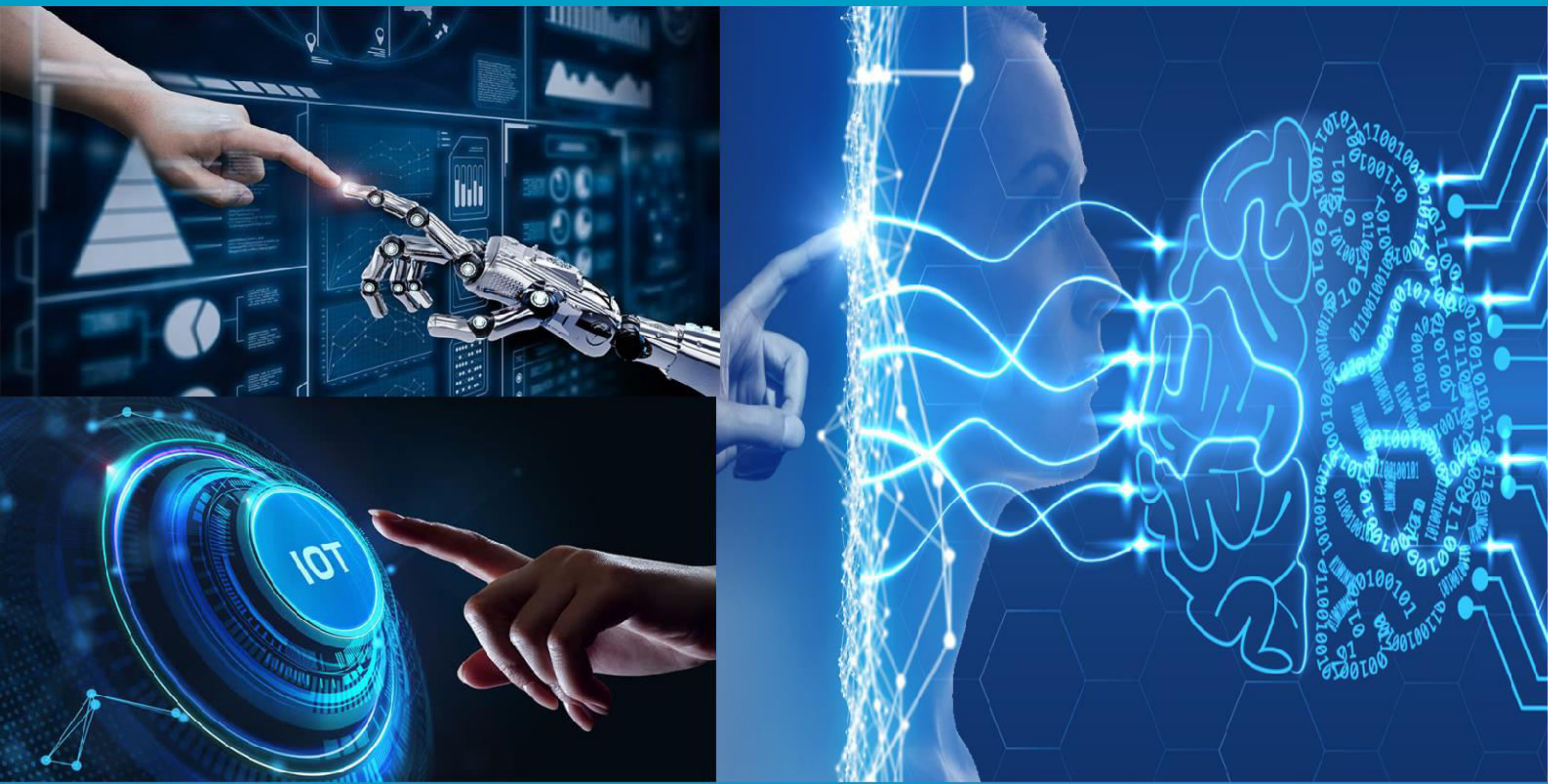
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 9, Issue 4, April 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

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International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580|

| Volume 9, Issue 4, April 2022 |

| DOI: 10.15680/IJMRSETM.2022.0904011 |

A Review on Taguchi Method for Evaluating the Problems of Metal Cutting and Study on Surface Roughness and Removal Rate in CNC Lathe Machine

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ABSTRACT: This thesis, the surface roughness and removal rate of a CNC lathe were affected by several process parameters (cutting speed, feed and depth of cutting). An important consideration in the production of high-quality, fully automated products is the quality of the machined surface's polish and surface condition. This procedure relies heavily on exact tolerances and high-quality surface polishing. Many CNC manufacturing lines use towing as a typical machining procedure. The most frequent way to remove metal is through turning. When it comes to machining, production managers must keep an eye on the removal rate (MRR). Analysis of the cutting speed, twisting cutter feed speed, and cut profile may provide the MRR productivity statistic. The most significant component in surface finishing is reducing water. When a large nose radius is used, surface roughness increases at the same feed rate. The correct feed rate and geographical boundary conditions might boost efficiency and MRR. Using a laboratory set-up based on good scientific principles, Taguchi's technique avoids network modifications. The manufacturer's ultimate goal is to provide high-quality products at a lesser cost via this process. An orthogonal array is one of Taguchi's methods for organizing processes and rates that may fluctuate. The Taguchi Model, unlike the factorial approach, only tests pairs of potential combinations. This study's metal cutting problems are well-suited to Taguchi's methodical design approach.

KEYWORDS: Taguchi's methods, CNC lathe, MRR productivity statistic

I. INTRODUCTION

Different process parameters have an effect on CNC lathe surface roughness and removal rate, as seen in this experiment (cutting speed, feed and depth of cutting). High-quality and completely automated manufacturing places an emphasis on surface condition and finish of the machined surface because of their influence on product appearance, operation, and longevity. Maintaining precise tolerances and high-quality surface finishing are critical in this process.

Towing is a standard machining method in a large number of CNC production lines. Turning is the most common method of metal removal. The removal rate (MRR) is a key control component for machining activities, and production managers must regulate this rate. MRR is a productivity statistic that may be derived analytically from the cutting speed component, the twisting cutter feed speed, and the cuts profile. In surface finishing, cutting water is the most important factor. Surface roughness rises at the same feed rate when a wide nose radius is utilised. It was possible to increase efficiency and MRR by selecting the right feed rate and spatial boundary conditions.Taguchi optimization is explained in this study, which discusses how to enhance machining settings. The inspection is done on steel die EN18. Machines are used to complete the work under finishing circumstances. Processor characteristics were assessed, mainly power, feed rate, and cutting range. Experiments were done utilising the orthogonal spectrum recommended by Taguchi from L-9 (34). (34). With a device called the rotating knife, the cutting edges are referred to as the "nose" in this technique. During this procedure, the job is rotating and the gadget is fixed to one spot. This is often done using the turning machine's instrument.It has lately been employed in manufacturing, biotechnology, marketing, and advertising. Genichi Taguchi invented Taguchi techniques to boost the efficiency of processed materials.

1.1 QUALITY AND PRODUCTIVITY There has to be a rational definition of performance in industry, production, and development as either inferiority or supremacy. As a perceptual, contextual, and a tad subjective attribute, quality might be interpreted differently by diverse people. Rather of focusing on the product or service itself, consumers might instead focus on how it compares to other products or services on the market. The manufacturing companies may determine the product's or service's consistency or degree of quality.

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II. LITERATURE SURVEY

M. Kaladhar et al (2012) Surface quality improvement of coating materials and process parameters during the turning of AISI 304 Austin-less steel is the focus of this study. PVD-coated tool results were superior than CVD-coated tool outcomes at any level of cutting parameters.

Ilhan Asilturk et al (2011) This work uses Taguchi's min orthogonal series to optimise turning parameters in a CNC rotating system. Coated carbide cutting tools made of durable AISI 4140 are used for dry turning (51 HRC). To achieve accurate measurements of surface roughness, each research makes use of a fresh insert and three copies of the original shot. The signal-to-noise ratio's methodological methods (SNR).

Shetty et al. (2010) Weave aluminium compounds (DRACs) that minimise surface roughness while boosting their performance. A typical level of 25pm in the pressure plane of typical silicon carbide particles. A MINITAB15 industrial software package was used to analyse the results. It was also determined that the cutting parameters had an influence on surface roughness, and that the best cutting condition to minimise surface roughness was identified. The response surface technique constructed a second order relationship between cutting parameters and surface rugging. Vapor pressure, followed by feed, was shown to be the most important surface machining parameter in the experiments.

Wang and Lan (2008) When four system factors are taken into consideration, the Taguchi process orthogonal array and grey link research are used. ECOCA3807 CNC lattice, cutting depth, feed rate, nose spinning, and surface roughness are the three answers to the issue of how the material is removed. MINITAB has been studied to establish the mean influence of the Signo-Noise (S-N) ratio in order to achieve the dual goal features. In this study, orthogonal arrays and grey connection analysis were offered as optimization methodologies, but a viable approach for optimizing multiple was also developed.

Kamala (2008) Real Coded Genetic Algorithm (RCGA) and several RCGA problems were used to assess optimum cutting parameter standards, and their advantages over the standard form were established. Cut speed, eat, cut depth, and nose radius are all factors to consider. According to the authors, this approach can be achieved with reasonably high-performance levels, with selected machining requirements, while increasing overall product efficiency by decreasing manufacturing costs, reducing processing time, and increasing versatility with respect to the range of machining parameters.

Sahoo et al. (2008) The features of the fractal surface formed by CNC rotation have been examined to find the best possible system settings. To experiment with rpm, feed, and cut size, the authors L27 Taguchi created an orthogonal matrix using three different component materials. Flat sheets of stainless steel and brass. Feed rate was shown to have a greater impact on the surface quality of all three materials.

Reddy et al. (2008)machined aluminium alloys using multiple regression and an artificial neural network for surface avoidance, respectively. The model's ability to predict surface roughness was assessed using its percentage and average variance.

Wannas (2008) Contrary to conventional regression models, the artificial neural network has been proved in experiments to be effective in assessing surface roughness. Wannas (2008) experimented with a graphical cast iron transformation utilising the RBFNN pattern in order to evaluate instrument wear. The RBFNN had three inputs: rpm, feed, and cuts depth, and a variable output: a node. As predicted by the neural network test, the error was less than half that of the regression function.

Fnides et al. (2008) Use of ceramic tools (CC650) to machine X38CrMoV5-1 sliding grade steel made in 50 HRC has resulted in cutting parameters such as feed rate and depth of cut as well as fibre surface wear and roughness. Tangential cuts were shown to be quite sensitive to the breadth of the cut.

Biswas et al. (2008) examined the direct influence of wing erosion on energy consumption, surface finishing efficiency, machine presence, profitability, etc. The authors used a Neuro-Fuzzy model to estimate instrument use. The experimental findings for the link between cutting strength and transverse strength of orthogonal aluminium processing using a high-speed steel device for tilting, feeding, and varying speed angles were integrated with other processing factors. This was done to estimate the wear of the gadget.

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Biswas et al. (2008) Energy utilisation, surface finishing efficiency, tool stock, cost effectiveness, and other factors are all adversely affected by corrosion that is already present. The authors used a fuzzy neural network to estimate the tool's use. The experimental findings for the link between cutting strength and transverse strength of orthogonal aluminium processing using a high-speed steel device for tilting, feeding, and varying speed angles were integrated with other processing factors. It was used to determine how long the gadget had been in use. The model's last component was a back propagation learning approach used to fine-tune the rough values obtained from the mountain clustering framework.

Fu and Hope (2008)used a unique neural hybrid interface detection approach to establish an insightful tracking framework for instrument condition. The researchers came to the conclusion that the current intelligent tool condition monitoring system, which uses the most recent pattern recognition algorithms, was optimal for a wide range of machining settings since it was noise-resistant and fault-sensitive.

Wang et al. (2008) For the CBN-hardened 52100 bearing steel flank, the Hybrid Neural Network simulation approach was evaluated and applied into a wear model and a cortical neural network.

Shetty et al. (2008)) Treatment employing Taguchi technique and surface response methods to minimize the surface roughness in DRAC conversion using aluminium alloy 6061 as an array and comprising 15 vol. Silicon carbide typically has a particle level of 25 m at a pressure. A MINITAB15 industrial software package was used to analyses the results. Taguchi's experimental design approach was used to conduct the research.

III. CONCLUSION AND FUTURE SCOPE

3.1 THE FOLLOWING ARE THE CONCLUSIONS DRAWN FROM THE WORK DONE IN THIS INVESTIGATION

1. Taguchi's rigorous design methodology is a good fit for this study's metal cutting issues.

2.Surface roughness, feed velocity, and cutting depth all had an effect on the R/N (S/N) ratio, with the latter two having the most effect of the three (.40 mm).

2. Cutting speed (120 m/min), feed rate (0.19 mm/rev), and cutting depth all had greater S/N values throughout the rotating process (.25 mm). MRR's ideal parameters are those that fall within that range.

4. Low cutting speeds will be employed to extend the life of the machine.

5. Cut depth should be small, but not so shallow as to cause excessive machine vibration, in order to provide the optimum surface finishes at high cutting speeds with low feed rates.

6. Typical cutting speeds for mild steel are 30 to 50 m/min.

7. For cutting hot steel, the cutting speed will be between 250 and 350 m/min.

3.2 SCOPE OF FUTURE WORK

Following are the changes and additions made to the programme in this research.

1. An orthogonal sequence (L18, L27) should have been offered in comparison, as should other research approaches (response surface methodologies, swarm control of particles, etc.).

2.Researching the impact of surface roughness may need the addition of other factors (e.g. the vibration of the device, the lubricant, etc.).

3. Boiling, grinding, and other activities may be taken into consideration in a more thorough examination.

4. Non-stahl products, such as carbon steel, may be studied in the future.

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3.3 COST ESTIMATION

The cost of carry out this project will be around Rs. 5000 to Rs. 6000. This cost comprises of following: -

Cost of Raw material = Rs. 1500

Cost of machining = Rs. 2000

Other expenses = Rs. 1800

3.4 PROPOSED PLACE OF WORK

B-15-B, Lane No.-8, Opp. TECHNO PRECISION. Anand Parbat Indl, Mandir. , NEW DELHI-110005 area.

In this area, CNC LMW LL20 T L5 turning has been completed. Anand Parbat, Delhi-based manufacturing company "KANSIL BRIGHT STEELS" is the source of the product.

The finishing examination for the surfaces was carried out at "MMU, MULANA."

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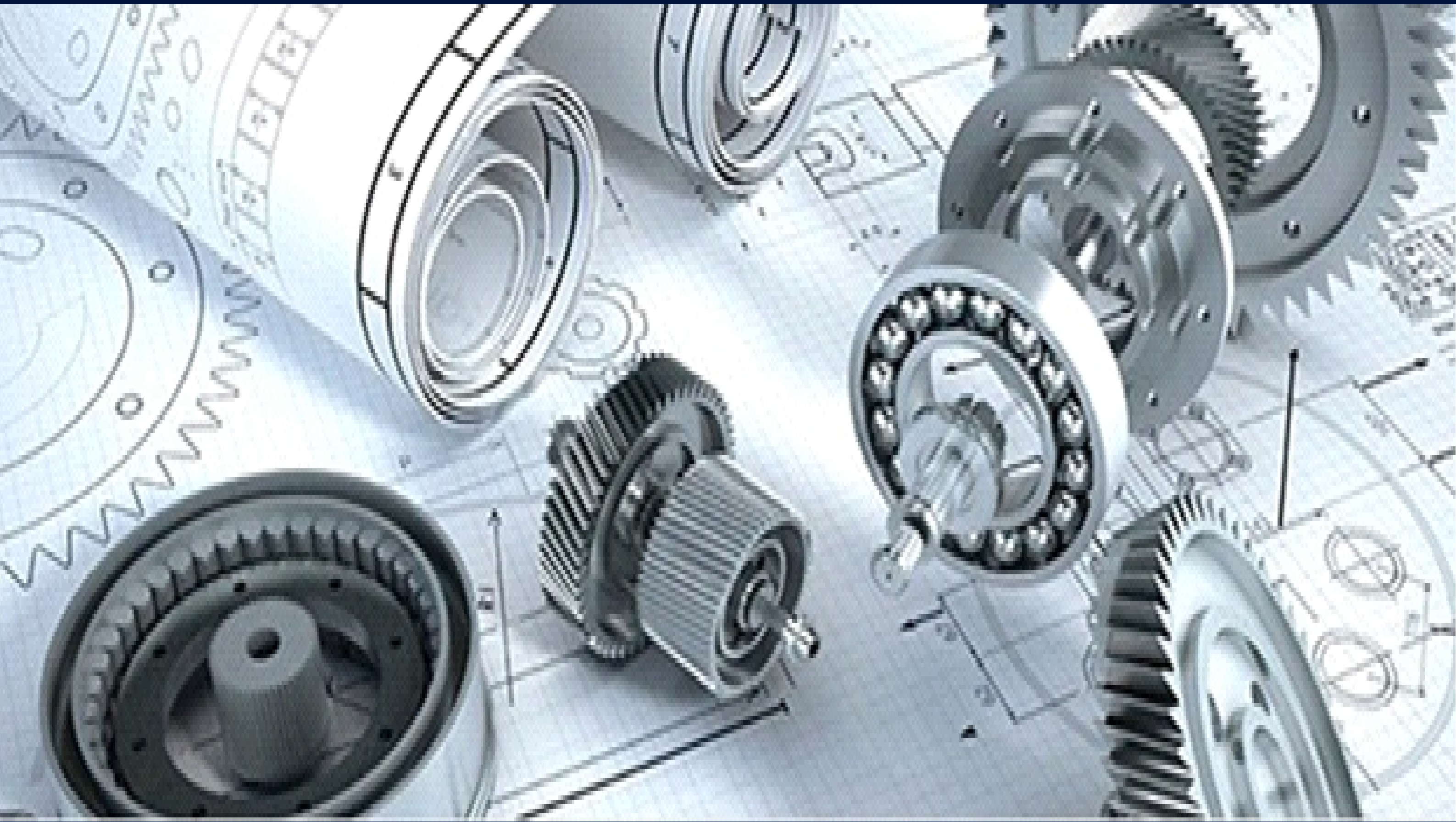

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