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Optimization of CNC Machining Parameters in Turning En 9 Steel Using Taguchi Method

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Abstract - Surface roughness is the significant important parameter in conventional machining. Optimizing this parameter is most challenging task in turning process. Industries are working more on reducing the rejection rate and improving the surface roughness. Better quality of the product can afford finest customer satisfaction. There is a neck to neck competition in the trade market which requires highly quality products at the lowest cost. The transformation of raw materials into finished goods result various kinds of products. Surface roughness says about the quality of machining and also about the quality of product. The materials which have good surface finish posses better property as compared to lower surface finish of that material .Industries across the world are struggling to overcome the problem of rejection rate. By reducing rejection rate and optimally utilization of machines and their working conditions, we can not only be able to produce good products but can also reduce the cost significantly. Industries are in need of working skills of machine tool operator for the selection of best cutting conditions. This helps not only in producing the product with less rejection rate, but also help in reducing the cost of the product.

***Key Words*:** Surface roughness, machining,, cost,

1.INTRODUCTION *(Size 11, Times New roman)*

This Metal cutting is the significant processes and broadly used manufacturing processes in mechanical industries (Yang et al., 1998) (Aggarwal et al, 2008). There is a neck to neck competition in the trade market which requires highly quality products at the lowest cost (Davis et al, 2013). Industries where the cost of raw material is a prominent cost of finished goods, higher productivity can be gained through correct selection and use of the materials. Surface finish is an significant factor in manufacturing engineering and it can control the performance of mechanical parts and the production costs (Valeraa et al, 2014).Surface roughness says about the quality of machining and also about the quality of product. The materials which have good surface finish posses better property as compared to lower surface finish of that material. Such surface roughness plays a very important role as one of the parameter in machining process.

Industries across the world are struggling to overcome the problem of rejection rate. By reducing rejection rate and optimally utilization of machines and their working conditions, we can not only able to produce good products but can also reduce the cost significantly. Industries are in need of working skills of machine tool operator for the selection of best cutting conditions. This helps not only in producing the product with less rejection rate, but also help in reducing the cost of the product. In machining industries it is regular practice to use hand book based traditional cutting conditions at the process planning level. The main drawback of this irrational practice is the diminishing factor in productivity due to sub optimal use of machining capability. The various literature reviews have highlighted that several researchers attempted to analyze the optimal cutting conditions in turning operations. The concept of maxima / minima of differential calculus used by Armarego and Brown help the industries to optimize machining variable in turning operation (Armarego et al, 1969) . Brewer and Rueda have introduced different monograms which help in the selection of optimum conditions. Few of the additional techniques that have been used to optimize the machining parameters include goal programming (Sundaram, 1978) and geometrical programming (Petropoulos, 1973). Precision and surface roughness of the product is the matter of more attention in the organizations now days. Surface roughness is the most significant criterion in determining the metal

removal rate of the material. Surface roughness and dimensional accuracy are the key factors needed to forecast the machining performances of any machining operation (Mital et al. 1988). Most of the surface roughness prediction models are empirical and they are generally based on experiments conducted in the laboratory. Also it is difficult in practice, to keep all factors under control as required to obtain the reproducible results (Luhervelt et al, 1988). Optimization of machining parameters increases the efficacy for machining economics and also increases the product quality to a larger extent (Azouzi et al, 1998).

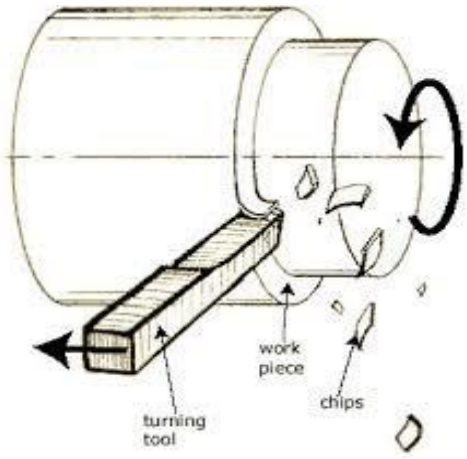

Fig 1.1: Turning Process Adapted from www.sinotech.com

2. CNC Turning center

Machine used for this experimental setup is CNC Turning center. Computer Numerical Control (CNC) is a machine in which the functions and motions of a machine tool are controlled by means of a set of program based on G and M code. CNC can organize the motions of the work-piece or tool, the other input parameters such as feed, depth of cut, speed, and the operations such as turning spindle on/off, turning coolant on/off. Experimental setup was carried out on CNC Lathe MCL12. This machine works on two X and Z direction along with spindle encoder feedback. Various programmes are designed by CAD/CAM on PC. Programme input and DNC online is executed from PC through RS232C interface. It has 4 station automatic tool turrets on which four tools can be mounted and used during the program

Table -1: Orthogonal array (a)

Exp. No	Variable 1	Variable 2	Variable 3	Variable 4
10	3	2	3	-

Table -1: Orthogonal array (b)

On the basis of various experiments and analysis carried out,

Exp. No	Variable 1	Variable 2	Variable 3	Variable 4
10	950	0.2	0.3	2.015 µm

3. Design Layout

Experiment is carried out under dry condition using CNC Lathe MCL12 which has maximum spindle speed of 2800 rpm. During the process three things were kept constant viz: cutting tool, machining condition i.e. dry and diameter of rod (EN8 steel). Experiment was carried out under tripartite parameters viz: cutting speed (rpm), feed (mm/rev) and depth of cut with their different levels which are three in numbers as given in the table below. Most of these range of various parameters used were selected in the light of data available in the text, machine technical data. Optimal value of surface roughness was measured to get the result, which was measured by SURFCOM FLEX machine with a sampling length of 30 mm.

4. Signal to Noise ratio (S/N)

The signal to noise ratio (S/N ratio) is used to calculate the proneness of the quality attribute which was being supervised in a controlled manner. Well known Taguchi method reveals that the term ‘signal' denotes the desirable effect (mean) for the output attribute whereas the term ‘noise' denotes the undesirable effect (signal disturbance, S.D) for the output attribute which has got impact of outcome because of exterior factors viz; noise factors.

Table -2 Cutting parameters

Factor	Cutting parameters	Level 1	Level 2	Level 3
N	Speed (rpm)	650	800	950
f	Feed (mm /rev)	0.1	0.2	0.3
d	Depth of Cut (mm)	0.2	0.4	0.6

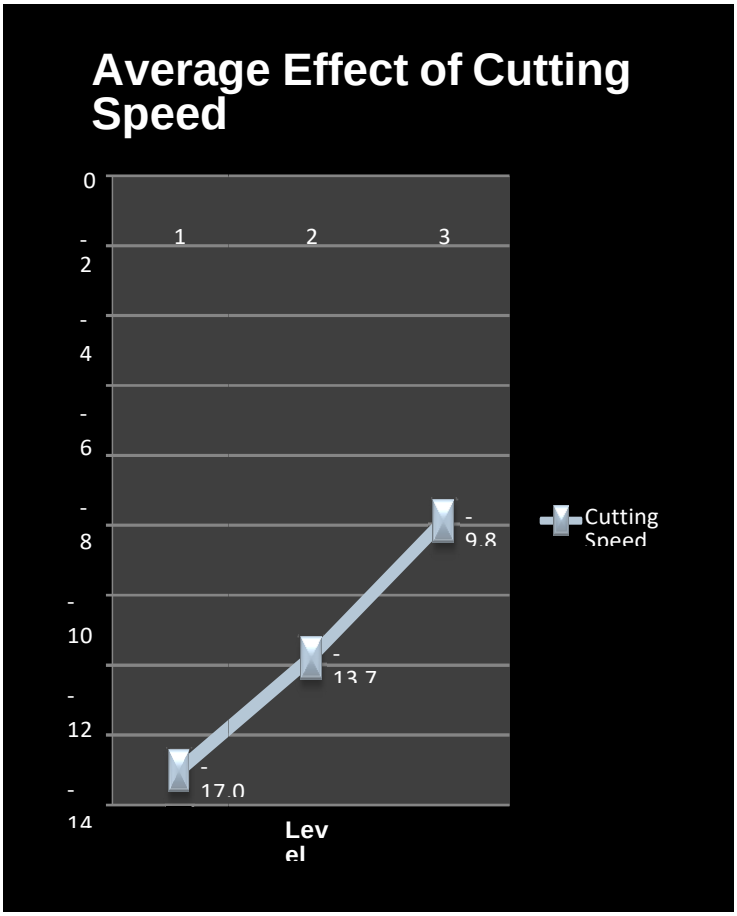

Fig.2 Average effect of cutting speed

following are the results that we have obtained.
We have plotted the graph between Mean S/N response and cutting speed (fig 2).
It has shown from the graph that on increasing the cutting speed there is various in the value of Mean S/N response value. We have received the maximum value of Mean S/N response when the cutting speed is at level 3 (950 rpm).

3. CONCLUSIONS

The optimum conditions are A3B2C3 i.e. Cutting speed at level 3 (950) , feed at level 2 (0.2), and depth of cut at level 3 (0.3).. The optimum surface roughness is 2.015 µm which is obtained after the confirmation test.

Earlier by using the combination A3B1C3 the surface roughness obtained was 2.148 µm. Thus after confirmation test and using optimum conditions A3B2C3 the surface roughness has been 0.133 µm (reduced by 6.19%).

REFERENCES

1. A.Mital, M.Mehta, “surface roughness Prediction models for fine turning”,International journal of production research 26 (1988) 1861-1876
2. Adem Çiçek ,Turgay Kıvak, Gürcan Samtaş (2012). Application of Taguchi Method for Surface Roughness and Roundness Error in Drilling of AISI 316 Stainless Steel. Strojniški vestnik - Journal of Mechanical Engineering 58(2012)3, 165-174
3. Aggarwal, A., Singh, H., Kumar, P., & Singh, M. (2008). Optimizing power consumption for CNC turned parts using response surface methodology and Taguchi's technique—a comparative analysis. Journal of materials processing technology, 200(1), 373-384.
4. Avinash A. Thakre (2013). Optimization of Milling Parameters for Minimizing Surface Roughness Using Taguchi‘s Approach. International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 6, June 2013
5. BalaRaju.J, Anup Kumar.J, Dayal Saran.P, Dr.C.S.Krishna Prasad Rao (2015). Application of Taguchi Technique for Identifying Optimum Surface Roughness in CNC end Milling Process. International Journal of Engineering Trends and Technology (IJETT) – Volume 21 Number 2 – March 2015
6. C.A.VanLuhervelt,T.H.CChilds,I.SJawahir,F.Klocke.P.K. Venuvinod.present situation & future trends modeling of machining operations.progress report of the CIRP Working group “Modelling of machining operations” Annalysis of the CIRP, 47/2(1998)587- 626
7. Davis, R., John, V., Lomga, V. K., & Horo, R. P. (2013). The Application of Taguchi’s Optimization Method in Wet Turning Operation of EN 19 Steel. International Journal of Mechanical & Production Engineering Research & Development (IJMPERD), 3(2).
8. Deepak Mahajan, Ravindra Tajane (2013). The Optimization of Surface Roughnessof Al 6061 using Taguchi Method in Ball Burnishing Process. International Journal of Scientific and Research Publications, Volume 3, Issue 10, October 2013 ISSN 2250-3153