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A REVIEW OF PEELING OPERATION FOR AISI 202 STEEL WITH RESPONSE SURFACE METHOD

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ABSTRACT Bar peeling is a method which is used to remove oxide scale, mill scale, surface cracks etc. from hot rolled or forged blanks. During peeling operation, the bar is passed through a rotating peeling head, with a radial direction of cut. The influence of cutting parameters on surface roughness was analyzed for one insert and the influence of these parameters was obtained. There are many parameters that have an effect on surface roughness such as cutting speed, feed rate, and depth of cut are known to have a large impact on surface quality.

KEYWORDS Peeling; bright bar; cutting parameters; surface roughness; insert

I. INTRODUCTION

Bar peeling is a method, which is used to remove oxide scale, surface cracks, etc. from hot rolled and forged blanks. The size of blank can vary from 4 mm to over 400 mm in diameter. Compared with conventional turning bar peeling is a method of machining which provides high productivity and low production costs due to the shorter throughput times. He surface quality and dimensional tolerances are also high, which in turn leads to less machining at succeeding stages. During the peeling operation the bar is moved through a rotating peeling head, with a radial direction of cut. The peeling head in this case four cartridges, each with one to three insert which are all in contact with the bar. The inserts serve for roughing and finishing.

During the peeling operation the bars getting a helical pattern, "ringing", on their surface. So, more tolerance is to be provided on the peeled bars (around 0.1 – 0.5 mm). After peeling operation, the bars are taken on the center less grinding machines, at where the grinding is done on the bars to achieve the required size. This is done with the help of 3-4 grinding passes. So the operation cost is affected adversely.

II. WORKING PRINCIPLE OF PEELING PROCESS

In peeling process, first the black bar is fixed between jaws of input carriage manually and then it is fed to feed rolls. The feed rolls are driven through feed gear box, which is located on backside of the feed rolls. The feed roll gives linear feed to the bar. The bar then enters to the headstock where it passes through the rotating cutter head. The cutter head gets power and motion through gears and v-belt drive from cutter head gear box. Due to the rotating cutter head the bar is peeled off and gets the shape of bright bar. Then the bar moves further to output carriage. The bright bar is then once again fixed between the jaws of output carriage. The speed of the cutter head and feed of bar depends on the size and material of the black bar. The speed and feed are changed with hand lever manually. The machine is very simple in construction and quite similar to turning machine. It consists main 4 parts. Carriage, feed unit, head stock and power transmission system

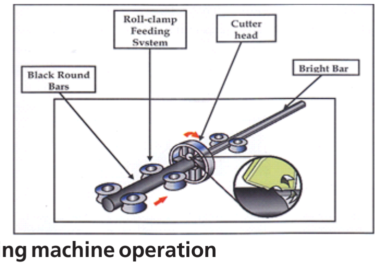

Fig 1. Peeling machine operation

Fig 2. Peeling machine

III. LITERATUREREVIEW

Hari Singh had optimized tool life of carbide inserts for turning parts using Taguchi's design of experiments approach, in which the results indicate that the selected process parameters significantly affect the mean and variance of the tool life of the carbide inserts. The contributions of parameters quantified in the S/N pooled ANOVA envisage that the relative power of feed (8.78%) in controlling variation and mean tool life is significantly smaller than that of the cutting speed (34.89%) and depth of cut (25.80%). The predicted optimum tool life is 20.19 min. The results have been validated by the confirmation experiments. **[1]**

A.Javant and V. Kumar had used the Taguchi optimization methodology, which is applied to optimize cutting parameters in turning when machining hardened steel AISI 4140 with carbide insert tool under semi-finishing and finishing conditions of high speed cutting on CNC lathe. The experiments carried out by' using L-27 (313) orthogonal array. The turning parameters evaluated are cutting speed, feed rate and depth of cut. An orthogonal array, signal-to-noise (S/N) ratio and Pareto analysis of variance (ANOVA) were employed to analyze The effect of these turning parameters on surface roughness.Main effects of process parameters on the quality characteristics have been analyzed and the results show that the optimum parameter setting for surface roughness obtained at a cutting speed of 200 m/min, feed rate 0.1 mm/rev and depth of cut 1.5 mm and the optimum parameter setting for force required was obtained at a cutting speed of 200 m/min, feed rate 0.1 mm/rev and depth of cut 1 mm Confirmation test with the optimal levels of cutting parameters were carried out in order to illustrate the effectiveness of Taguchi optimization method. Using Taguchi method for design of experiment (DOE), other significant effects, such as, the interaction among -turning parameters were also investigated. The selection criterion for parameters was based on out Puts of turning, namely, cutting force and surface roughness. And they concluded that optimum Parameter setting for better surface finish was obtained at a cutting speed o{ 200 m/min, feed rate 0.1 mm/rev and depth of cut i.5 mm. **[2]**

Krizbergs, J.; and Kromanis, A. has developed techniques to predict the surface roughness of a part to be machined. In their study all the surface parameters have been expressed in 3D parameters, like Sq, Ssk, Sa etc. 3D surface Parameters give more precise picture of the surface, therefore it is possible to evaluate more precise the surface parameters according to used machining technique' In the result of study, the mathematical models were developed, which may help technologists to understand more completely the process of forming surface roughness. This paper presents the surface roughness 3D parameters which can be used for more precise surface evaluation than 2D surface parameters, actually profile parameters **[3]**

Ty G. Dawson and Rhomas R. Kurfess have selected five different tool materials for full tool life tests at a range of reasonable cutting conditions. They tested a new tool geometry design which had a wiper on the nose radius of the tool that allowed improved surface finish. They derived one mathematical model to predict life of the selected tool. The model was tested against experimental data and they found that the model does an adequate job of capturing the effect of cutting speed and feed on tool life **[4]**

G. Akhyar, C.H.Che haron, J.A.Ghani have implement the taguchi optimization methodology to optimize cutting parameters in turning Ti-6%AL-4%V extra low interstitial with coated and uncoated cemented carbides tools under dry cutting condition and high cutting speed.the turning parameters evaluated are cutting speed of 55, 75, and 95 m/min, feed rate of 0.15, 0.25, and0.35 mm/rev, depth of cut of 0.10, 0.15 and 0.20 mm and tool grades of K313, KC9225 and KC5010, each at three levels. The analysis of results show that the optimal combination of parameters are at cutting speed of 75 m/min, feed rate of 0.15 mm/min, depth of cut of 0.10 mm and tool grade of KC9225. The cutting speed and tool grade have a significant effect on surface roughness are 0.000 and have a contribution are 47.146% and 38.881% respectively. At optimal condition contribution of each cutting parameter on surface roughness is reached at 20.47 from tool grade, 21.01 from feed rate, 11.54 from depth of cut and 11.17 from cutting speed.**[5]**

A.Al-Refaie, L.Al-Durgham, and N.Bat-This research proposes an approach for optimizing multiple responses in the Taguchi method using regression models and grey relational analysis. In this approach, each response is transformed into signal-to-noise (S/N) ratio. The S/N ratios are then utilized to model each response with process factors and complete the responses for all factor level combinations. The grey relational analysis is then used to combine the quality response at each experiment into a single grey grade. Typically, the larger grey grade indicates better performance. Thus, the factor level with the largest level grade is selected as the optimal level for that factor. Three case studies in manufacturing applications on the Taguchi method are utilized for illustration of the proposed approach. It is concluded that the proposed approach is efficient for finding global optimal factor levels. Moreover, this approach can be used with incomplete data. Finally, the regression models can be used to determine the process factors that significantly affect quality response. This research proposed an approach for optimizing multiple quality responses using the regression models and grey relational analysis. Three case studies were provided for illustration, in all of which the proposed approach was found efficient. As a result, this approach can be effectively utilized for optimizing multiple quality responses in a wide range of applications on the Taguchi method. This approach also is found efficient for determining the global optimal combination of factor levels. Future research will apply this approach for determining optimal factor levels with fuzzy outputs.**[6]**

IV. OBJECTIVE

1. To establish the best or the optimum condition for a product or a process,
2. To estimate the contribution of individual factors.
3. To eliminate the number of grinding pass and reduce the process cost under the optimum condition

V. EXPERIMENTAL SET UP

In this work input parameters considered for peeling machine are machining parameters. Output parameter is surface roughness. Other parameters are considered as constant parameters. Input parameters are cutting speed(m/rev), cutting feed(mm/rev), depth of cut(mm). and constant parameters are Inser(RNGH 2509 MOS50-R50), work piece material(SS 202), work piece diameter(25mm), cutting condition, cutting length(4m) and output parameter are surface roughness. So here for my experimental work, we have 3 factors each with different levels.
The description of SS 202 is as follow:

Material	Chemical Composition
SS-202	C-0.15%Max.
	Mn- 8-10%
	Cr – 17-19%
	Ni- 4-6%
	P-0.060%
	S-0.03%Max.
	Si-1% Max.
	Cu-1.5%Max.

Full factorial method is used for DOE.A design in which every setting of every factor appears with every setting of every other factor is a full factorial design.

Three-level full factorial design is used. The three-level design is written as a 3^k factorial design. It means that k factors are considered, each at 3 levels. This is a design that consists of three factors, each at three levels. It can be expressed as a 3 x 3 x 3 = 27.

Factors	Level 1	Level 2	Level 3
Cutting Speed (m/min)	24.976	60.633	66.916
Cutting Feed (mm/rev)	5.341	7.0986	8.6201
Depth of Cut(mm)	0.5	1.0	1.3

VI. FUTURE SCOPE

Here, we have selected three inserts having different grades and of same shape. But possible to select different inserts of different shape by changing/designing the cutter head to check the surface quality of bright bar. Force analysis can be carried out for further parametric analysis and its effect on surface quality. Surface finish prediction model can be prepared by Artificial Neural Network and it can be helpful to select the proper parameter to get required surface finish of the bright bar.

VIII. CONCLUSION

1. In the work, there are three different inserts are utilized to get the different surface qualities of the bright bar. Out of there inserts, one RNGH 2509 MOS50-R50 is selected based on the experimental data, in which it provides better surface quality compared to existing insert.

2. By selecting the new insert, one pass of grinding is eliminated entirely from peeling process. So it reduces the production time as well as the cost.

3. Parametric study shows the effect of different parameters i.e Speed, feed depth of cut etc. on the surface roughness.

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