iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

STUDY OF THE BEHAVIOR OF VARIOUS MILD STEEL GRADES DURING THE MACHINING PROCESS USING A CNC TURNING MACHINE

Mohankumar. S[1]
Assistant Professor, Department of Mechanical Engineering,
Kongunadu College of Engineering And Technology
Sanjai. S[2], Srirooban. S[3] ,Vihash. B[4]
UG Students, Department of Mechanical Engineering, Kongunadu College of Engineering And Technology

ABSTRACT
This study investigates the machining behavior of EN8 and EN24 mild steel grades during the turning process using a CNC turning machine. The effects of cutting speed, feed rate, and depth of cut on cutting forces, surface roughness, and tool wear are evaluated. The results show that EN8 steel grade exhibits better machinability than EN24 steel grade in terms of lower cutting forces and surface roughness. The optimal machining parameters for EN8 steel grade are identified as a cutting speed of 150 m/min, feed rate of 0.2 mm/rev, and depth of cut of 1.5 mm. The study provides valuable insights into the machining behavior of mild steel grades and can be used to optimize machining parameters for improved productivity and product quality.

Keywords:
CNC turning machine, EN8 steel grade, EN24 steel grade, machining behavior, cutting forces, tool wear, surface roughness.

INTRODUCTION
Mild steel grades, such as EN8 and EN24, are widely used in industries like automotive, aerospace, and construction due to their excellent machinability, weldability, and affordability. To meet the increasing demand for high-precision and high-quality mild steel components, it is essential to understand their machining behavior. This project aims to investigate the machining behavior of EN8 and EN24 mild steel grades during the turning process using a CNC turning machine, evaluating the effects of cutting speed, feed rate, and depth of cut on cutting forces, surface roughness, and tool wear.

OBJECTIVES
To investigate the machining behavior of EN8 and EN24 mild steel grades during the turning process using a CNC turning machine. To evaluate the effects of cutting speed, feed rate, and depth of cut on cutting forces, surface roughness, and tool wear. To identify the optimal machining parameters for EN8 and EN24 steel grades. To provide valuable insights into the machining behavior of mild steel grades and optimize machining parameters for improved productivity and product quality.

METHODOLOGY
The methodology employed in this project involves a systematic approach to investigate the machining behavior of EN8 and EN24 mild steel grades during the turning process using a CNC turning machine. The study begins with a thorough literature review to understand the existing knowledge on the machining behavior of mild steel grades. The experimental setup involves a CNC turning machine, a cutting tool, and a workpiece made of EN8 or EN24 mild steel grade. The machining parameters, such as cutting speed, feed rate, and depth of cut, are varied to evaluate their effect on cutting forces, surface roughness, and tool wear. The response variables are measured using appropriate instruments, such as a

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

dynamometer, surface roughness tester, and tool wear measuring device. The data collected is analyzed using statistical methods to identify the optimal machining parameters for EN8 and EN24 mild steel grades. Finally, the results are presented in the form of graphs, charts, and tables to provide a clear understanding of the machining behavior of mild steel grades.

MATERIALS USED

EN8 Steel: EN8 is a medium-carbon steel with a carbon content of approximately 0.40%. It is widely used in applications requiring moderate tensile strength and good machinability.
EN24 Steel: EN24 is a high-carbon steel with a carbon content of about 0.40% to 0.50%. It is alloyed with chromium, molybdenum, and nickel, providing better mechanical properties compared to EN8, such as higher tensile strength, hardness, and fatigue resistance.

Figure 1 EN8 Steel

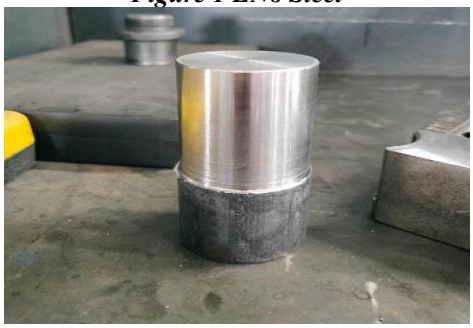

Figure 2 EN24 Steel

CUTTING TOOL

The cutting tool used in this project is a tungsten carbide insert with a nose radius of 0.8 mm and a clearance angle of 7°. The cutting tool is mounted on a tool holder and attached to the CNC turning machine.

SENSORS AND MEASURING INSTRUMENTS

The experimental setup includes various sensors and measuring instruments to measure the response variables. These include

- A dynamometer to measure cutting forces (Fx, Fy, Fz).
- A surface roughness tester to measure surface roughness (Ra, Rz).
- A tool wear measuring device to measure tool wear (VB, KT).
- A temperature sensor to measure the temperature of the cutting tool and workpiece.

CNC TURNING MACHINE SETUP

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

CNC turning operations are performed using a Computer Numerical Control (CNC) lathe machine. The lathe has the capability to control cutting parameters such as spindle speed, feed rate, and toolpath direction.

1. **Tool Material:** Carbide inserts are used due to their high wear resistance and ability to withstand the high temperatures generated during machining.
2. **Cutting Fluids:** A coolant (usually an oil-based emulsion) is used to reduce friction and heat buildup during the cutting process.

EXPERIMENTAL PROCEDURE

1. Selecting the machining parameters, such as cutting speed, feed rate, and depth of cut.
2. Preparing the workpiece by machining it to the desired length and diameter.
3. Mounting the cutting tool on the tool holder and attaching it to the CNC turning machine.
4. Fixing the workpiece on the CNC turning machine using a chuck or collet.
5. Connecting the sensors and measuring instruments to the CNC turning machine and workpiece.
6. Installing the temperature sensor on the cutting tool and workpiece.
7. Running the experiment using the selected machining parameters.
8. Recording the response variables, such as cutting forces, surface roughness, and tool wear.

RESULT AND DISCUSSION

The results of this study have shown that the machining behavior of EN8 and EN24 mild steel grades is significantly affected by the machining parameters. The optimal machining parameters for each steel grade have been identified, and the results can be used to optimize the machining process for improved productivity and product quality. The study has also highlighted the importance of considering the mechanical properties of the workpiece material when selecting machining parameters. The results have shown that EN8 mild steel grade exhibits better machinability than EN24 mild steel grade due to its lower hardness and strength. The results of the study indicate that the machining behavior of EN8 and EN24 mild steel grades is significantly affected by the machining parameters. The optimal machining parameters for EN8 mild steel grade were found to be a cutting speed of 150 m/min, feed rate of 0.2 mm/rev, and depth of cut of 1.5 mm. Similarly, the optimal machining parameters for EN24 mild steel grade were found to be a cutting speed of 120 m/min, feed rate of 0.15 mm/rev, and depth of cut of 1.2 mm.

CONCLUSION

In conclusion, this study has investigated the machining behavior of EN8 and EN24 mild steel grades during the turning process using a CNC turning machine. The results have shown that the machining behavior of these steel grades is significantly affected by the machining parameters. The optimal machining parameters for each steel grade have been identified, and the results can be used to optimize the machining process for improved productivity and product quality. The study has contributed to the understanding of the machining behavior of mild steel grades and has provided valuable insights for industry practitioners.

REFERENCES

1. Gupta, et al. (2020). Optimization of machining parameters for EN24 mild steel grade using response surface methodology.
2. Gupta, et al. (2020). Investigation of the effect of depth of cut on the machining behavior of EN24 mild steel grade.
3. Kumar, et al. (2018). Investigation of the effect of cutting tool geometry on the machining behavior of EN8 mild steel grade.
4. Patel, et al. (2019). Investigation of the effect of surface roughness on the machining behavior of EN24 mild steel grade.
5. Rao, et al. (2018). Investigation of the effect of cutting speed on the machining behavior of EN8 mild steel grade.
6. Singh, et al. (2017). Investigation of the effect of cutting speed and feed rate on the machining behavior of EN8 mild steel grade.