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"A REVIEW ON OPTIMIZATION OF TURNING PROCESS PARAMETERS BY USING TAGUCHI METHOD"

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ABSTRACT

A common method to manufacture parts to a specific dimension involves the removal of excess material by machining operation with the help of cutting tool. Turning process is the one of the methods to remove material from cylindrical and non-cylindrical parts. In this work the relation between change in hardness caused on the material surface due the turning operation with respect to different machining parameters like spindle speed, feed and depth of cut have been investigated. Taguchi method has been used to plan the experiments and EN 8 metal selected as a work piece and coated carbide tool as a tool material in this work and hardness after turning has been measured on Rockwell scale. The obtained experimental data has been analyzed using signal to noise and. The main effects have been calculated and percentage contribution of various process parameters affecting hardness also determined.

Key Words: *EN 8 , Rockwell Scale, S/N ratio, Turing, Taguchi, Regression.*

I. INTRODUCTION

Machining is the most wide spread metal machining process in mechanical manufacturing industry. The goal of changing the geometry of raw material in order to form mechanical parts can be met by putting material together. Conventional machining is the one of the most important material method. Machining is a part of the manufacturing all most all metals products. In order to perform cutting operations, different machining tools such as lathes, drilling machine, horizontal and vertical milling machines etc. are utilizing. Out of this machining process, turning still remains most important operation used to shape metal, because in turning the condition of operation are most varied. Increasing productivity and reducing manufacturing cost has always been the primary object of successful business. In turning, higher values of cutting parameter offered opportunities for increasing productivity but it also involves greater risk of deterioration in surface quality and tool life. Turning operation is very important material removal process in modern industry. The study on the influence of hardness during machining has been going back to change. From the previous studied, it is evident that although researchers have tried to investigated the relation of surface roughness with different process parameters of different machining operations like drilling, milling etc. but there is a gap in determining of the exact affect of speed, feed and depth of cut on hardness of work piece in turning operation. Therefore this aspect has been selected in this research paper.

II. TAGUCHI METHOD

Taguchi method is a powerful tool for the design of high quality systems. It provides simple, efficient and systematic approach to optimize design for performance, quality and cost. Taguchi method is efficient method for designing

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process that operates consistently and optimally over a variety of conditions. Taguchi approach to design the of experiments easy to adopt and apply for users with limited knowledge of statics, hence gained wide popularity in the engineering and scientific community. The desired cutting parameters determined by handbook. Cutting parameter are reflected on surface roughness, surface texture and dimensional deviation on turned product. Taguchi method is especially suitable for industrial use but can also be used for scientific research.

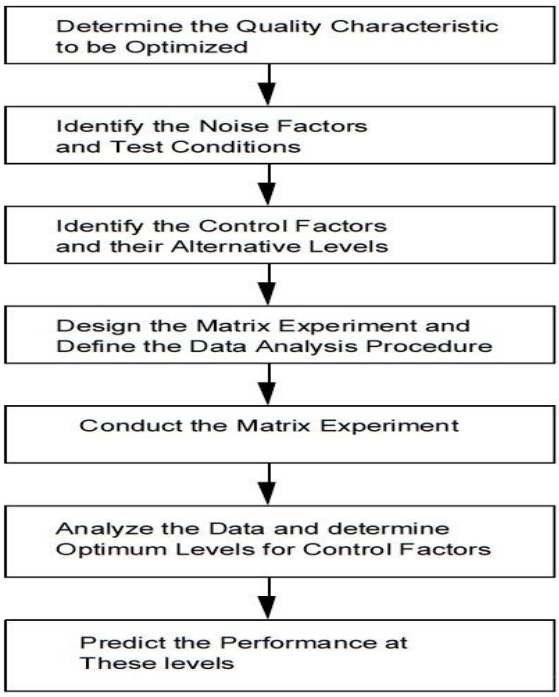

Figure 2.1 steps in Taguchi method

III. LITERATURE REVIEW

G. Akhtar, C.H. CheHaron and J.A. Ghaniet (2008) - In this paper it has been shown that design quality can be improved by improving quality and productivity in companywide activities. Taguchi's parameter design is a very important tool for ROBUST design, providing a simple and systematic approach to optimize a design for cost, performance and quality. The Taguchi optimization method is applied to optimize the cutting parameters in turns. [1]

Sijo M. T. and Biju. Ann (2010) - In this research paper the optimization method of Taguchi parameters is applied to cut parameters in bend. Turning parameters evaluated include cut velocity, feed rate, and depth of cut, radius of the tool's nose and stiffness of the material at each of two levels. The results of the analysis show that surface roughness of feed rate, cutting velocity and nasal radius have a less significant contribution to surface roughness at cut depth and material hardness.[2]

Dr. SS Chowdhary, SS Khedkar, N.B. Borkaret (2011) - The performance of manufactured products is often evaluated by several quality characteristics and reactions and experimental techniques. In the present investigation optimization model based on the Taguchi technique has been developed to optimize the process point parameters, such as speed, feed, depth of impact, and nose radius of a single point cutting tool. Taguchi's L9 orthogonal array is chosen for the experimental scheme. Experimental result analysis revealed that a combination of cutting speed, cut depth, and lower level of feed is required to achieve maximum, along with reducing material removal rate and surface roughness.[3]

AL. Arumugam and R. Ragothsingh (2013) - Turning is one of the common machining methods in manufacturing industry. Hardness of the material is the most significant property in the field of design to satisfy the safety and reliability. The main objective of this investigation is to analyse the changes in the hardness of material on the

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machined surface due to machining operation (turning) by considering the spindle speed, feed and depth of cut. EN353 forged steel was selected for the analysis to measure the hardness. The hardness was estimated using Rockwell hardness tester by varying the cutting parameters using Taguchi method.[4]

S.Sathiyaraj, A.Elanthiraiyan, G.Haripriya and V.Srikanth Pari (2015) - Surface roughness is one of the important parameter in conventional machining. Optimising these parameters is most challenging task in turning process. In this experiment we consider the parameters of alloy of steel to attain best surface finish. Here we undertake speed, feed and depth of cut as machining parameter. Taguchi method is further implemented to find the various levels of chosen parameter and thus using statistical analysis we find the optimum range of speed, feed and depth of cut to minimize the surface roughness and employed in working model for real time experiment. Here we use work material of EN8 steel and tungsten carbide tipped tool.[5]

Ankit Dogra, Hartaj Singh, Dharampal, Vishal Singh and Sunil Kumar (2016) - In this research the experiments were performed by using material specimens of EN8 to know the effect of different machining parameters on tool wear. The main objective of this study was to investigate the effect of cutting parameters and the work piece on the tool wear during a machining of EN8 material. The quality of work piece material is main contributing factor as spindle speed, depth of cut and feed rate which may be influence by tool wear through cutting operation. The experimental design was formed based on Taguchi's Technique. An orthogonal array L(3)9 and Analysis of Variance are employed to investigate the turning conditions and machining was done using coated tool.[6]

B.Suresh, Pon.Azhagiri, T.Senthil Kumar and B.Kumarakurubaran (2016) - The present paper is an experimental study to investigate the effect of cutting parameters (cutting speed, depth of cut and feed) surface roughness and material removal rate (MRR) during turning of EN8 steel. Turning experiments were conducted with cutting speeds: 1000,1250,1500 rpm , feeds: 0.1, 0.2, 0.3 mm/rev and depth oh cuts: 0.3, 0.4, 0.5 mm. The experimental layout was designed based on the Taguchi's analysis. Orthogonal array technique and analysis of variance (ANOVA) was performed to identify the effect of the cutting parameters on the response variables. Finally, the relationship between cutting parameters and the performance measures (machining time, surface roughness and material removal rate) were developed by using multiple regression analysis.[7]

P. G. Inamdar, N. S. Bagal, V. P. Patil, K. K. Bhosale and V. V. Mane (2017) - The main aim of this paper is to optimise the surface roughness in conventional turning operation using Taguchi Method for the material medium carbon steel EN8. In this work cutting speed, feed rate and depth of cut are taken as performance parameters to achieve better surface roughness. Taguchi Method is used to obtained the main parametric effect on the surface roughness using there levels and factors. L9 orthogonal array is used to design the experiments. Also analysis of variance (ANOVA) was carried out with the significance factor of 95%. After the experimentation, it was found that cutting speed has more influenced on the surface roughness in conventional turning process than feed rate and depth of cut.[8]

Digvijay kushwah and Ravi Ranjan (2017) - The surface finish is one of the prime necessities of clients, for machine parts. This investigation concentrates on improving turning parameters in view of Taguchi technique, to limit surface harshness. Tests have been directed utilizing the L27 orthogonal array in a lathe machine, hard turning of EN-8 steel, utilizing carbide tool in dry condition.The statistical methods of S/N ratio- 'smaller is better'- and the analysis of variance (ANOVA) were applied, to investigate the effects on spindle speed, feed rate and depth of cut on surface roughness. The depth of cut was recognized as the most influential process parameter for minimum surface roughness. [9]

Satish Kumar and Ravi Bishnoi (2019) - In the present work, Turning Parameters were optimized using Taguchi Method. Also, the effect of turning parameters such as rotational speed, feed rate, depth of cut and tool nose radius on surface roughness of high carbon steel was investigated. L8Taguchi's method was used for designing the experiments and optimization of turning parameters. Eight experiments were conducted with four factors having two levels for each factor. Results revealed that tool nose radius has a significant effect on surface roughness and it is the most dominating factor affecting the surface roughness with contribution of 99.58 %.[10]

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IV. CONCLUSION

In author work, the relationship between hardness and various process parameters namely spindle speed, feed rate and depth of cut was developed. Taguchi method has been adopted for the design of experiments and the results have been analyzed by maximize S/N ratio.

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