International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 12 Issue 7, July-2023, Impact Factor: 7.957

Investigation on Metal Removal Rate by Changing Various Parameters like RPM, Feed, Depth of Cut on Mild Steel by Taguchi Method

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ABSTRACT

In a manufacturing industry lead time is very crucial fact to maintain to survive in the competitive market in today's era. Manufacturing industries can achieve maximum productivity by reducing lead time. Using latest technologies and advance machining process industries are constantly trying to reduce cost of cutting operation, wastage of material which ultimately leads to improve productivity and quality industry. The objective of this paper is to seek out the optimum machining parameters thus on minimize the input of the resources and to maximize the output of the process. The present work involved an experimental study of turning on alloy steel of ISI875-15C8 grade Over the years the demands of economic competition have Motivated a lot of research in the field of metal cutting leading to the evolution of new tool materials of remarkable performance and vast potential for an impressive increase in productivity. In actual practice, there are various parameters like tool material, rake angle cutting edge geometry, work piece material, cutting speed, feed and depth of cut which affect these factors. So it is essential to choose the most suitable machining condition in order to improve cutting efficiency. In turning operation, material removal rate is key aspect, which has need of attention both from industry as well as researcher. In recent industry one of the trends is to manufacture low cost, high quality production less time. On the other hand, material removal rate is another main factor that greatly affects production rate and cost. The purpose of this research work is to find the influence of cutting parameters on material removal rate in turning operation. This paper presents a Taguchi's L9 orthogonal array for the optimization of the material removal rate for turning operation of mild steel as work piece material by high speed steel as tool material. ANOVA (Analysis of variance) is used to find the most and least significant parameters.

INTRODUCTION

In today's time it is very important to find a material which provide us best machinability and better quality of product .So this thesis is totally focus on the work by which we get a various parameters due to which we get material having better machinability and better final product. The important task of this research is getting best performance of machined material by selecting the best parameter of turning operation Over the last few year competition in market rises so researchers focus on evolution of new tool materials of better performance and vast potential for an impressive increase in productivity.

In true practice, various parameters like material of tool , cutting edge ,rake angle, geometry, speed of cutting of tool , cut length ,work piece material, and feed which affect these factors. So it's very significant to identify the most appropriate machining condition for improving cutting efficiency. In turning operation, rate of material removal is very important factor, which has need of attention both from industry as well as researcher. In recent industry one of the trends is to manufacture low cost, high quality production less time. On other hand, material removal rate is another important factor that directly affects production rate and cost. The purpose of this research work is to discover the cutting parameters effect of on Rate of removal of material in turning operation. Statistical design of experiment defines as the method of planning the experimental so that the best data can be resolute by arithmetical methods, resulting a in valid and reliable outcome.

The purpose of this research work is to discover the cutting parameters effect of on Rate of removal of material in turning operation. Statistical design of experiment defines as the method of planning the experimental data so that the best data can be getting through the arithmetical methods, resulting a in good and required outcome. By getting different values of cutting speed RPM and Depth of cut, we get a desired value which we need to increase the productivity and decrease the wastage of raw material. Taguchi's L9 orthogonal array used for the optimization of material removal rate during turning operation

Objectives of Present Work

The Purpose of this study is to discover the best machining constraints that can minimize the contribution of the resources (i.e. Input) and give maximum output from the process. This research paper include an investigational study of turning process on alloy steel material of gradecISI875-15C8 . In turning operation, material removal rate is a notable factor, which has need of attention both from industry as well as researcher. In recent industry one of the trends is to manufacture less cost, high quality production less time. On the other side, material removal rate is another main factor that greatly affects production rate and cost. The purpose of this study is to treasure the influence on how material removal rate effected relative to cutting parameters using turning process that the proper data can be analyzed by statistical methods and get better and reliable result .Tool wear cause an imminent occurrence in any machining process. Wear affects tool life and product quality. Hence, enhancements must to be done just to to escalate tool life. Surface finish's also an important aspect of a machined product.

a) To study tool wear effect due to parameters of machining like feed, speed, and depth of cut
b) To examine surface roughness of machining material effect due to machining parameters like feed, speed and depth of cut
c) To determine the optimal machining constraint sceneries for the tool and material to be machined or work piece combination in order to mineralize the surface unevenness and tool wear
d) To develop an empirical of model to find Roughness value and minimum Tool Wear for the selected tool & work grouping within the specified domain of parameters.

Metal cutting process forms the base of engineering industry and it is also involved directly or indirectly in the manufacture of nearly the every product of oalsour modern civilization. In order to find the full potential of any metal cutting operation, cutting tools are the important element.

LITERATURE SURVEY

This chapter cover the published work on the research of the turning processes done the mild steel in order to get the optimized parameter .Specifically , This chapter provide the information related to all about turning operations done onn materials and focus on the responses on the surface methods .The surface finish of products are measured in terms of a parameter which is known as surface roughness. It is also considered as an index of product quality . Better surface finish may bring about improved strength properties of material such as resistance to corrosion, resistance to temperature, and higher fatigue life of the machined surface . In addition to strength properties, surface finish may affect the functional behaviour of machined parts too, as in friction, light reflective properties, heat transmission, ability of distributing and holding a lubricant etc.

Production costs is also affected by surface finish

The Turning Operation

The operation of turning is a fundamental metal machining operation that is pre-owned widely in industries which deals with metal cutting .In this process material is removed from outer side of the work piece. It is used to reduce the work piece diameter up to a required size, mostly turning operation done to create different diameter wok piece. Turning operation applies on round work pies and often this process known as external material removal process. Cutting tool is placed parallel to the machining part. but in tapper turning operation process tool is place at an angle to the axis of the workpiece .Multiple tool setup also be used in turning operations

In this operation, tool having single point cutting with high-precision is rigidly grasp in tool post and fed p a rotating metal to be machined or work piece in a path which is firmly parallel to axis of rotation of work piece metal to be machined or work piece, at a constant rate, and the material which is not desired have removed as the form of the chips rising as a cylindrical and more –complex profile [12,13].

The operation is performed in a Lathe _Machine which can operate either manually under supervision, or can be controlled by computer program. Turning operation can consist mainly two types of motion. 1st is the cutting motion which is the circular nod of the work and another one is the feed motion which is the linear nod given to the tool.

Machining Parameters
Geometry factors and the machining factors are the parameters that governed the turning operation. Feed speed and depth of the cut are three basic adjustable machining constraints in a fundamental turning operation are studied here.

These three parameters are shown in Fig 4 Materials removal is acheived by the amalgum of these three constraints. Other input factors that affects the output of parameters are tool wear and roughness of surface also exist, but they can be modified easily by the operator during the operation .

METHODOLOGY

Mild steel is very common and useful material in present day so we are using mild steel as a material to be machined .Cylindrical shape specimen is used with size of work piece taken for machining is 50 mm as adiameter and 40 mm in lengths. Material removal rate was calculated using Eq.

For all the experimental conditions. Where W1 and W2 represent as the whole weight of work piece before maching and after machining respectively (grams), q represent density of material which is machined in (gm/cc), t is the time of machining in minutes. Density .of Mild Steel Is 7.85 g/ccIn conventional experimental design approaches which are difficult to used due to its complex form, so by changing machining parameter large number of experiments are carried out. And those factors can be determined and checked with best laboratory conditions. So Taguchi method help to solve these problem because these methods are useful in decreasing number of experiments by using orthogonal array which tries to minimize effects of the factors out of control.

Cutting Speed
Cutting speed is expressed as the degree at which the uncut surface, of the work part permits the cutting tool . It is usually mentioned to speed of surface and is ordinarily shown by unit m/min, however ft./min is also used as an unit which is acceptable . Cutting speed has to be defined as the spindle speed of the machine .

Insert Material
Thrcoated carbide tool (Kennametal make) is used as tool insert whose characteristics are shown below. Uncoated carbide tools carry out better than the coated ones [11].

Experimental Setup and Initial Preparation
A CNC machine was used to carry out the machining. The insert was clamped in a holder and mounted on the tool post.

The job was held rigidly by the chuck of the lathe. Centre drilling was done and the job was held at the other end by the tail stock and a skin pass was carried out. The setup was thus through going and the runs might be approved out from here

MATERIALS AND METHODS

Work Material
The work part used for the concluded experiment was AISI 202 grade Austenitic stainless steel. Steel can be made into plates, coils and sheet and finds extensive use in equipment of restaurants utensils for cooking , sinks, automotive trims, applications of architectural such as doors and windows, railways cars, trailers, horse clamps etc.

Material taken for the machining Operation is Mild steel. Reason for taking Mild steel are as follows:

a) Mild steel is widely used in today's industries
b) Due to its good machining ability.
c) Due to Presence of less percentage of carbon
d) It is soft and offer good ductility property
e) Tough but has low wear resistance
f) Can be easily welded

Mild Steel has a tensile strength of 395 N/ square mm and its hardness is about 118 BHN Mild steel is used for making Camshaft , sheets crankshafts connecting rod and strip of blades, welded tubing , forgings , Drag line , Railway Axil , Valve etc

RESULT AND DISCUSSIONS

Experimental Results

As the various changes done in various parameter like feed RPM depth of cut, decrease the time of material and increase the rate of material removal as shown in figure. Various parameter or
data which we get from the machine are shown in table below

Table 4.1: Results Obtained

S.No	RPM	FEED RATE	DEPTH OF CUT (RADIAL)	TIME (SECOND)	MATERIAL REMOVAL RATE (mm3/min)
1	800	0.05	0.2	44	1215
2	900	0.07	0.3	29	3430.1
3	1000	0.09	0.5	21	10181.8
4	1200	0.11	0.7	16	19138.7
5	1400	0.13	0.9	15	25510.2
6	1600	0.15	1.0	14	42622.9
`7	1800	0.17	1.2	13	58823.5

CONLUSION

After analysis of the input data of rake angles and feed rates with constant spindle speed, it is clear that maximum rate of removal of material is obtained at 6 degree of rake angle is 0.10 mm/rev of feed rate. Also we observed from the table-5 feed rate increase directly increase the rate of material removal rate, but with increase in rake angle for same feed rate the MRR decreases. So for Material Removal Rate the contribution of the feed rate is more than the rake Angle In this work, Investigation done on rate of removal of material and time at which material removed from mild steel having changes different parameter like RPM , feed rate , depth of cut is done on CNC Machine . The conclusions we get from this research work are as follows:

1. Rate of removal of material can be increased by increasing RPM, feed rate and depth of cuts.
2. After a extent of time increase in these factor disturb the surface roughness value
3. Time of materials removal decreases as the RPM increases but at a point increase in parameter does not affects the time.
4. Initially continuous chips formed but as the feed rates and depth of cut increases, continuous chips changes to discontinuous chips
5. As the RPM increase after 1400 colour of chips changes to blue colour

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