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Optimization of Process Parameters in Turning and Threading Operation-A Review

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Abstract: In order to produce any product with desired quality by turning and threading, proper selection of process parameters are essential. Surface roughness is a measure to determine the quality of turned and threaded product. Critical parameters like speed, feed and depth of cut etc. are affect the surface finish. Optimization of boring process parameters is highly complex and time consuming. The results explained a sort of dynamic behaviour of both processes and the established the differences of the processes with the variation of their parameters.

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.

Turning is a form of machining or a material removal process which is used to create rotational parts by cutting away unwanted material. The turning process requires a turning machine or lathe, work piece, fixture, and cutting tool. The work piece is a piece of re-shaped material that is secured to the fixture, which itself is attached to the turning machine, and allowed to rotate at high speeds. The cutter is typically a single-point cutting tool that is also secured in the machine. The cutting tool feeds into the rotating work piece and cuts away material in the form of small chips to create the desire shape.

The threaded joint is one of the most adopted solutions for mechanical assemblies, since it leads to an assemblage with high mechanical strength and stiffness. In addition, threaded joints allow disassembly for means of maintenance and component exchanges. There are two main processes for manufacturing internal threads.

II. PROCESS PARAMETERS

The quality of the boring process depends on the following parameters

A. Speed

Speed always refers to the spindle and the work piece. When it is stated in revolutions per minute (rpm) it tells their rotating speed. But the important feature for a particular boring
operation is the surface speed, or the speed at which the work piece material is moving
past the cutting tool. It is simply the product of the rotating speed times the circumference of the work piece before the cut is started. It is expressed in meter per minute (m/min), and it refers only to the work piece. Every different diameter on a work piece will have a different cutting speed, even though the rotating speed remains the same. $v = \frac{\pi DN}{1000}$ *m/min*

Here, *v* is the cutting speed in turning, *D*is the initial diameter of the work piece in mm, and *N* is the spindle speed in RPM.

B. Feed

Feed always refers to the cutting tool, and it is the rate at which the tool advances along its cutting path. On most power-fed lathes, the feed rate is directly related to the spindle speed and is expressed in mm (of tool advance) per revolution (of the spindle), or mm/rev.

.min 1 $m\ F = f\ N\ mm -$ Here, $m\ F$ is the feed in mm per minute, *f* is the feed in mm/rev and *N* is the spindle speed in RPM.

C. Depth of Cut

Depth of cut is practically self-explanatory. It is the thickness of the layer being removed (in a single pass) from the work piece or the distance from the uncut surface of the work to the cut surface, expressed in mm. It is important to note, though, that the diameter of the work piece is reduced by two times the depth of cut because this layer is being removed from both sides of the work. d $cut = \frac{D-d}{2}$ mm

III. LITERATURE REVIEW

1) Prashant D. Kamble, is concluded that increased cutting speeds (Vc) resulted in decreased cutting tool forces and machined surface temperatures. Tool wear resulted in increased cutting tool forces and machined surface temperature. The formation of built-up layers in metal cutting processes is very common with a variety of layers formed having different compositions and effectiveness in reducing cutting tool wear.
2) Jiya Jonathan Yisa, all concluded that Considering the various cutting conditions applied in this experiment, it is observed and consequently concluded that the cutting speed (mm/min), feed rate (mm/rev) and depth of cut (mm) have a significant influence on the tool life of the cutting tool used (HSS) and surface finish of the work piece (mild steel). When a smooth finish is to be achieved, machining with high cutting speed and spindle speed has positive effect on surface roughness as against feed rate if the turning operation is the final step in the production process.
3) M. B. Da Silva, all investigated that considering the general behaviour of the dynamic forces in the time domain, the form tap process presents higher low frequency (quasi-static) vibration in relation to the form process, as it was verified in the literature. On the other hand, the behaviour in higher frequencies has no such differences in global values. Considering the speed variation, the form tapping process vibration presented more influence with the cutting speed, indicating higher force amplitude with the speed increasing.
4) PANKAJ KUMAR SAHU, all is concluded that the harder the work material, the slower the cutting speed. The softer the work material the faster the recommended cutting speed. The harder the cutting tool material, the faster the cutting speed. The softer the cutting tool material the slower the recommended cutting speed. If the cutting speed is too slow than a lot of time is wasted during the machine process but if the cutting is too fast than also time is wasted in replacing or regrinding the cutters so the process should be carried out with an optimum cutting speed.
5) Yash R. Bhoyar, all investigated that Tool wear resulted in increased cutting tool forces and machined surface temperature. Force has been found to be an important variable in the generation of surface temperature. Increasing the rake angle in positive section caused the decrease of the cutting force. On the other hand, increasing the rake angle in negative section increases the cutting force.
6) Balamuruga Mohan Raj. G, all investigated three cutting speeds, three feed rates and three depth of cuts were used in turning and threading operation. Finally the Gaussian Process regression model has been developed to predict the surface roughness based on tool post vibration and cutting conditions. The developed Gaussian model was used in predicting surface roughness for various cutting conditions with tool post vibration signal. The developed prediction system was found to be capable of accurate surface roughness prediction.
7) S. Jindal , all suggested that The result shows that both two parameters have their effect on the measured cutting forces. The effect of rake angle is more than spindle speed. As rake angle of tool vary, cutting force value also vary due to change in contact area of work piece and tool. There is less effect of spindle speed on cutting force as the increase in spindle speed leads to a very less increment in cutting force.
8) L Vamsi Krishna Reddy, all suggested via experiment the results obtained in this study lead to conclusions for turning of EN 24 after conducting the experiments and analysing the resulting data. From the results obtained by experiment, the influence of surface roughness (Ra) is depend on feed and next is followed by speed and depth of cut. Taguchi method is applied for optimization of cutting parameters.
9) Amol Y. Chaudhari, all investigated that in literature review summary we found that the researchers had taken spindle speed, feed rate and depth of cut as input turning and in some cases turning environment, tool tip temperature and cutting tool nose radius. Material Removal Rate, Surface Roughness and cutting tool wear as output parameters. After studying the above literature review inferences can be concluded that for Material Removal Rate the most significant parameters were depth of cut, feed rate and spindle speed. The least significant parameter was cutting tool nose radius. Whereas feed rate was most significant parameter for surface roughness followed by depth of cut. For cutting tool flank wear speed, depth of cut and feed rate were

significant factors. We also found that taguchi gives systematic approach and efficient method for the optimum operating conditions.

10) Shreyas Kulkarni, all concluded that internal threading is important aspect in various operations. But many times it is difficult to thread cut the internal surfaces especially when the size of job is small (less than 5 mm).Hence if the small thread attachment is attached to the lathe machine in place of tailstock, then the internal threading can be done precisely. But it is needed to mount the attachment in lace of the tail stock. Hence the precise threads are produced and the productivity is increased. Following are the main points that concluded from the work .The small thread cutting can be done precisely. The production rate can be increased.

IV. CONCLUSION

From the above review it is concluded that speed, feed and depth of cut are most significant parameters. Optimizing these parameters gives better surface finish considering the various cutting conditions applied in this experiment, it is observed and consequently concluded that the cutting speed (mm/min), feed rate (mm/rev) and depth of cut (mm) have a significant influence on the tool life.

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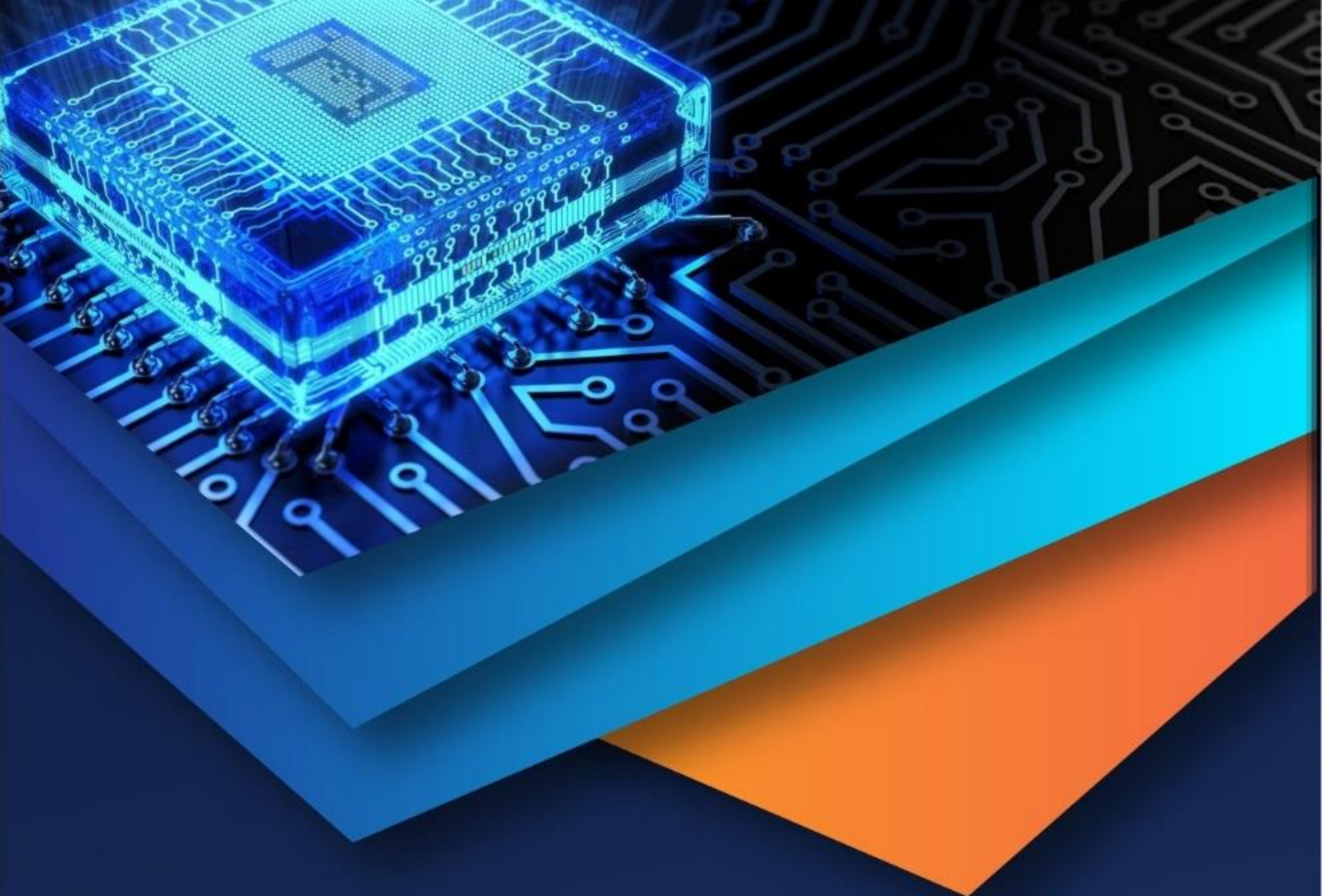

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