To Study Effect of Some of the Performance Parameters, During Turning of AISI4340 Alloy Steel in Dry and Wet Environment: A Review

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Abstract—This review paper outlines an optimization of turning process. As alloy steel has crucial importance in manufacturing industry. AISI4340 material is taken into consideration by some of researchers for investigation. The present paper focuses on achieving high quality, in term of component accuracy, surface finish, high production rate and increase the product life with lesser environmental impact.

Index Terms—Alloy steel, MRR, Optimization, Surface Roughness, CNC Turning, Tool Inserts

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I. INTRODUCTION

In manufacturing processes Machining is the most important Phenomenon. Machining is process of producing work piece by removing unwanted material from block of metal in the form of chips. This process is important since almost all the products get their final shape and size by metal removal. Machining offers important benefits such as excellent dimensional tolerances, external and internal geometrical features, surface finish, Removal of heat treat distortion. Machining efficiency is improved by reducing the machining time with high speed machining. Increase in productivity of newer and newer cutting tools with respect to material and designs can be done by machining.

Cutting force and chip reduction coefficient is the important index of machinability as it determines the power consumption and amount of energy invested in machining actions. It is primarily influenced by process parameters like cutting speed, feed and depth of cut.

The challenge of modern machining industries is mainly focused on the achievement of high quality, in term of work dimensional accuracy, surface finish. Surface texture is concerned with the geometric irregularities. The quality of a surface is significantly important factor in estimating the productivity of machine tool and machined parts. The surface roughness of machined parts is a significant effects on some functional attributes of parts, such as, contact causing surface friction, wearing, light reflection, ability of distributing and also holding a lubricant, load bearing capacity, coating and resisting fatigue. In manufacturing industries, manufacturers attentive on the quality and Productivity of the product. Thus there is need to achieve optimum parameters which will control the process effectively.

II. LITERATURE REVIEW:

A considerable number of studies have investigated the general effects of the speed, feed, and depth of cut, nose radius and others on the surface roughness, material removal rate and tool wear. These studies have been briefly discussed for the variations observed experimentally.

Rahul Davis et al. [1] investigates that, Analysis of Variance (ANOVA) and Signal-to-Noise (SN) ratio and were used to analyze the performance characteristics in turning operation The results depict that Spindle speed followed by feed and depth of cut was the combination of the optimal levels of factors that significantly affects the mean and variance of the tool life of the carbide cutting tool and gives the optimum tool life. The results have been validated by The confirmation experiments. The Future implications for manufacturers in regard to optimization of tool life are discussed.

E .Koorapati et al. [2] have investigated the surface roughness produced during hard turning of hard chrome plated surfaces with various cutting inserts. The optimization of the surface roughness was carried out with Taguchi's Design of Experimentation technique. The results of the experimentations revealed that the hard turning operation can be extended to the hard chrome plated surfaces.

Krishankant et al.[3] performed experiment on "Application of Taguchi Method for Optimizing Turning Process by the effects of Machining Parameters". They have explored that Taguchi method is a good method for optimization of various machining parameters as it reduces the number of experiments. So in this project the turning of AISI4340 (EN24) steel is done in order to optimize the turning process parameters for maximizing the material removal rate.

Hari Singh et al. [4] have found in this paper is to obtain an optimal setting of turning process parameters (cutting speed, feed rate and depth of cut) resulting in an optimal value of the feed force when machining AISI4340 (EN24) steel with TiC-coated tungsten-carbide inserts. The results indicate that the selected process parameters significantly affect the selected machining characteristics.

V. SureshBabu et al. [5] found that The effect of process parameters with the output variable were predicted which indicates that the highest cutting speed has significant role in producing least surface roughness followed by feed and depth of cut. The optimized parameters are verified and validated through a validation experiment, which concurs with the predicted optimal value in the design of experiment and also inline to the previous researches.

R. Kumar et al. [6] have investigated that the effects of input parameters such as speed (rpm), feed (mm/rev), depth of cut (mm)and nose radius (mm) on output parameter such as material removal rate and surface roughness. Equal weightage has been assigned to all input Parameter and a (Multi attribute decision making) MADM approach then performed to find out the best result.

M. Adinarayana et al. [7] investigated the influence of spindle speed, feed rate, and depth of cut were studied as process parameters. The experiments have been conducted using full factorial design in the design of experiments (DOE) on a conventional lathe. A Model has been developed using regression technique. The optimal cutting parameters for minimum surface roughness, maximum MRR and minimum power consumption were obtained using Taguchi technique.

M. Korat et al. [8] performed experiment on "Optimization of Different Machining Parameters of (AISI4340) EN24 Alloy Steel in CNC Turning by Use of Taguchi Method". They have investigated effects of cutting parameters on surface finish and MRR of EN24/AISI4340 work material by employing Taguchi techniques. Thus, it is possible to increase machine utilization and decrease production cost in an automated manufacturing environment.

Hari Singh. [9] have investigated that the selected process parameters significantly affect the mean and variance of the tool life of the carbide inserts. The percent contributions of parameters as quantified in the S/N pooled ANOVA investigated 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

Miroslav et al. [10] have explored the effects of cutting parameters on the cutting force components were experimentally investigated. Experimentation was conducted as per Taguchi's orthogonal array. Based on the analysis, the optimal cutting parameter settings were determined.

M. A. Sulaiman et al. [11] discussed tool-wear behavior of various cutting-speed values (high speed range) on the tool life of the cutting tools, specifically in finishing titanium alloy. In this work, the Sandvik uncoated carbide insert, CNGG 120408-SGF-H13A was used as a cutting tool in high-speed turning of titanium alloy Ti-6Al-4V ELI (extra-low interstitial) with hardness of 32 HRC. The experiments were performed under flooded coolant condition using water-based mineral-oil. By relating the machine operations and the tool life curves obtained using flank wear data, the wear behavior of uncoated carbide was described.

M.A. Sulaiman et al. [12] studied the wear behavior of uncoated carbide tools based on the flank wear data. The 80˚ diamond shape insert uncoated carbide tool was used in turning titanium alloy Meanwhile the experiment was performed under dry cutting condition at various cutting speeds 15, 25, 35 and 45 m/min . The feed rates were used at 0.02 and 0.04 mm/rev, meanwhile depth of cut was kept constant at 0.5 mm. The experiment's result showed that the flank wear increased with the cutting speed and feed rate. The flank wear occurs gradually at beginning of machining and at the end of failure when reached 0.3 mm where flank wear occurs.

R.F. Avila, A.M. Abrao [13] in their work, the performance of three types of cutting fluids were compared to dry cutting when continuous turning hardened AISI 4340 steel using mixed alumina inserts. The parameters they gone through are tool life, surface finish, and chip form. They found that when finish cutting at high cutting speeds, the use of cutting fluid is responsible for reducing the scatter in the surface roughness value.

M. Nalbantet. al. [14] have taken orthogonal array, the signal-to-noise ratio, and analysis of variance for study the performance characteristics in turning operations of AISI 1030 steel bars using TiN coated tools. They took three parameters nose radius, feed rate and depth of cut for optimized the surface roughness. L9 orthogonal array was used for the study. They found that for surface roughness the percentage contributions of insert radius, feed rate and depth of cut are 48.54, 46.95 and 3.39, respectively.

Suleiman Abdul kareemet. al. [15] have investigated of the influence of the three most important machining parameters of depth of cut, feed rate and spindle speed on surface roughness during turning of AISI 1045. Box Behnken experimental design method as well as analysis of variance (ANOVA) is used to analyze the influence of machining parameters on surface roughness height Ra. From the experiments they concluded that the feed rate is found to be the most important parameter effecting Ra, followed by cutting speed while spindle speed has the least effect. They also found that machining with high cutting speed and spindle speed has positive effect on Raas against feed rate.

According To **R. Suresh et al.[16]** The feed rate has highest physical as well statistical influence on the machining force to perform the machining operation followed by depth of cut and cutting speed Machining force initially increases with increase in feed rate and depth of cut and decreases with increase in cutting speed. The cutting speed has highest influence on the tool wear and feed rate and then depth of cut .

III. CONCLUSION

From the above literature review it is found that most of the researcher have taken input parameters (controllable factors): speed, feed and depth of cut and only few researcher taken input parameter: nose radius, environment and output parameters: Surface roughness for turning few researcher taken output parameter: material removal rate ,surface roughness. From the literature review, it is observed that less research work has been seen for CNC Turning by use of different cutting tool geometry and very less work has been reported using coated and uncoated cutting tool square geometry. Researchers have used different methods for optimization. Also very less work has been done considering the parameter chip reduction coefficient. Thus there is need to find optimum conditions considering influence of cutting environment i.e. dry or wet and coated and uncoated tool inserts.

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