UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AN EXPERIMENT STUDY OF THE EFFECT OF RPM ON TURNING MACHINE

This report submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Process) with Honours.

By

AHMAD RASYDAN BIN HASAN

FACULTY OF MANUFACTURING ENGINEERING

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Author's Name	:	Ahmad Rasydan Bin Hasan
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ABSTRACT

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Surface roughness and dimensional accuracy play an important role in the performance of a machined component. As competition among industries grows rapidly, customers have highly demand on quality, making surface roughness become a main competitive demand in manufacturing industry nowadays. The aims of this research it to find the effect of revolution per minute (rpm) on turning machine. There are parameters such as rpm, feed rate and depth of cut that are known to have a large impact on the surface roughness. This research uses 4 samples such as aluminum, stainless steel, mild steel and medium carbon steel. Spindle speed is set to 185 rpm and 340 rpm (low speed), 625 rpm and 1150 rpm (medium speed), 1400 rpm and 1750 rpm (high speed). The feed rate is 0.2 mm/rev and depth of cut is 0.2 mm will remain constant. Surface roughness value is taken through the surface roughness tester and surface texture observation is done using metallurgy microscope (Axioscope 2 MAT)

ABSTRAK

Kekasaran permukaaan dan dimensi ketepatan pengukuran memainkan peranan penting didalam perlaksanaan komponen mesin. Persaingan di dalam industri yang semakin berkembang maju menyebabkan para pengguna mementingkan kualiti menjadikan kekasarasan permukaaan sebagai permintaaan yang amat tinggi di dalam industri pembuatan pada masa kini. Tujuan kajian ini adalah untuk mencari kesan kelajuan (rpm) terhadap mesin larik. Di antara parameter yang dikaji adalah kelajuan (revolution per minute), kedalaman (feed rate), pemontongan (depth of cut) yang dikenalpasti memberikan impak yang besar terhadap kekasaran permukaaan. Kajian ini juga menggunakan 4 jenis material iaitu, aluminum, stainless steel, mild steel, dan medium carbon steel. Parameter kelajuan seperti pusingan memotong diaturkan secara berbeza-beza iaitu 185 rpm dan 340 rpm (kelajuan rendah), 625 rpm dan 1150 rpm (kelajuan sederhana), 1400 rpm dan 1750 rpm (kelajuan tinggi). Kadar suapan adalah 0.2 mm/rev dan kedalaman memotong adalah 0.2 mm akan dikekalkan nilainya. Nilai kekasaran permukaan diambil terus daripada penguji kekasaran permukaan dan pemerhatian tekstur permukaan adalah dibuat menggunakan mikroskop metalurgi (Axioscope 2 MAT)

DEDICATION

For my beloved parents, my family, best friend and all friends, and to those who's with me all this time

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LIST OF ABBREVIATIONS

AISI	American Iron and Steel Institute
CLA	Center Line Average
CNC	Computer Numerical Control
Cm	Centimeter
°C	Celsius
Cu	Cooper
C	Carbon
DOC	Depth of Cut
FKP	Fakulti Kejuruteraan Pembuatan
Ft	Feet
HSS	High Speed Steel
in	Inch
kg	Kilogram
MPa	Mega Pascal
m	Meter
Mn	Manganese
min	Minute
mm	Millimeter (metric unit)
PSM	Projek Sarjana Muda
P	Phosphorus
Pa	Pressure
rpm	Revolution per minute
Ra	Arithmetic Mean Deviation Of The Profile
Rq	Root Mean Square Average
sfpm	Surface Feet Per Minute
S	Sulfur
Si	Silicon
μm	Micrometer (1 millionth of a meter) (metric unit)

Utem	Universiti Teknikal Malaysia Melaka
V	Volt
μ	Micro
μm	Micrometer (Micron)
%	Percent

CHAPTER 1
INTRODUCTION

1.1 Background

Surface roughness is an important measure of the technological quality of a product and a factor that greatly influences manufacturing cost. The mechanism behind the formation of surface roughness is very dynamic, complicated and process dependent; it is very difficult to calculate its value through theoretical analysis. (Tsai et al, 1999).

Many factors contribute to the surface roughness in manufacturing. When molding or forming a surface, the impression of the mold or die on the part is usually the principle factor in the surface roughness. In machining, and abrasive processes the interaction of the cutting edges and the microstructure of the material being cut both contribute to the roughness. Just as different manufacturing processes produce parts at various tolerances, they are also capable of different roughness. Generally these two characteristics are linked: manufacturing processes that are dimensionally precise create surfaces with low roughness. In other words, if a process can manufacture parts to a narrow dimensional tolerance, the parts will not be very rough. (Whitehouse, 1994).

Turning is the operation that removes the metal sheet whilst the metal twist and the cutting tool touch the material to remove the unwanted metal. Turning produces solids of revolutions which has tight tolerance because of the specialize nature of the operations. Turning is performed on a machine called lathe in which the tool is stationary and the part is rotated. Turning is the process of rotating or turning a workpieces against a cutting tool to impart a new shape, hence the name. Machines

performing this operation may bear different names (engine lathe, chucker, automatic screw machine, turret lathe, turning center, etc.) but all are lathes. There are many parameters and variables that influence the turning operations. The parameters that ware used in turning operations influence by the value and the result of the surface roughness. The parameters which influenced surface roughness are cutting speed, feed rate, depth of cut and machining time.

From research by Michigan Technological University in year 2007 the cutting speed is the speed of the work as it rotates past the cutting tool. Speed, always refers to the spindle and the workpiece. When it is stated in revolutions per minute (rpm) it tells their rotating speed. But the important figure for a particular turning operation is the surface speed, or the speed at which the workpiece material is moving past the cutting tool. It is simply the product of the rotating speed times and the workpiece before the cut is started. Every different diameter on a workpiece will have a different cutting speed, even though the rotating speed remains the same.

1.2 Problem statements

The importance of surface roughness during turning process relationship with parameters such as spindle speed has been studied in this project. The surface roughness also contributed an important factor in the industry. Roughness is a measure of the texture of a surface. It is quantified by the vertical deviations of a real surface from its ideal form. If these deviations are large, the surface is rough; if they are small the surface is smooth. Roughness is typically considered to be the high frequency, short wavelength component of a measured surface. Rough surfaces usually wear more quickly and have higher friction coefficients than smooth surface. Roughness is often a good predictor of the performance of a mechanical component, since irregularities in the surface may form nucleation sites for cracks or corrosion. Although roughness is usually undesirable, it is difficult and expensive to control in manufacturing. Decreasing the roughness of a surface will usually increase exponentially its manufacturing costs. This

often results in a trade-off between the manufacturing cost of a component and its performance in application.

1.3 Objectives

The objectives in this research are:

(a) To study the performances of variable spindle speed (rpm) for different workpiece use lathe machine by turning process.

(b) To determine how to reduce the effect of the parameter on the surface roughness.

1.4 Scope of project

This project involves experimentation by machining parts using conventional lathe machine (turning) in UTeM machine shop. This experimentation will concern about the parameters as stated in this project like rpm (revolution per minute) for different workpieces use lathe machine by turning process. The insert carbide cutting tools are used for all the machining process. There are 24 pieces of workpiece provided as materials for machining by the conventional lathe machine. Four types of materials will be used including aluminum, stainless steel, mild steel and medium carbon steel. The 24 samples then planned to be analyzed by using portable roughness measuring machine located at the UTeM Metrology Lab. This study purposely for analyzing the surface roughness with different of spindle speed and different of the materials.

1.5 Structure of The Report

The summary of each chapter was described in the structure of report. The structure of report include from chapter 1 until chapter 6 of the report.

1.5.1 Chapter 1: Introduction

Include the background of the project, problem statement, objectives, and scope of the project and structure of the report.

1.5.2 Chapter 2: Literature Review

Literature review on the machining process, mechanics of cutting, type of insert in turning, machining parameters, tool life and surface roughness.

1.5.3 Chapter 3: Methodology

Describes methodology to develop the experiment, sample preparing, experiment preparing, machine setup etc.

1.5.4 Chapter 4: Result and analysis

This chapter is consisting with two sections. The first section is includes the presentation of data and secondly the analysis of data for surface texture.

1.5.5 Chapter 5: Discussion

General discussion on the results of study, which are discussing on factors that significance on surface roughness.

1.5.6 Chapter 6: Conclusion and Recommendations

Finally, the conclusion about whole field of study in the experiment was made based from the objective of the study. The value of the project itself and recommendation for same kind of project to develop in the future are determined in this chapter.