Optimization of Material Aisi-316 by Milling Parameters

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***Abstract*- Manufacturing industries try to make high great products at decrease price to remain competitive within the market. The merchandise can be made the use of numerous production methods, including machining, etc. Milling is many of the most common machining processes used to make planar surfaces with faster material elimination and good floor first-rate. The vital objective of the technology of steel reducing is the solution of realistic issues associated with the green and particular removal of metal from work piece. It has been diagnosed that the dependable quantitative predictions of the numerous technological overall performance measures, preferably in the form of equations, are critical to broaden optimization techniques for deciding on slicing situations in procedure making plans. In this thesis experiments conducted to improve the floor end pleasant of AISI-316 work piece by way of the use of HSS and by using Taguchi"s approach including QA8 orthogonal array. The test results were analyzed using smaller-the-better criteria for Signal-to-Noise ratio in order to optimize the process. The experimental results were analyzed, conformed and successfully used to achieve good surface finish on work piece materials.**

Index Terms- QA8 orthogonal array, smaller-the-better criteria, Signal-to-Noise ratio, HSS.

1. INTRODUCTION

For present this work AISI-316 alloy of steel is used as a material and face milling as a process for study. Design of experiments is done using the response surface methodology which is based on face centered second order central composite design (CCD). In the past many researcher Optimization of AISI-316 Material made attempt the study on optimizing process parameters for increasing tool life, minimum cutting forces, power with different coolant and different tools. Also the work is done on milling machine. Researchers mainly used the Taguchi method for design of experiments and grey relational analysis for optimization. But this research paper is mainly focused on dry operation and wet operation of AISI-316 alloy stainless steel on the milling machine (without heat treatment of the material and study the effect of spindle speed, feed rate, and depth of cut on the surface roughness and material removal rate (MRR) Response surface methodology is used to develop mathematical modeling .

Optimization has been attempted for surface roughness and material removal rate for combination of process parameters spindle

2. PROBLEM STATEMENT

As per the requirement in industry, customer demands better quality with minimum cost to increases productivity. In automotive industry, they required a metal that can withstand the certain conditions at the low cost of manufacturing process. In order to meet such condition satisfactorily, a material of a soft and tough nature should be employed something that possesses strength and resistance to wear, and still conforms to standard practice of design regarding the proportions of part. Such problem have come and have to be met by the manufacturer, they constitute the problem of casehardening. It is not a new subject it is not well understood and not always easy to control.

The result from this experiment will be validate to get the optimum time with the greater hardness can achieve without changing the specimen to brittle material. This will help manufacture to estimate the optimum time for process can be done in order to get high quality material at the minimum cost.

3. OBJECTIVE

1. To find out the effect of process parameters viz. spindle speed, feed rate, depth of cut on the surface roughness and material removal rate.

2. To develop the mathematical model for surface roughness and material removal rate for predicting the value of response.
3. To find out which process parameters are more significant and which is less significant to affect the
4. Material removal rate and surface roughness.
5. To identify the non- significant parameters to be removed from mathematical model.
6. Optimize the process parameters for minimum surface roughness and maximum material removal rate.

AISI316	C	Cr	Ni	Mn	Si	Mo	P
%OFMATERIAL	0.0180	16.9280	9.580	0.6020	0.3644	0.2898	0.0015

4. METHODOLOGY

4.1 Selection of Material:-
AISI316 steel is an alloy of stainless steel which has high degree of hardness with compressive strength and abrasion resistance. It is usually supplied in the annealed and machinable condition

4.2 Selection of Tool:-
High speed steel tool will be using for optimization of material AISI-316.

4.3 Selection of Machine:
Universal milling machine will be using for analysis current experiment of material AISI- 316

4. 4 Selection of Software:-
MINITAB software has been using for optimization of material AISI-316 by parameters

4.5 Parameters:-
In our project optimization of high speed face milling parameters of AISI-316 alloy steel material we are selected input parameters as depth of cut, feed rate and speed rate. And output parameters as Surface Roughness (Ra) and Material Removal Rate (MRR).

4.5.1 Input Parameters:-
1. Depth of Cut:-
Depth of cut is the distance that the tool bit moves into the work, usually measured in thousandths of an inch or in millimeters. General machine practice is to use a depth of cut up to five times the rate of feed

2. Feed Rate:-
It is defined as a distance the tool travels during one revolution of the part. Cutting speed and feed determines the surface finish, power requirements and material removal rate.

3. Speed Rate:-
It is defined as a speed at which the work moves with respect to the tool (usually measured in feed/min) .

4.5.2 Output Parameters:-
1. Surface Roughness:-
It is defined as the shorter frequency of real surface relative to the troughs The Surface roughness (SR) of the work piece is measured in terms of (Ra) by using Surface Roughness Tester.

2. Material Removal Rate:-
It can be defined as a volume of material removed divided by the machining time.

4.6 Design of Experiment:-
The process of planning to study meet specified objectives. Design of experiments (DOE) is a systematic, rigorous approach to engineering problem-solving that applies principles and techniques at the data collection stage so as to ensure the generation of valid, defensible, and supportable engineering conclusions. Design of experiment is used to manipulate the conditions of the experiment and to control the factors that are irrelevant to the research objectives. Various statistical techniques can be used,
1. Factorial based DOE
2. RSM based DOE
3. Taguchi base DOE

4.6.1 Taguchi Method:-

Taguchi‟s comprehensive system of quality engineering is one of the greatest engineering achievements of the 20th century. His methods focus on the effective application of engineering strategies rather than advanced statistical techniques. It includes both upstream and shop-floor quality engineering. Upstream methods efficiently use small-scale experiments to reduce variability and remain cost-effective, and robust designs for large-scale production and market place. Shop-floor techniques provide cost-based, real time methods for monitoring and maintaining quality in production. The farther upstream a quality method is applied, the greater leverages it produces on the improvement, and the more it reduces the cost and time. Taguchi‟s philosophy is founded on the following three very simple and fundamental concepts.

1. Quality should be designed into the product and not inspected into it
2. Quality is best achieved by minimizing the deviations from the target.
3. The product or process should be so designed that it is immune to uncontrollable environmental variables.

The cost of quality should be measured as a function of deviation from the standard and the losses should be measured system-wide

Orthogonal Array:-

Orthogonal Array plays a critical part in achieving the high efficiency of the Taguchi method. Orthogonal Array is derived from factorial design of experiment by a series of very sophisticated mathematical algorithms including combinatorics, finite fields, geometry and error correcting Codes. The algorithms ensure that the Orthogonal Array to be constructed in a statistically independent manner that each level has an equal number of occurrences within each column; and for each level within one column, each level within any other column will occur an equal number of times as well.

1. Consistency in experimental design and analysis.
2. Reduction of time and cost of experiments.
3. Robustness of performance without removing the noise factors. The selection of orthogonal is Depends on below

a. The number of factors and interactions of interest
b. The number of levels for the factors of interest

Sr. No.	Spindle speed	Feed rate	Depth of Cut
1	1	1	1
2	1	2	2
3	1	3	3
4	2	1	3
5	2	2	2
6	2	3	1
7	3	1	3
8	3	2	1
9	3	3	2

5. ADVANTAGES

1. This work is rich in terms of literature review.
2. Analysis of this method is easy.
3. Less costly process.
4. Less time consuming process.
5. Robustness of performance without removing the noise factors.

6. APPLICATION AND FUTURE SCOPE

APPLICATION:-

1. In Automobile industry
2. In Marine industry
3. In Manufacturing of different materials
4. In Aerospace industry

FUTURE SCOPE:-

As a Future Scope, these work can be extended to coated tools with the lubricant machining as well as the multi-objective optimization approach can be solved by using Meta-heuristic approaches also.

REFERENCES

[1] Tonk, R., and Ratol, J. S. Investigation of the Effects of the Parametric Variations in Turning Process of En31 Alloy. “International Journal on Emerging Technologies”, 3(1), 160-164. (2012).

[2] Borse, S. C. Optimization of Turning Process Parameter In Dry Turning of Sae52100 Steel. “International Journal of Mechanical Engineering and Technology (IJMET)”, ISSN, 0976-6340. (2014).

[3] Bala Raju, J., Leela Krishna, J., and Tejomurthy, P. Effect and Optimization of Machining

Parameters on Cutting Force and Surface Finish in Turning of Mild Steel and Aluminum. "International Journal of Research in Engineering and Technology", 2(11). (2013).

[4] Basil K Mathew Paul, Tina Raju, Dr. Biju BOptimization of Cutting Parameters in Hard Turning of AISI 4340 Steel. "International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163 Volume 1 Issue 8."(2014).

[5] Jitendra J. Thakkar Mitesh I. Patel Viral B. Prajapati Sachin PatelOptimization of Process Parameters For Surface Roughness And Material Removal Rate For Ss410 Material During Turning Operation. "International Journal for Scientific Research & Development| Vol. 2, Issue 03", 2014 | ISSN (online): 2321-0613. .(2014)

[6] Mahdavinejad, R. A., and Bidgoli, H. S. Optimization of surface roughness parameters in dry turning. "Journal of achievements in materials and manufacturing engineering", 37(2), 571-577. (2009).

[7] Ganesh, N., Kumar, M. U., Kumar, C. V., and Kumar, B. S. Optimization of Cutting Parameters in Turning of EN 8 Steel Using Response Surface Method and Genetic Algorithm. "International Journal of Mechanical Engineering and Robotics Research", 3(2), 75. (2016).