnil Singh[2]

[1]M. Tech. Scholar Department of Mechanical Engineering, RNTU, Bhopal, (M.P.), India.

[2]Assistant Professor, Department of Mechanical Engineering, RNTU, Bhopal, (M.P.), India.

Abstract: *This paper investigates the parameters affecting the roughness of surfaces produced in the turning process for the various materials studied by researchers. Design of experiments were conducted for the analysis of the influence of the turning parameters such as cutting speed, feed rate and depth of cut on the surface roughness. The results of the machining experiments were used to characterize the main factors affecting surface roughness by the Analysis of Variance (ANOVA) method Taguchi's parametric design is the effective tool for robust design it offers a simple and systematic qualitative optimal design to a relatively low cost. From the response graph plotted between turning parameters and hardness of EN 8, it is observed that there is increase in hardness as the speed is increased at 850 rpm but when speed is further increased hardness goes decreased. The hardness increases when feed rate is changed from 0.2 mm/rev to 0.3 mm/rev and 0.3 to 0.4 mm/rev, but when depth of cut is 1 mm then hardness increases, but as the depth of cut is further increased then hardness decrease considerably.*

Keywords: Turning Process, Parameters of machining, EN-8 steel, Taguchi Method, Experiments.

Introduction

1.1 Introduction

Globalization of world market creates a challenge in products marketing, due to high competition induces in manufacturing to produce better quality product within a shorter period of time as well as low cost. Precise product could be produced while utilizing the machine as optimum working condition. Optimum machining parameters are of great concern in the manufacturing environment, where the economy of machining operation plays a key role in competitiveness in the market.

1.2 Lathe machine

The lathe machine is used to perform basic tasks such as cutting, drilling, tapping, which turns with the help of various tools placed there. Basic parts of the lathe machine such as base head stock, tail stock, main drive, carriage.

Working principle: A lathe is a machine tool that places a work piece in the centre or in a chuck or face plate between two rigid and strong supports that rotate. The cutting tool is tightly held and supported in a tool post which is fed against rotating work.

Due to their extreme capacity, people associated with the metal-work area prefer to designate the lathe as a machine tool. Therefore, the lathe is not a machine; It is a machine tool.

1.3 Turning operation

A common method to create specific dimension involves the removal of excess material by machining operation by cutting tool. Turning process is the process of remove material from cylindrical and non-cylindrical parts. It is used to reduce the diameter of the work piece, usually to a specified or different diameters.. In its basic form, it can be defined as the machining of an external surface:

- With the work piece rotating.
- With a single-point cutting tool, and
- With the cutting tool insert parallel to the axis of the work material and at a distance that will remove the excess material of the work.

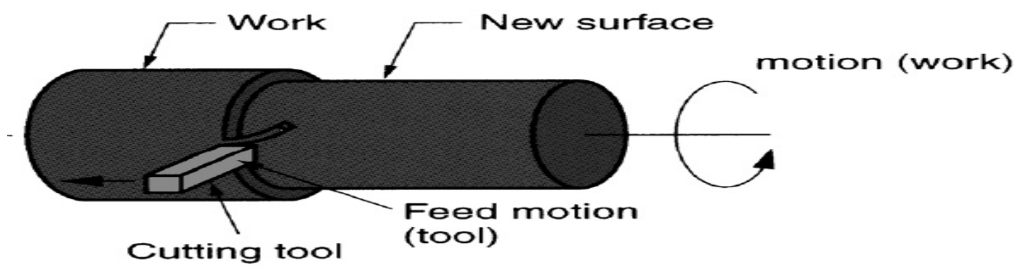

Fig 1: Turning operation.

1.4 Adjustable cutting parameter in turning

The three primary factors in turning operation are speed, feed, and depth of cut. Other factors such as material and type of tool have a large influence, of course, but these three are the ones the operator can change by adjusting the controls, right at the machine.

Speed:

Speed always refers to the spindle speed/ work piece speed. When it is stated in revolutions per minute (rpm) it tells their rotating speed, and it refers only to the work piece. Any different diameter on a work piece has a different cutting speed, but rotating speed remains the same.

$$v = \frac{\pi d N}{1000} \; m/min$$

Here, v is the cutting speed

D is the initial diameter in mm

N is the spindle speed in RPM.

Feed:

Feed always refers to the cutting tool, and explain as rate at which the tool advances along its cutting path, and is expressed in mm (of tool advance) per revolution (of the spindle), or mm/rev.

$$F\,m = f\,N \; mm/min$$

Here, $F\,m$ is the feed in mm per minute, f is the feed in mm/rev and N is the spindle speed in RPM.

Depth of Cut:

It is the thickness or amount of the the material being removed (in a single pass) from the work piece or the distance from the initial surface of the work to the cut surface, expressed in mm.

$$d_{cut} = \frac{D-d}{2}$$

Here, D = intial diameter
d = final diameter

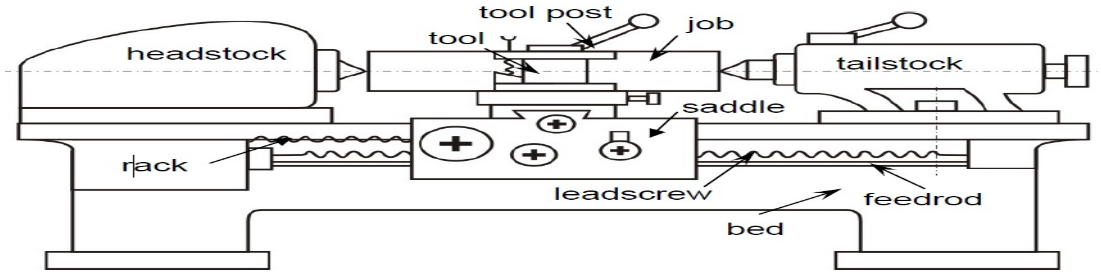

Fig 2: Schematic view of a centre lathe.

II. EN8 Material

EN8 is a medium carbon steel that is usually untreated. EN8 has good tensile strength and is often used in applications such as: shafts, gears, stressed pins, studs, bolts, keys, etc. EN8 is a very popular grade and is readily available under any condition. The surface can be further hardened to produce components with further wear resistance, typically through induction processes at 50–55 HRC. It is also available in free-machining versions, EN8DM and EN8M (212A42)

EN8 is an unalloyed medium carbon steel which is used in applications where better properties than mild steel are required but where the costs do not justify the purchase of a steel alloy. EN8 can be heat treated to provide a good surface hardness and moderate wear resistance by flame or induction hardening processes.

Table 2.1 Process parameters and their level

Sr. No.	Symbol	Process Parameter	Levels		
			Low	Medium	High
1.	Ss	Spindle speed (rpm)	750	850	1150
2.	F	Feed Rate (mm/rev)	0.2	0.3	0.4
3.	D	Depth of Cut (mm)	1	1.5	2

III. Experimental Data Analysis And Regression Modelling

Fig 3: Work piece before turning process.

(Courtesy: RNTU Engineering works)

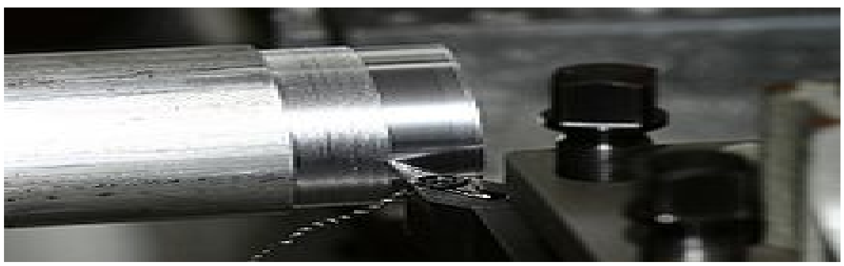

Fig 4: Work piece after turning process.

(Courtesy: RNTU Engineering works)

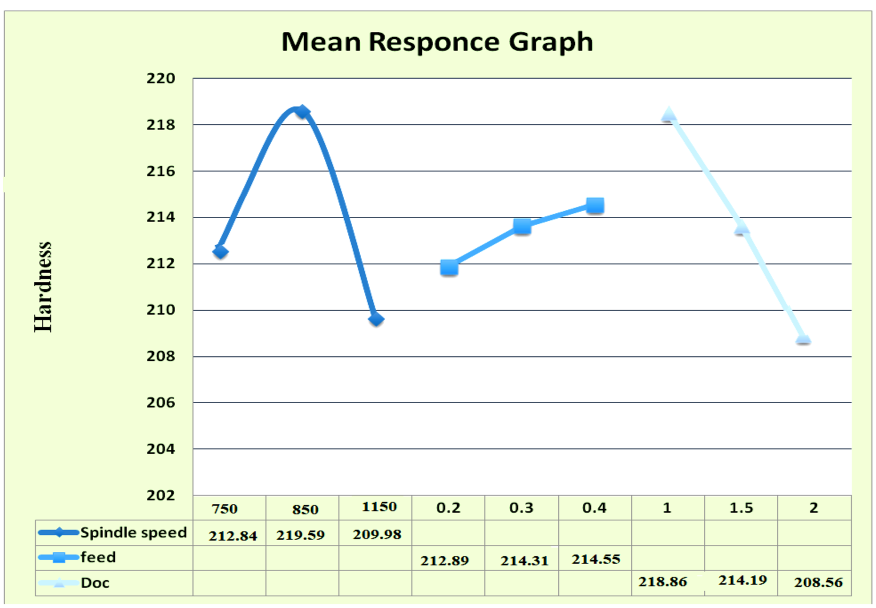

Fig 5: Mean response graph for three turning parameters.

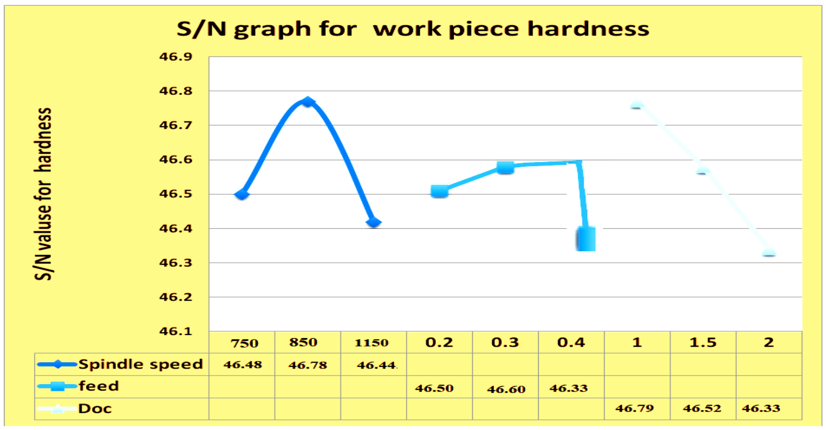

Fig 6: Mean S/N graph for Hardness.

IV. Conclusion

This paper has discussed an application of Taguchi method for optimizing the turning parameters in turning operation and indicates that the Taguchi design of experiment is an effective way of determining the optimal turning parameters for Hardness.

The outcome of the calculation and formulation for the optimization by the method i.e. prediction by Taguchi method, and using the optimum factor level combination suggested by Taguchi methodology by experiments are conducted and result are summarized.

References

[1] AL. Arumugam R. Ragothsingh (2013) "Optimization of Turning Process Parameters forHardness in Forged Steel" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 12, PP- 2401-2405.

[2] Digvijay kushwah and Ravi Ranjan " Evaluation and optimization of cutting for parameters parameters turning of EN 8 steel. A Taguchi Appproach." International Journal of Mechanical Engineering (IJME) Vol. 6, Issue 4, PP- 35-44.

[3] Satish Kumar and Ravi Bishnoi (2019) "Optimization of Turning Process Parameters using Taguchi Method" International Journal For Technological Research In Engineering Volume 6, Issue 11, PP – 5800-5803

[4] Ankit Dogra, Hartaj Singh, Dharampal, Vishal Singh and Sunil Kumar (2016) "Optimization of Turning Parameters of En-8 Steel Cylindrical Rods Using Taguchi Methodology" International Journal for Research in Applied Science & Engineering Technology (IJRASET). Volume 4 Issues XII, PP- 97-103.

[5] S.Sathiyaraj, A.Elanthiraiyan, G.Haripriya and V.Srikanth Pari (2015) "Optimization of machining parameters for EN 8 steel using Taguchi Method" ICRAMET, Special Issue 9, ISSN: 0974-2115, PP-157-161.

[6] P. G. Inamdar, N. S. Bagal, V. P. Patil, K. K. Bhosale and V. V. Mane (2017) “Optimization of Surface Roughness in Turning Operation of EN8 using Taguchi Method” International Advanced Research Journal in Science, Engineering and Technology, Vol. 4, Special Issue 1, PP-127-132.

[7] B.Suresh, Pon. Azhagiri, T.Senthil Kumar and B. Kumarakurubaran (2016) “Experimental Investigation on Surface Roughness and Material Removal Rate during Turning of EN8 Steel” International Journal of Emerging Technologies in Engineering Research (IJETER) Volume 4, Issue 6,PP-142-154.

[8] G. Akhtar, CheHaron C.H., Ghani J.A. (2008) "Application of Taguchi methodology in optimization of turning parameters for surface roughness". International Journal of Science Engineering and Technology Vol. 1, No. 3, PP-60-66

[9] Sijo MT and Biju N, 2010, "Taguchi method for optimization of cutting parameters in turning operations" AMAE.2010.01.536 PP-103-105.

[10] ChowdharyDr. SS, Khedkar SS, Borkar N.B. "Optimization of process parameters using aguchi approach with minimum volume lubrication for turning". International Journal of Engineering Research and Applications (IJERA) ISSN: 2248–9622, Vol. 1, Issue 4, pp.1268–1273.