# OPTIMIZATION OF MACHINING PARAMETERS OF STAINLESS STEEL 410 FOR BORING OPERATION IN A LATHE BASED ON GRA

[1]T.THARUN KUMAR,[2]M.PEERAIAH,[3]S.MADHU SUDHAN,[4]Dr.CHANDRASEKHARA REDDY
[1]MTECH ,[2]ASSOCIATE PROFESSOR, [3] ASSISTANT PROFESSOR, [4]PROFESSORAND HOD
[1234]MECHANICAL DEPARTMENT,
[12 3 4]S.V.COLLEGE OF ENGINEERING,TIRUPATHI.

*Abstract :* In the era of mass manufacturing, MRR (material removal rate) could be a major concern indeed in manufacturing utilizing conventional lathes. The main objective of modern manufacturing nowadays is to deliver high quality products and low cost in a short time. In order to improve quality and decrease cost, the material removal rate should be optimized. In machines, accurate dimensions are required, but with good product quality. The objective of the pilot study is to examine the MRR and surface roughness as quality targets, taking into consideration the speed, progress and depth of the cutting of 410 stainless steel utilizing the HSS tool utilizing the Taguchi and ANOVA strategies. The contribution rate of each factor is calculated utilizing ANOVA. The optimal parameter set for the boring handle was gotten through grayscale examination. The result of this investigation determines the optimum values of process parameters for effective and efficient operation. The result demonstrates that the optimal combination of operating parameters improved the performance of the machining process. The predicted results are found to be closer to experimental results.

***KEYWORDS*– ANOVA, TAGUCHI, HSS, MRR, $R_a$, GRA, STAINLESS STEEL410.**

## I. INTRODUCTION

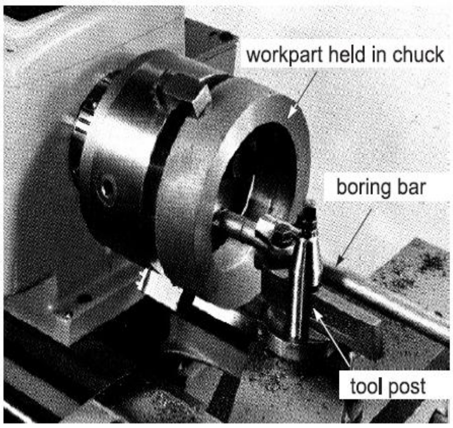
The challenge of recent machining industries is especially targeted on the achievements of prime quality in terms of work piece dimensional accuracy, surface finish, high production rate, less wear on the cutting tool, economy of machining in terms of cost saving and increase the performance of the product with reduced environmental impact.

Material Removal Rate plays an important role in several areas and is issue of nice importance in analysis Production rate. Boring is that the method whereby a single point cutting tool removes unwanted material from the cylindrical work piece to enlarge a hole that has been already drilled and the tool is feed extending in the same direction of axis of rotation.

### 1.1 BORING OPERATION

Boring operations including pivoting apparatuses are connected to machine gaps that have been made through strategies such as pre-machining, casting, fashioning, expulsion, flame-cutting, etc.

Boring may be a handle of creating circular inner profiles on a gap made by penetrating or another strategy. In boring, the boring bar is rotated, or the work portion is rotated. Machine tools which turn the boring bar against a motionless work piece are called boring machines (moreover boring mills). It employments single point cutting tool known as a boring bar. Boring is fulfilled on a turning machine with stationary boring bar positioned within the tool post and rotating work piece held within the lathe chuck as illustrated within the figure.




**1.1 Boring operation on lathe**

## II. EXPERIMENTATION AND METHDOLOGY

A lathe machine was used for testing. 410 stainless steel was used as a working material and the HSS tool was used as a cutting tool. The experience of this work was supported by the design of Taguchi (DOE) experiments and orthogonal matrix. It is necessary to distribute a large variety of experiments once the amount of process parameters is increased.
To solve this task, Taguchi uses a special design for orthogonal arrays to study the whole parameter area only with a small set of experiments. During this work, the three cutting parameters, spindle speed, cutting depth and the speed of the experiment were considered. Thus, there are three input parameters for each parameter that are assumed three levels. In an experiment of three factors, three levels, Taguchi had matrix orthogonal L27 (33) for experiment (Table 3.10). The response obtained from the tests conducted in accordance with the L27 matrix experiment was recorded and analyzed. It shows the specific parameter parameters used in each test experiment as well as the values corresponding to the MRR (material removal rate) observed. The design of the experiment (DOE) is a good way to improve the result in many manufacturing processes. DOE has been implemented to determine manufacturing standards that can lead to a better quality product. In this study, the maximum MRR value of the workpiece was examined. The L27 orthogonal matrix was selected for this study.

### 2.1 PROCESS PARAMETERS AND THEIR LEVELS

The cutting parameters of machining of stainless steel 410 are Depth of cut, Spindle Speed, and Feed are taken as three levels as shown below

| Level | Depth of cut(d)(mm) | Spindle Speed (s)(rpm) | Feed rate(f)(mm/rev) |
|---|---|---|---|
| 1 | 0.2 | 280 | 0.05 |
| 2 | 0.3 | 450 | 0.09 |
| 3 | 0.4 | 710 | 0.16 |

**Table 2.1 Process parameters and their levels**

## III. EXPERIMENTAL DATA

### 3.1 EXPERIMENTAL DETAILS AND SPECIFICATIONS

| | |
|---|---|
| Machinetool | : KirloskarTurnmaster35 Lathe Machine |
| Cutting tool | : HSS |
| Work material | : Stainless steel410 |

**3.2 Available cutting parameters and ranges**

| | |
|---|---|
| Cutting conditions | : Dry environment |
| Depth of cut, d (mm) | : 0.2, 0.3, 0.4 |
| Spindle Speed, S (rpm) | : 280, 450, 710 |
| Feed rate, f (mm/rev) | : 0.05, 0.09, 0.16 |

**3.3 WORKPIECE DIMENSIONS:**

| | | |
|---|---|---|
| Diameter | : | 40mm |
| Initial Diameter of Bore | : | 18.5mm |
| Length of boring | : | 50mm |

### 3.4 DESIGN OF EXPERIMENT

**3.5.1 Plan of investigation:**

To achieve the specific objective, the investigations were planned to be carried out in the following steps:

- Determination of machining parameters of selection of useful boundary parameters for the segments, specifically the speed (n) and nutrition (f) and the depth of the cut (d).
- Development of the design matrix. MRR values are obtained by a mathematical formula.
- The experiment is carried out according to Taguchi design matrix.
- Test the significance of the regression coefficient and income in the final form of mathematical models.
- most introduced most of the effects, and therefore important interactions between the different parameters are completely in graphical models. Analysis of findings and conclusions.

| | |
|---|---|
| 1 | Identify the response variables and corresponding S/N ratio |
| 2 | Identification of controllable parameters, interactions and their levels |
| 3 | Identify orthogonal array and assign parameter levels to each colum |
| 4 | Conduct the experiment and collect the data for response variables |
| 5 | Data preprocessing by normalizing the S/N ratio for all sequences |
| 6 | Calculate grey relational coefficients for each sequence |
| 7 | Determine the grey relational grade by averaging the grey coefficients |
| 8 | Determine the optimum sequence, from the higher grey relational grade |
| 9 | Determination of optimum parameters |
| 10 | Predication of GRG for optimal parameters |

**FIGURE 3.1 STEPS IN TAGUCHI METHODOLOGY**

### 3.5 Material removal rate(MRR)

The MRR can be calculated by considering weight of the work piece before and after boring process of the work piece.

Grams/second

$$MRR = \frac{(IW - FW)}{T}$$

Where,
IW = Intialweight(grams)
FW = Final weight(grams)
T = Time(min)

## IV. RESULTS AND DISCUSSIONS

### 4.1 ANALYSIS OF VARIANCE (ANOVA):

ANOVA can be a measurable way to determine the existence of varieties among many population groups, which means that. While the objective of ANOVA is that varieties detected among many populations mean this, the strategy requires examining different types of changes related to arbitrary tests under the variance test. A statistical survey of fluctuations was created by the statistician in the country, Sir Ronald A. Fischer, in the middle of a fundamental part of this century.

Part of the initial work in this space is controlled by the agricultural tests where the crops have obtained completely different drugs, such as fully developed using completely different fertilizers. Analysts were required to know whether all of the treatments listed below were unconvincing or if some drugs were higher than others.

### 4.2 ORTHOGONAL ARRAY:

In order to limit the full range of experiments, "Sir Ronald Fischer" developed a solution: "orthogonal arrays". The orthogonal matrix can be considered a distillation mechanism through which engineers pass the experiment (Ealey, 1998). The matrix allows the engineer to change multiple variables at the same time and to gain the effects of this set of variables on average and dispersion.

Taguchi uses method experiments using unusual manufacturing tables, called orthogonal order (OA), to deal with organizational strategy, so that the quality of the article is integrated into the middle of the articles. The orthogonal matrix (OA) is a rare group of Latin squares, made by Taguchi to test object object tests. The relationship between the orthogonal group can be a kind of exploration where the columns of free factors are "perpendicular" to each other. Orthogonal matrices are used to look at the effect of many control variables. Orthogonal arrays are used to explore quality. The orthogonal arrangements are not interesting to Tajuchi. They were found impressively earlier (Pendel, 1998). But Taguchi reorganized its use by giving organized groups of typical orthogonal matrices and comparing straight graphs to fit certain aspects (ASI, 1989, Taguchi and Kenishi, 1987).

| S.No | Spindle Speed (rpm) | Feed (mm/rev) | Depth of cut (mm) | MRR (grams/min) | Ra (µm) |
|---|---|---|---|---|---|
| 1 | 280 | 0.05 | 0.2 | 0.496755565 | 0.85 |
| 2 | 280 | 0.05 | 0.3 | 0.586401654 | 0.77 |
| 3 | 280 | 0.05 | 0.4 | 0.625925926 | 0.617 |
| 4 | 280 | 0.09 | 0.2 | 0.742842324 | 0.7 |
| 5 | 280 | 0.09 | 0.3 | 0.773520249 | 0.873 |
| 6 | 280 | 0.09 | 0.4 | 0.578058743 | 0.893 |
| 7 | 280 | 0.16 | 0.2 | 0.750600875 | 0.756 |
| 8 | 280 | 0.16 | 0.3 | 0.570450656 | 1.103 |
| 9 | 280 | 0.16 | 0.4 | 0.769908815 | 1.127 |
| 10 | 450 | 0.05 | 0.2 | 0.591837322 | 0.99 |
| 11 | 450 | 0.05 | 0.3 | 0.622396706 | 0.97 |
| 12 | 450 | 0.05 | 0.4 | 0.76558687 | 1.023 |
| 13 | 450 | 0.09 | 0.2 | 0.624386763 | 0.907 |
| 14 | 450 | 0.09 | 0.3 | 0.467618198 | 0.913 |
| 15 | 450 | 0.09 | 0.4 | 0.62150404 | 0.8 |
| 16 | 450 | 0.16 | 0.2 | 1.484496124 | 1.017 |
| 17 | 450 | 0.16 | 0.3 | 1.24230676 | 0.9 |
| 18 | 450 | 0.16 | 0.4 | 2.191914272 | 0.937 |
| 19 | 710 | 0.05 | 0.2 | 0.084019493 | 1.03 |
| 20 | 710 | 0.05 | 0.3 | 0.672099471 | 0.853 |
| 21 | 710 | 0.05 | 0.4 | 0.531867585 | 0.697 |
| 22 | 710 | 0.09 | 0.2 | 1.193463479 | 0.903 |
| 23 | 710 | 0.09 | 0.3 | 1.657894737 | 0.773 |
| 24 | 710 | 0.09 | 0.4 | 1.329787234 | 0.707 |
| 25 | 710 | 0.16 | 0.2 | 1.49378882 | 0.883 |
| 26 | 710 | 0.16 | 0.3 | 1.577287066 | 0.92 |
| 27 | 710 | 0.16 | 0.4 | 1.357407407 | 1.093 |

**Table 4.1 Stainless Steel 410 Measurement of Material Removal Rate(grams/min) and $R_a$(µm)**

### 4.3 Gray Relation Analysis:

GRA may be a new analysis procedure, which has been proposed within the grey system theory and it is established by Prof Deng Julong from Huazhong University of Science and Innovation, People's Republic of China. GRA is predicated on geometrical mathematics, that compliance with the standards of ordinariness, symmetry, aggregate, and nearness. GRA is reasonable for finding difficult interrelationships between different variables and factors and has been with victory connected on cluster examination, robot way planning, extend choice, forecast investigation, execution investigation, and calculate affect investigation and multiple criteria choice. Nitty gritty clarification with respect to GRA strategy is given within the taking after section.

| S NO | MRR (gram/min) | Normalizing of MRR | Delta Values | Grey Relational Co-efficient |
|---|---|---|---|---|
| 1 | 0.496755565 | 0.195804874 | 0.804195126 | 0.383378216 |
| 2 | 0.586401654 | 0.238333605 | 0.761666395 | 0.396301274 |
| 3 | 0.625925926 | 0.257084195 | 0.742915805 | 0.402279863 |
| 4 | 0.742842324 | 0.312550151 | 0.687449849 | 0.421070414 |
| 5 | 0.773520249 | 0.327103973 | 0.672896027 | 0.426295246 |
| 6 | 0.578058743 | 0.23437567 | 0.76562433 | 0.395061937 |
| 7 | 0.750600875 | 0.316230862 | 0.683769138 | 0.422379655 |
| 8 | 0.570450656 | 0.23076634 | 0.76923366 | 0.393938497 |
| 9 | 0.769908815 | 0.325390683 | 0.674609317 | 0.42567345 |
| 10 | 0.591837322 | 0.240912324 | 0.759087676 | 0.397112933 |
| 11 | 0.622396706 | 0.255409909 | 0.744590091 | 0.401738696 |
| 12 | 0.76558687 | 0.323340322 | 0.676659678 | 0.424931702 |
| 13 | 0.624386763 | 0.256354006 | 0.743645994 | 0.40204367 |
| 14 | 0.467618198 | 0 | 1 | 0.333333333 |
| 15 | 0.62150404 | 0.254986422 | 0.745013578 | 0.401602046 |
| 16 | 1.484496124 | 0.664395892 | 0.335604108 | 0.598369485 |
| 17 | 1.24230676 | 0.549499567 | 0.450500433 | 0.526038687 |
| 18 | 1.19142718 | 0.525361938 | 0.474638062 | 0.513010952 |
| 19 | 0.840194925 | 0.358734905 | 0.641265095 | 0.438110306 |
| 20 | 0.672099471 | 0.278989247 | 0.721010753 | 0.409496803 |
| 21 | 0.531867585 | 0.212462262 | 0.787537738 | 0.388338132 |
| 22 | 1.193463479 | 0.526327973 | 0.473672027 | 0.513519939 |
| 23 | 1.657894737 | 0.746657404 | 0.253342596 | 0.663708654 |
| 24 | 1.329787234 | 0.591000914 | 0.408999086 | 0.550055559 |
| 25 | 1.49378882 | 0.668804411 | 0.331195589 | 0.601543135 |
| 26 | 1.577287066 | 0.708416563 | 0.291583437 | 0.631645353 |
| 27 | 1.357407407 | 0.604104117 | 0.395895883 | 0.558100567 |

**Table 4.2 Gray-Taguchi calculations**

$$\textbf{Normalizing of MRR} = \frac{MRR - LEASTVALUE}{LARGESTVALUE - LEASTVALUE}$$

$$\textbf{Delta Values} = (1 - \textbf{Normalizing of MRR})$$

| SNO | Ra (µm) | Normalizing of (Ra) | Delta Values | Grey Relational Co-efficient |
|---|---|---|---|---|
| 1 | 0.85 | 0.543137255 | 0.456862745 | 0.522540984 |
| 2 | 0.77 | 0.7 | 0.3 | 0.625 |
| 3 | 0.617 | 1 | 0 | 1 |
| 4 | 0.7 | 0.837254902 | 0.162745098 | 0.75443787 |
| 5 | 0.873 | 0.498039216 | 0.501960784 | 0.499021526 |
| 6 | 0.893 | 0.458823529 | 0.541176471 | 0.480225989 |
| 7 | 0.756 | 0.72745098 | 0.27254902 | 0.647208122 |
| 8 | 1.103 | 0.047058824 | 0.952941176 | 0.344129555 |
| 9 | 1.127 | 0 | 1 | 0.333333333 |
| 10 | 0.99 | 0.268627451 | 0.731372549 | 0.406050955 |
| 11 | 0.97 | 0.307843137 | 0.692156863 | 0.419407895 |
| 12 | 1.023 | 0.203921569 | 0.796078431 | 0.385779123 |
| 13 | 0.907 | 0.431372549 | 0.568627451 | 0.467889908 |
| 14 | 0.913 | 0.419607843 | 0.580392157 | 0.462794918 |
| 15 | 0.8 | 0.641176471 | 0.358823529 | 0.582191781 |
| 16 | 1.017 | 0.215686275 | 0.784313725 | 0.389312977 |
| 17 | 0.9 | 0.445098039 | 0.554901961 | 0.473977695 |
| 18 | 0.937 | 0.37254902 | 0.62745098 | 0.443478261 |
| 19 | 1.03 | 0.190196078 | 0.809803922 | 0.381736527 |
| 20 | 0.853 | 0.537254902 | 0.462745098 | 0.519348269 |
| 21 | 0.697 | 0.843137255 | 0.156862745 | 0.76119403 |
| 22 | 0.903 | 0.439215686 | 0.560784314 | 0.471349353 |
| 23 | 0.773 | 0.694117647 | 0.305882353 | 0.620437956 |
| 24 | 0.707 | 0.823529412 | 0.176470588 | 0.739130435 |
| 25 | 0.883 | 0.478431373 | 0.521568627 | 0.489443378 |
| 26 | 0.92 | 0.405882353 | 0.594117647 | 0.456989247 |
| 27 | 1.093 | 0.066666667 | 0.933333333 | 0.348837209 |

**Table 4.3 Grey Table**

**Relational Co-efficient for Ra(µm):**

**Normalizing of MRR** $= \frac{LARGER\ VALUE - Ra}{LARGESTVALUE - least\ value}$

**Delta Values**$=(1 - Normalizing of Ra)$

**Table 4.4 Grey Relational Grade:**

4.4 Grey relational coefficient of each performance characteristic and Grey relational grade calculated from them

| S.No | MRR (Grey Relational Co-efficient) | Surface roughness (Grey Relational Co-efficient) | GRAY RELATION GRADE | RANKING ORDER |
|---|---|---|---|---|
| 1 | 0.383378216 | 0.522540984 | 0.4529596 | 18 |
| 2 | 0.396301274 | 0.625 | 0.510650637 | 9 |
| 3 | 0.402279863 | 1 | 0.701139932 | 1 |
| 4 | 0.421070414 | 0.75443787 | 0.587754142 | 4 |
| 5 | 0.426295246 | 0.499021526 | 0.462658386 | 16 |
| 6 | 0.395061937 | 0.480225989 | 0.437643963 | 19 |
| 7 | 0.422379655 | 0.647208122 | 0.534793888 | 8 |
| 8 | 0.393938497 | 0.344129555 | 0.369034026 | 27 |
| 9 | 0.42567345 | 0.333333333 | 0.379503392 | 26 |
| 10 | 0.397112933 | 0.406050955 | 0.401581944 | 24 |
| 11 | 0.401738696 | 0.419407895 | 0.410573295 | 21 |
| 12 | 0.424931702 | 0.385779123 | 0.405355413 | 23 |
| 13 | 0.40204367 | 0.467889908 | 0.434966789 | 20 |
| 14 | 0.333333333 | 0.462794918 | 0.398064126 | 25 |
| 15 | 0.401602046 | 0.582191781 | 0.491896913 | 13 |
| 16 | 0.598369485 | 0.389312977 | 0.493841231 | 11 |
| 17 | 0.526038687 | 0.473977695 | 0.500008191 | 10 |
| 18 | 0.513010952 | 0.443478261 | 0.478244607 | 14 |
| 19 | 0.438110306 | 0.381736527 | 0.409923416 | 22 |
| 20 | 0.409496803 | 0.519348269 | 0.464422536 | 15 |
| 21 | 0.388338132 | 0.76119403 | 0.574766081 | 5 |
| 22 | 0.513519939 | 0.471349353 | 0.492434646 | 12 |
| 23 | 0.663708654 | 0.620437956 | 0.642073305 | 3 |
| 24 | 0.550055559 | 0.739130435 | 0.644592997 | 2 |
| 25 | 0.601543135 | 0.489443378 | 0.545493256 | 6 |
| 26 | 0.631645353 | 0.456989247 | 0.5443173 | 7 |
| 27 | 0.558100567 | 0.348837209 | 0.453468888 | 17 |

According to the Taguchi strategy, the statistic delta characterized as the contrast between the tall and the moo impact of each figure, was utilized. A classification can be done to decide the foremost influent figure. When so done, the numerous objective optimization issues are changed into a single proportionate objective work optimization issue. The higher grey relational grade will be near to the ideal condition. Utilizing the grey relational grade value, the cruel of the dim social review for each level of different components, and the full cruel of the grey social review is summarized in Above Table. At that point a response chart of the dim social examination is gotten by primary impact explanatory computation, as appeared in Figure.

**Table4.5:Response table for signal to noise ratio larger is better for HSS tool [GRG]**

| Level | Spindle Speed(s) | Feed(f) | Depth of cut(d) |
|---|---|---|---|
| 1 | -6.583 | -6.890 | -5.104 |
| 2 | -6.721 | -5.941 | -6.701 |
| 3 | -5.827 | -6.300 | -7.326 |
| Delta | 0.894 | 0.949 | 2.223 |
| Rank | 3 | 2 | 1 |

GRG=Grey Relational Grade

**Table 4.6: Response table for means for HSS tool [GRG]**

| Level | Spindle Speed(s) | Feed(f) | Depth of cut(d) |
|---|---|---|---|
| 1 | 0.4878 | 0.4708 | 0.5836 |
| 2 | 0.4741 | 0.5242 | 0.4699 |
| 3 | 0.5362 | 0.5032 | 0.4447 |
| Delta | 0.0621 | 0.0533 | 0.1389 |
| Rank | 2 | 3 | 1 |

**Fig 4.1 Main effect plot for Means for GRG**

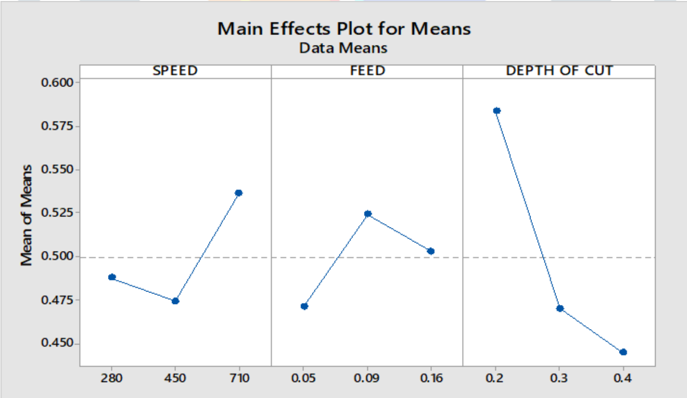



**Fig 4.2 Main effect plot for SN ratios for GRG**

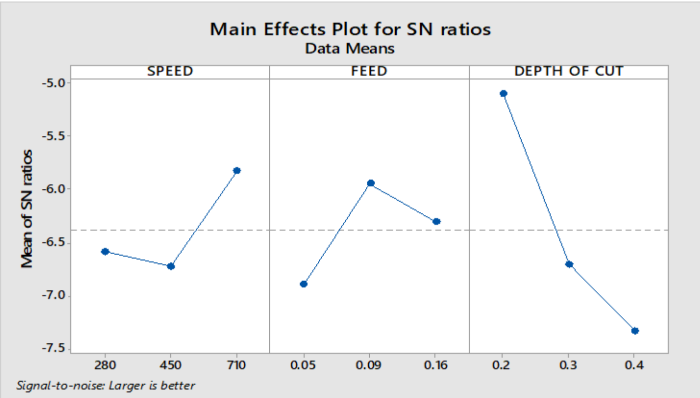
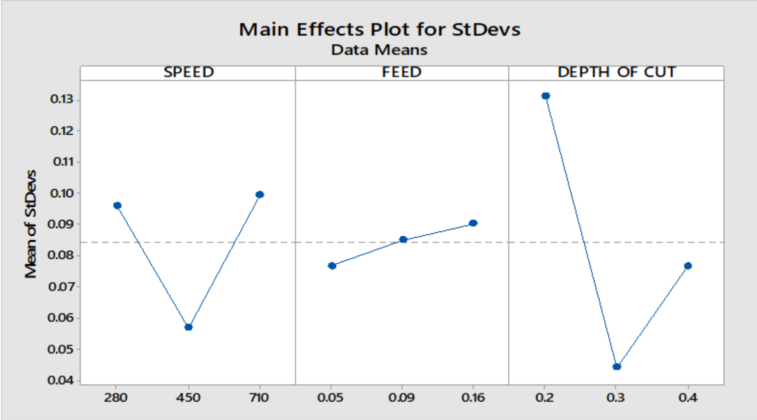


Fig 4.3Main effects plot for StDevs for GRG




**4.6 ANOVA FOR STAINLESS STEEL 400ON HSS TOOL FOR THE RESPONSE GRG**

**Table 4.6: ANOVA for the response GRG**

| SOURCE | DOF | Seq SS | Adj SS | Adj MS | F | P | %CONTRIBUTION |
|---|---|---|---|---|---|---|---|
| SPEED | 2 | 0.006393 | 0.006393 | 0.003197 | 10.64 | 0.086 | 14.6628 |
| FEED | 2 | 0.004332 | 0.004332 | 0.002166 | 7.21 | 0.122 | 9.9358 |
| DOC | 2 | 0.032872 | 0.032872 | 0.016436 | 54.72 | 0.018 | 75.4014 |
| RESIDUAL | 2 | 0.000601 | 0.000601 | 0.000300 | | | - |
| TOTAL | 8 | 0.044198 | | | | | 100% |

**4.7 Analysis of Regression for Prediction of GRG**

From table 4.6, the % contribution of values for Spindle Speed (14.6628%)Feed rate (9.9358%) and Depth of cut (75.4014%). It is observed that the Depth of cut has great influence on Surface Roughness. Because this analysis is optimized design based on parameters. From previous values, it is clear that the depth of cut the main factor that must be selected effectively to obtain the minimum surface roughness

**4.8 ANOVA CALCULATIONS:**

**Percentage contribution (MRR)**

| | | |
|---|---|---|
| S | = | 36.846% |
| F | = | 12.653% |
| D | = | 12.038% |

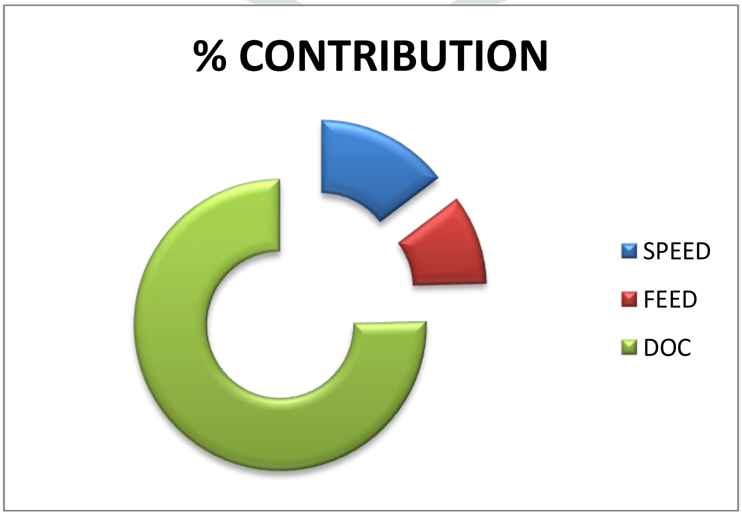



**Fig 4.4: % contribution of speed, feed and DOC in GRG**

**Optimized table obtained for Stainless steel 410 on HSS tool**

| Control factors | SpindleSpeed(s)rpm | Feed (f) mm/rev | Doc(d) mm |
|---|---|---|---|
| Grey Relational Grade GRG | **710** | **0.09** | **0.2** |

## REFERENCES


**[1]** S. MadhuSudhan, M. Peeraiah, S. Jaya Kishore, Dr. M. Chandrasekharareddy, "Monel400 Analysis and Optimisation of Process Parameters during Boring Process", Journal of Advances in NATURAL and APPLIED SCIENCES, 2017, 440-455.

**[2]** S.Jaya Kishore, K.Siva Kumar, Dr.M.Narayana Rao, "ExperimentalParametric Studies on Hastelloy Using Abrasive Water Jet Machining", International Conference on Precision, Mesco, Micro and Nano Engineering – Indian Institute of Technology Madras, 1-5, 2017.

**[3]** Parida, "Experimental investigation on tool life and chip morphology in hot machining of Monel-400", Engineering Science and Technology, an International Journal, vol. 5, no. 3, pp. 2215-0986, 2018

**[4]** Maity, "Modeling of machining parameters affecting flank wear and surface roughness in hot turning of Monel-400 using response surface methodology (RSM)", ELSEVIER, 2019, 375–381.

[5] Alpesh R. Patel, Lalit S. Patel, Tejas C. Patel, "Optimization of Turning Process Parameters for Mild Steel",IJSRD - International Journal for Scientific Research & Development, Vol. 3, Issue 11, 2016, ISSN : 2321-0613