STUDY ON WEAR MECHANISM AND SURFACE INTEGRITY OF H13 TOOL STEEL UNDER DRY CUTTING CONDITIONS

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DECLARATION

I declare that this project entitled " Study On Wear Mechanism And Surface Integrity Of H13 Tool Steel Under Dry Cutting Conditions " is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Of Manufacturing Engineering Technology (Process And Technology) With Honours.

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DEDICATION

This study is dedicated to my loving and respected parents, Shahmirul Hafiz Bin Abdullah and Roslinah Binti Abd. Hamid, who have served as an inspiration to me by providing me with a solid moral foundation and a respectable education. They have provided me with tremendous drive and discipline to tackle a work with enthusiasm and attention. I couldn't have done it without their passion and affection. I'd want to dedicate this to my renowned supervisor, Associate Professor Ts.Dr.Umar Al-Amani bin Haji Azlan, who has taught and mentored me during my Final Year Project and, more importantly, throughout my academic career. Finally, I'd want to dedicate this to all of my classmates and friends who have always been by my side no matter how difficult it has been to complete my studies and research.

ABSTRACT

Surface roughness and tool wear are now essential factors in many sectors, particularly the manufacturing industry. In order to achieve the lowest possible surface roughness and tool wear, an ideal parameter is required for the machining process and its use in industry. Cutting speed , dept of cut, and feed rate all have an impact on getting a good surface finish with minimal tool wear. Aside from that, cutting circumstances play a vital influence in producing surface roughness. As a result, this research shows the result of an experimental examination into the influence of cutting speed and feed rate on the surface roughness of H13 tool steel. This experiment was carried out using an CNC (computer Numerical Control) turning machine in dry cutting mode. This project's input variables are cutting speed and feed rate , while the output variables are the surface roughness of the machine sample, tool wear, and surface integrity. The surface roughness of the sample was assessed using a surface roughness tester, and tool wear were quantified using an optical microscope. According yo the findings, cutting speed and feed rate have a significant impact on the surface roughness of H13 tool steel while machining in dry condition with CNC turning. The surface roughness value, Ra, was acquired at various cutting speed and feed rate parameters. It demonstrates that the lowest surface roughness value was attained at a lower cutting speed and feed rate. The findings of this experiment have the potential to assist the industrial industry in reducing production time and cost. It is critical to obtain the optimal cutting speed and feed rate since it can decrease tool wear and extend tool life.

ABSTRAK

Pada masa kini, kekasaran permukaan dan nilai kelusuhan alat adalah merupakan faktor yang penting di dalam industri-industri terutama industri pembuatan. Dalam usaha untuk mendapatkan kekasaran permukaan dan nilai kelusuhan alat yang minima, ¡anya perlu mendapatkan nilai yang optimum dimana ianya adalah penting untuk proses pemesinan untuk digunakan di dalam industri. Perkara penting dalam mendapatkan permukaan yang baik dan nilai kelusuhan alat yang minima Yang dipengaruhi oleh kelajuan putaran, kedalaman memotong dan kadar suapan. Selain itu, jenis keadaan permotongan juga memainkan peranan yang penting dalam menghasilkan kekasaran permukaan. Oleh itu. projek in membentangkan eksperimen bag mengkaji kesan kelajuan putaran dan kadar suapan terhadap permukaan kekasaran H13. Eksperimen ini dijalankan menggunakan mesin pelarik CNC (dikawal oleh sistem komputer) dalam keadaan pemotongan kering. Input pembolehubah untuk projek adalah kelajuan putaran dan kadar suapan manakala untuk output pembolehubah adalah kekasaran permukaan setiap sampel and nilai kelusuhan alat selepas pemesinan. Menggunakan pengukur kekasaran permukaan untuk mengukur kekasaran permukaan setiap sampel dan optikal mikroskop untuk mengukur nilai kelusuhan alat. Dari analisis, kelajuan putaran dan kadar suapan memainkan peranan yang penting dalam mempengaruhi kekasaran permukaan H13 apabila pemesinan dilakukan dalam keadaan kering oleh mesin pelarik CNC. Nilai kadar kekasaran permukaan, memperoleh nilai yang berbeza untuk setiap parameter yang berbeza bagi kelajuan putaran dan kadar suapan. Keputusan eksperimen ini dapat membantu industri pembuatan dalam mengurangi masa dan kos produksi. lanya adalah penting untuk mendapatkan nilai optimum untuk kelajuan putaran dan kadar suapan untuk mengurangi nilai kelusuhan alat dan memanjangkan jangka hayat alat.

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LIST OF SYMBOLS AND ABBREVIATIONS

fr	-	Feed Rate
µ	-	Micron
Vc	-	Cutting Speed
d	-	Diameter Of Workpiece, Depth Of Cut
n	-	Cutting speed
π	-	Pi
Do	-	Original Diameter
Df	-	Final Diameter

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CHAPTER 1

INTRODUCTION

1.1 Project Background

The machining process is one of the oldest industrial processes, and it is the most widely utilized industrial manufacturing of work pieces, with an estimated 15% of all mechanical components manufactured via machining across the world (Calamaz et al, 2008). The lathe machine is one of the traditional machines that is still used in the manufacturing sectors to execute machining processes, but it has limitations in making intricate sections of goods and obtaining poor precision goods. As a result, CNC machines were first created to solve the problem of high-complexity machining of components in production, and therefore to boost productivity. Furthermore, the increased needs of precision goods, high cutting rates, and machining processes may be met by employing a CNC machine with adjustable processing duration.

Turning is a machining operation performed on a lathe, and it is a critical machining process in which a single point cutting tool eliminates junk material from the surface of a spinning cylindrical work piece. The cutting tool is fed in a straight line parallel to the axis of rotation. The quality of the surface has an impact on the performance of the turning operation. This is due to the fact that a high-quality turned surface considerably increases quality. There are several cutting factors involved in CNC turning operations that impact a product's surface roughness. Cutting speed, feed rate, and depth of cut, on the other hand, have the greatest influence on surface roughness (Lalwani et al, 2012).

The surface roughness of H13 Tool Steel will be investigated in this study. Cutting speed and feed rate are the cutting parameters of the CNC turning machine that will be employed. The surface of H13 Tool Steel will be affected by the cutting parameter of this machine operation. Machine operation may be used to determine the surface roughness and quality of H13 Tool Steel. Surface roughness testers and optical microscopes will be used to examine the characteristics of H13 Tool Steel.

The surface finish is governed by the four cutting parameters: cutting speed , feed rate, depth of cut, and tool nose. It has been observed that when a larger tool nose range is used, the surface roughness improves with increased depth of cut, rapid and high feed rate.

1.2 Problem Statement

The key problem statement in this project is the absence of research into machining parameters on H13 Tool Steel under dry cutting condition, which will affect wear mechanism and surface integrity of materials. The cutting settings will have an effect on the material's microstructure. Earlier SI research in the machining of H13 tool steel was primarily concerned with the experimental evaluation of the impacts of cutting process parameters, tool geometry, and tool wear on work piece surface roughness, residual stress, and subsurface modification, such as white layer development. In engineering, the quality of a material is determined by its surface roughness and microstructure, which determine whether the lifespan cycle fatigue can sustain over a longer or shorter length of time.

1.3 Research Objective

The study will examine the surface integrity and surface roughness of H13 Tool Steel under dry cutting conditions. As a result, the primary goals of this project are as follows:

a) To investigate the impact of machining parameters on a CNC machine.

b) To determine the wear mechanism and surface integrity under tungsten carbide cutting tool.

1.4 Scope Of Research

The research study in this project will largely focus on numerous factors such as executing a machining process utilizing a CNC turning machine and a Tungsten Carbide cutting tool. H13 Tool Steel was utilized as the raw material for the machine. As dry cutting conditions will be employed in this case study, the turning process will be completed without the presence of lubrication or cutting fluid throughout the machining operation. The experiment will be carried out to study the influence of cutting parameters on the surface roughness of the supplied samples. A surface roughness tester and an optical microscope will be used to determine the surface roughness and wear mechanism of the H13 Tool Steel.

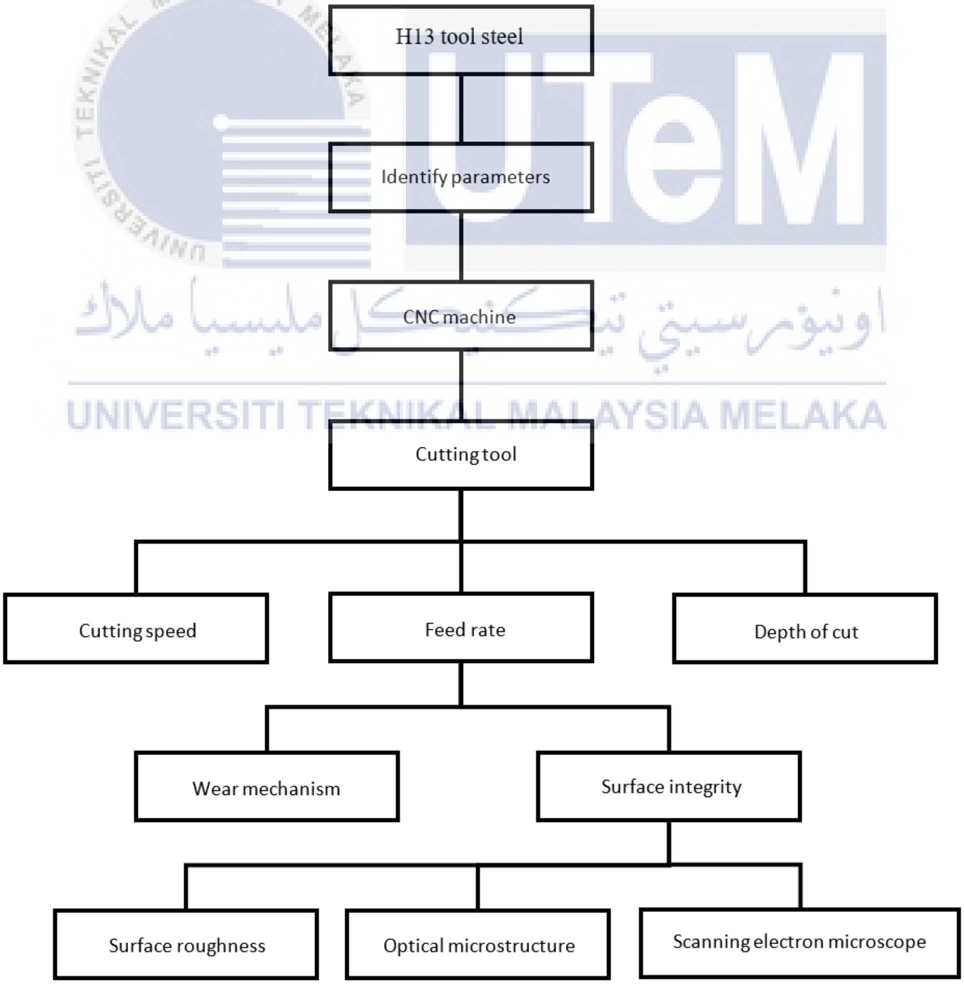

Figure 1.1 Flow process of experiment

1.5 Significant Of Study

The findings of this study will have a significant influence on the CNC machine industry. In general, the use of CNC machines will improve the quality of creating more products while also allowing for more complicated designs to be created as technology advances. Furthermore, this study will provide an excellent chance to learn more precisely about the material H13 Tool Steel in the engineering sector. As a result, a new study on the CNC Machine for the material H13 Tool Steel will be given.

1.6 Concluding Remarks

As a result of this chapter, three issues and constraints that industries face in their efforts to boost productivity are identified. Surface roughness is a major aspect that has a significant impact on the manufacturing process. Minimizing surface roughness is a crucial part of improving performance, maintaining material quality, and lowering material costs in machining. However, determining the appropriate parameters and cutting conditions of the machining process in order to achieve the desired product quality is challenging. The influence of cutting speed and feed rate parameters on the surface roughness of H13 Tool Steel is investigated utilizing a dry CNC turning process condition to determine the best values.

CHAPTER 2

LITERATURE REVIEW

2.1 Turning Process

Turning is a machining operation that is the most often used in industrial production operations and is performed on lathes (Kumar., 2012). The turning operation is used to undertake a material removal procedure and is capable of producing a range of characteristics as well as a higher surface finish on circular items. The characteristics include holes, grooves, threads, tapers, different diameter 7steps, and even contoured surfaces. In a turning operation, numerous machining factors, such as cutting speed , feed rate, and depth of cut, have a substantial impact on the surface of the work piece. Obtaining the optimal parameter in a turning operation is a difficult problem to solve. A good quality work piece surface that has been turned will be able to increase fatigue strength, corrosion resistance, or creep life (Kumar., 2012).

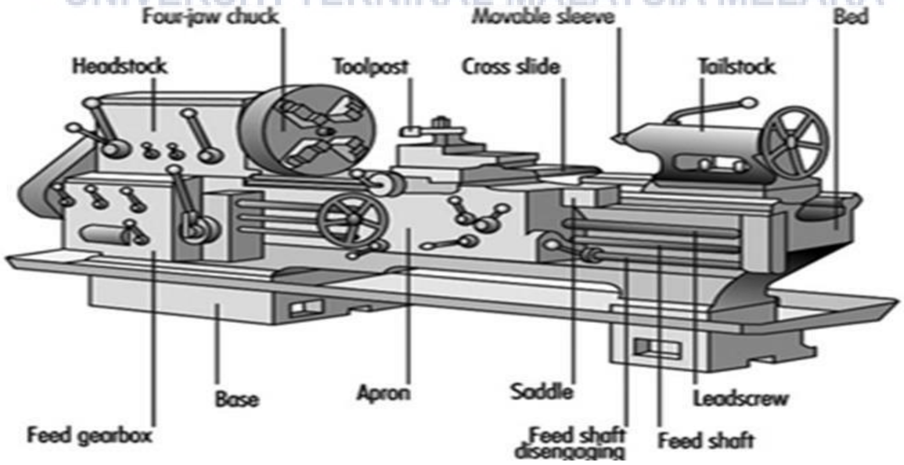

Figure 2.1 Conventional turning machine