

TO INFLUENCE THE PROCESS PARAMETERS OF CNC MILLING MACHINE USING THE TAGUCHI METHOD ON HOT DIE STEEL H-13

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ABSTRACT

In order to build up a bridge between quality and productivity, the present study highlights optimization of CNC milling process parameters to provide high material removal rate (MRR). The material removal rate (MRR) have been identified directly related to productivity. In this paper Taguchi method is applied to find out the influence of various machining parameters like Spindle speed (SS), feed rate (FR), depth of cut (DOC) on the quality characteristic Material removal rate (MRR) using Hot Die Steel H-13 work piece on Vertical CNC Milling machine. A L9 Orthogonal array is used to carry out the various experimental data in Mini Tab 15. Results obtained are plotted by Main effects MRR v/s SS, FR, DOC. The experimental results shows that in order to increase the productivity the quality characteristic MRR is optimised by the increase of control parameter Spindle speed & Depth of cut.

In this study, it was observed that, the order of significance of the main variables is as Spindle speed, depth of cut, feed rate.

Keywords: Hot Die Steel H-13, Vertical Milling Machine, Taguchi Method.

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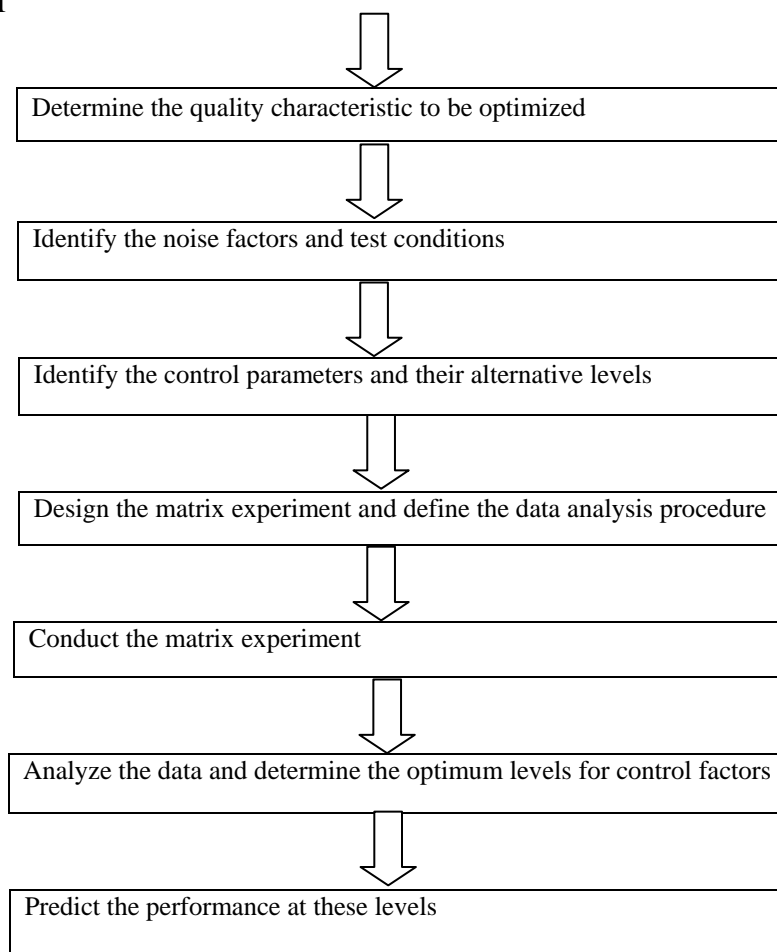
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INTRODUCTION:

Robust design is an engineering methodology for obtaining product and process conditions, which are minimally sensitive to the various causes of variation to produce high-quality product with low development and manufacturing costs. Various optimizations' techniques are being used by technologists and researchers to optimize the process. Engineering optimization provides engineers with a rigorous, systematic method for rapidly zeroing in on the most innovative, cost effective solutions to some of today's most challenging engineering problems; optimization is a powerful tool of the trade for engineers in virtually every discipline (Rao 2001). Taguchi's parameter design is an important tool for robust design. It offers a simple and systematic approach to optimize design performance, quality and cost.

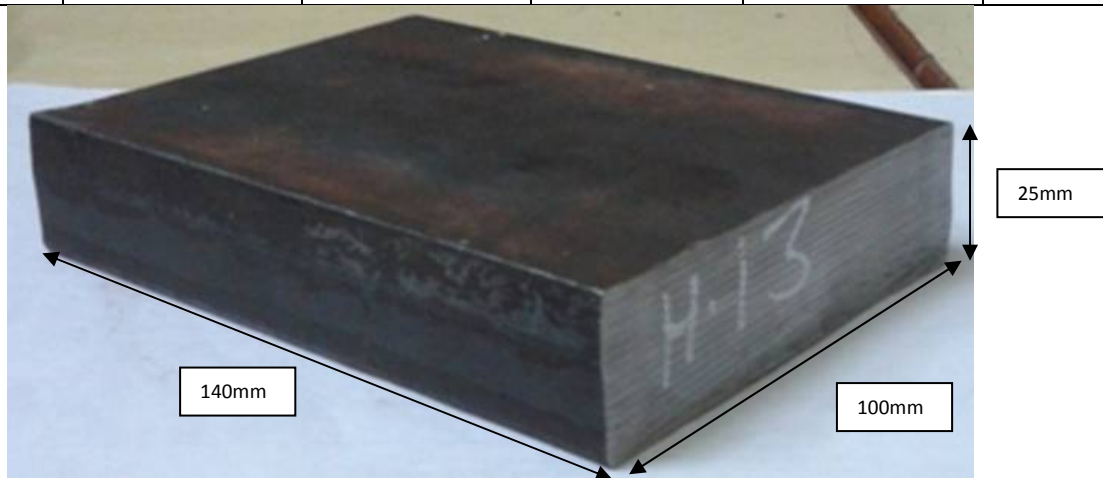
MATERIAL & METHOD:

STEPS: TAGUCHI



MATERIAL DESCRIPTION:

Sr. no.	Product description	Size of the material(mm ³)	Weight of the material (Kg)	Main Constituent of Hot Die Steel H13	Tool Material
1	Hot Die steel H13 Alloy steel/die steel/carbon steel/tool steel	140X100X25	3.3	Iron	Solid Carbide

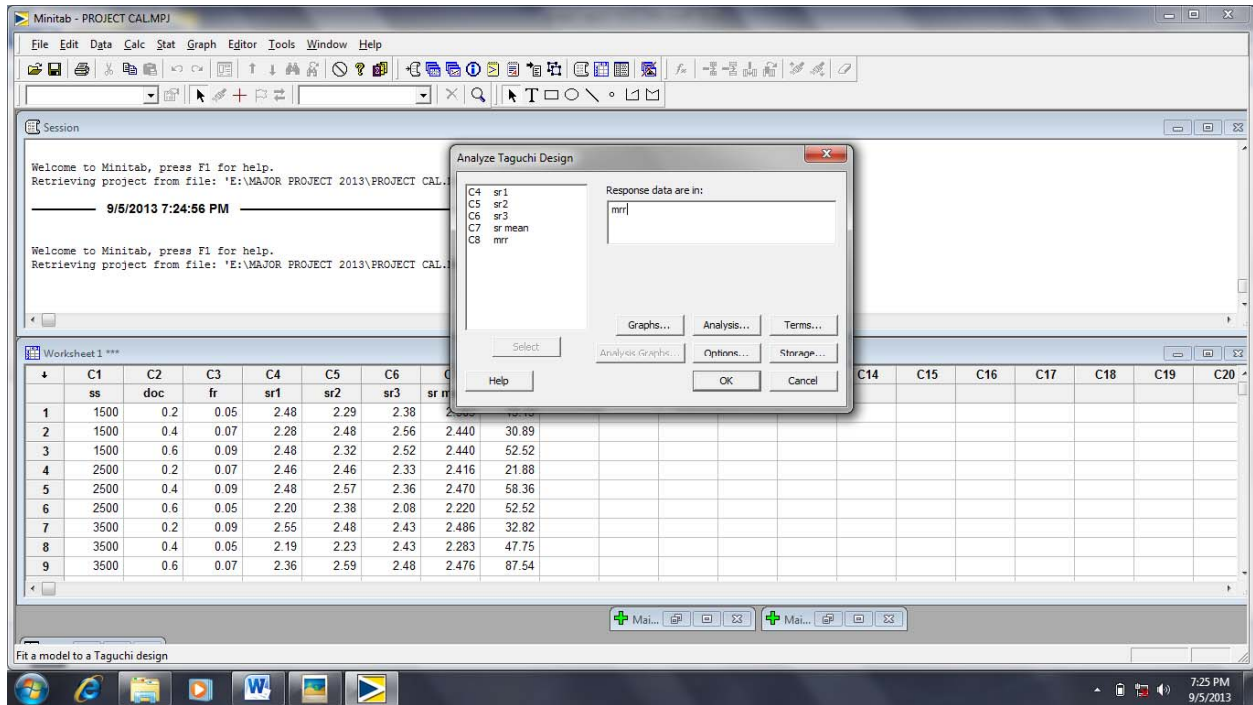


Side view of H-13 material

EXPERIMENTAL WORK:

Control Parameters & their alternative levels by the use of L₉ Orthogonal array data obtained from Mini

Tab 15 are Tabulated as:



SR. NO.	SPINDLE SPEED(rpm)	DEPTH OF CUT (mm)	FEED RATE (mm/teeth)
1	1500	0.2	0.05
2	1500	0.4	0.07
3	1500	0.6	0.09
4	2500	0.2	0.07
5	2500	0.4	0.09
6	2500	0.6	0.05
7	3500	0.2	0.09
8	3500	0.4	0.05
9	3500	0.6	0.07

Different level of input factor



Surface Grinding of H-13

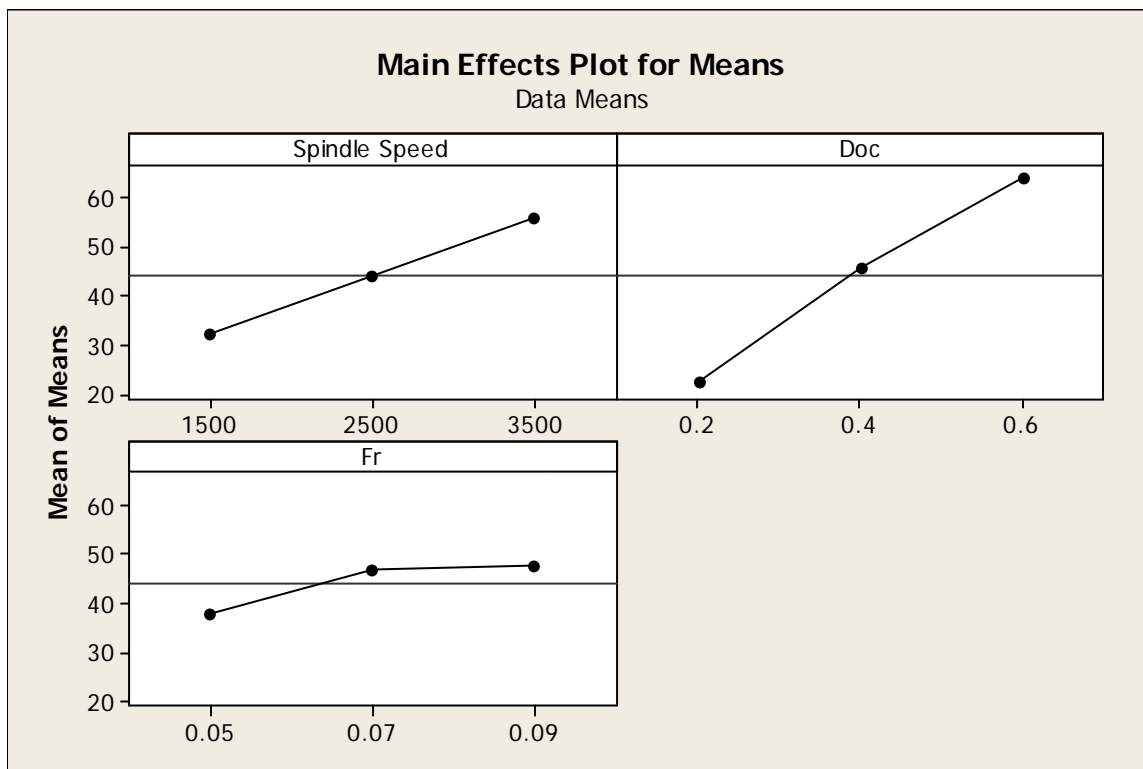


Operations on CNC Milling Machine

RESULTS & DISCUSSION:

SPINDLE SPEED(rpm)	DEPTH OF CUT(mm)	FEED RATE (mm/teeth)	MACHINING TIME(Sec)	MRR in mm ³ sec
1500	0.2	0.05	20	13.13
1500	0.4	0.07	17	30.89
1500	0.6	0.09	15	52.52

2500	0.2	0.07	12	21.88
2500	0.4	0.09	9	58.36
2500	0.6	0.05	15	52.52
3500	0.2	0.09	8	32.82
3500	0.4	0.05	11	47.75
3500	0.6	0.07	9	87.54



Main Effects (MRR)

As there are numbers of parameters which affect the material removal rate in Vertical CNC milling machine. According to present work conditions mainly three cutting parameters named Spindle speed, Depth of Cut, Feed rate may be selected and optimize the Material Removal rate using the DOE in Minitab software package.

In this case the experimental results demonstrate that the Spindle speed and DOC are the main parameters that influence the MRR of Vertical CNC milling machine. The graph MRR v/s Spindle speed, depth of cut shows that as the MRR is directly proportional to spindle speed & DOC.

The optimum value of MRR is 87.54 mm³/sec.obtained at Spindle speed 3500 r.p.m. & 0.6 mm of feed rate. So as we increase the Spindle speed & Depth of cut the MRR also increase.

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