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OPTIMIZATION OF TURNING PROCESS PARAMETER FOR LATHE MACHINE BY USING TAGUCHI METHOD

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ABSTRACT

In this project attempts on optimizing the turning process under various machining parameters by Taguchi method to develop or implement the quality of machined product. Taguchi optimization methodology is applied to optimize cutting parameters in turning EN 8, steel with coated cemented carbide tool under dry cutting condition. The center lathe machine is used to conduct experiments based on the Taguchi design of experiments (DOE) with orthogonal L9 array. The orthogonal array, signal to noise ratio (S/N) and were employed to Experiments conducted and subsequently analysis performed by using the Taguchi method. The optimum characteristics for high hardness in turning operation are identified. 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.

KEYWORD: Design of experiments, EN8, L9 array, signal to noise ratio, Taguchi method.

1. 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.

A lathe machine is a machine tool that is used to extract metals from a work piece to give the desired shape and size. In other words, it is a machine that is used to hold a work piece to remove various pieces, such as with the help of turning, grooving, chamfering, knurling, facing, tools.

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:

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- 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.

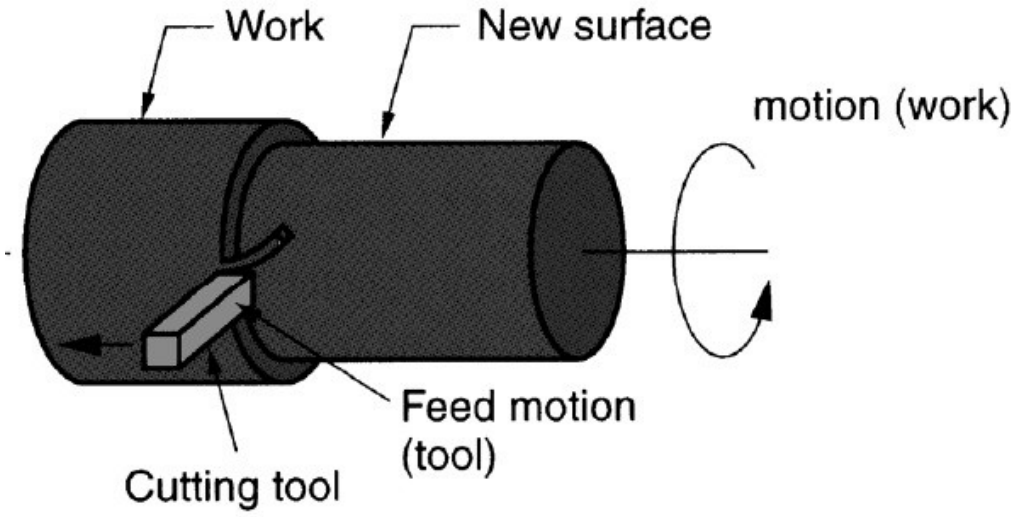

Figure 1.1 Turning operation

2. METHODOLOGY

2.1 Experimental Setup:

Selection of ranges and levels of process variables

As the literature suggested, the experimental setup is constructed for the various factors and their levels are chosen, which affect the quality of product.

- Spindle speed
- Feed rate
- Depth of cut

The factor that considerably contributes to the variation in Quality is selected.

Spindle speed

Spindle speeds also have effect on quality of product. In this experiment three different speeds is taken which is as follows.

L = Lower Level = 750 rpm
M = Medium Level = 850 rpm
H = High Level = 1150 rpm

Feed rate

The second parameter is feed rate and it has also three levels low, medium, high.

L = 0.2 mm/rev
M = 0.3 mm/rev
H = 0.4 mm/rev

Depth of cut

The third parameter is depth of cut and it has also three levels low, medium, high.

L = 1 mm , M = 1.5 mm , H = 2 mm

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Table 2.1 Process parameters and their level

S.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

I. RESULTS

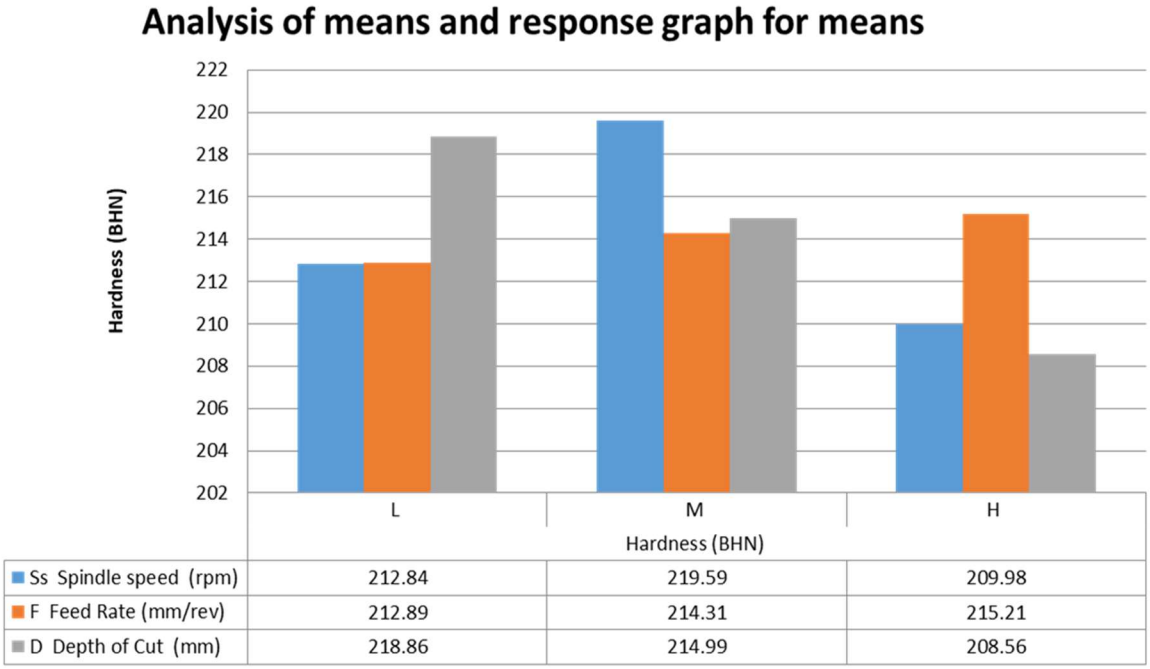

Fig. 3.1 Analysis of means and response graph for means

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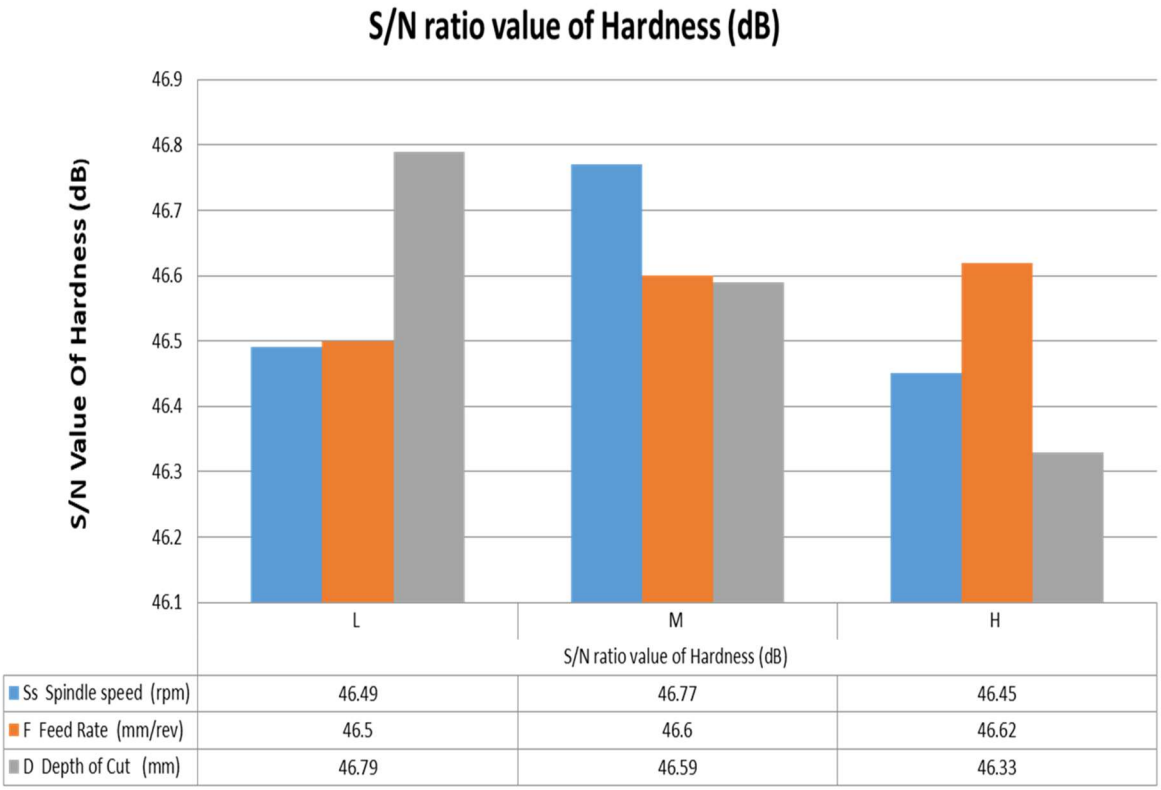

Fig. 3.2 S/N ratio value of hardness (db)

Mean of Response value (Hardness) = **235.48 BHN**
S/N ratio = **47.42 dB**
Predicted Result (By Taguchi Method)
Predicted Hardness = $Ss_2 + F_3 + D_1 - 2^* Y$
= 219.59 + 215.21 + 218.86 – (2 * 214.14) = 225.38 BHN
Predicted Hardness = **225.38 BHN**
Predicted S/N ratio = $Ss_2 + F_3 + D_1 - 2m$
= 46.78+ 46.62 + 46.79 – (2 * 46.57)
Predicted S/N ratio = **47.04 dB**
Predicted Mean of Response value (Hardness) = **225.38 BHN**
S/N ratio = **47.04 dB**

Table 3.1 **Confirmation of experiment**

Results	Actual Experimental Value	Prediction (Taguchi Method)
Level	Max. Hardness (BHN)	$Ss_2 + F_3 + D_1$ -2Y
Hardness (BHN)	**235.48**	**225.38**

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3. CONCLUSION

1. The thesis 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.
2. 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.

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