RELATIONSHIP BETWEEN MACHINING PARAMETERS AND SURFACE ROUGHNESS OF BRASS USING LATHE MACHINE

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RELATIONSHIP BETWEEN MACHINING PARAMETERS AND SURFACE ROUGHNESS OF BRASS USING LATHE MACHINE

RAJA MOHD. BIN RAJA IDRIS

Report submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Mechanical Engineering with Manufacturing Engineering

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OCTOBER 2008

DEDICATION

Especially dedicated to

To my beloved father and mother
Raja Idris Bin Raja Ismail
Noriyah Binti Mat Ali

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In the name of ALLAH, the most gracious, the most merciful..

First of all, I am very grateful to Allah S.W.T, for giving me opportunity to finish my Final Year Project. I want to express my greatest attitude and appreciation to the following person and organizations that have directly or indirectly given generous contributions towards the success of this project

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ABSTRACT

Surface roughness is a consequence of all machining operations and has been the subject of investigative research for the better part of the last century because the product produce good surface finish is very valuable. But, not all the product needs a good surface finish. If the product not demands a good surface finish, the time of machining can be reduce to minimize the cost. This is about the effect of machining parameters on surface roughness using lathe machine. The focus of this project is to study the effect of Cutting speed, feed rate, and depth of cuts on brass`s surface roughness. The experiment was design using Design of experiment (DOE) method and from which number of experiment was constructed. The result show that feed rate is the most effected parameter on surface roughness when machining process then followed by depth of cut and cutting speed. All the parameters are proportional with brass`s surface roughness.

ABSTRAK

Kekasaran permukaan adalah satu akibat dari proses memesin yang dijalankan dan telah menjadi bahan penyelidikan yang utama untuk meningkatkan lagi kualiti permukaan kapada yang lebih baik kerana kebanyakan produk yang menghasilkan permukaan yang baik akan memberikan pulangan yang lumayan. Walaupun begitu, tidak semua produk memerlukan permukaan yang licin untuk dipasarkan. Jika produk tidak memerlukan permukaan yang halus, penjimatan boleh dilakukan melalui pengurangan masa memesin dan secara tidak langsung kos. Fokus projek ini adalah untuk mengkaji kesan parameter mesin, (Kelajuan memotong, kadar suapan, dan kedalaman pemotongan) terhadap kekasaran permukaan Loyang. Projek ini akan diuji dengan menggunakan mesin larik dan Perthometer Surface Roughness. Eksperimen direka dengan menggunakan DOE Method (Rekabentuk ujikaji) untuk membina jadual dan mengetahui bilangan eksperimen. Hasil menunjukkan bahawa kadar suapan adalah parameter yang paling banyak member kesan kepada kekasaran permukaan semasa proses memesin kemudian diikuti oleh kedalaman pemotongan dan kelajuan pemotongan. Semua parameter adalah berkadar terus dengan kekasaran permukaan Loyang.

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i.e	-	Example
VB	-	Cutting Edge Displacement
%	-	Percentage
t_c	-	Chip thickness
t_o	-	Depth of cut
r	-	Chip thickness ratio
V	-	Cutting Speed
D_1	-	Initial diameter
D_2	-	Final diameter
N	-	Spindle speed
F	-	Feed
DOC	-	Depth of Cut
R_t	-	Maximum roughness height
R_a	-	Surface Roughness
R_q	-	Root mean square

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CHAPTER 1

INTRODUCTION

1.1 Project background

This project will investigate the effect of machining parameters for the brass including cutting speed, feed rate and depth of cut on surface roughness. The lathe machine will be used to test the sample because the all parameters of the lathe machine can be changed easily compared to CNC turning and the Perthometer Measuring machine will be used to analyze the surface roughness of brass.

1.2 Objective of Project

To study the effect of machining parameters (cutting speed, feed rate and depth of cuts) on surface roughness on brass.

1.3 Project Scope

The scopes of project are limited to brass, lathe machine, cutting speed, feed rate, depth of cut, and surface roughness.

1.4 Problem Statement

In general, brasses have excellent machining properties compared with other common engineering metals. However, an improvement in surface roughness can surely benefit the industry. In industry, some of product also needs a high surface for certain application. So, these papers provide guidance on how to vary the machining parameter to obtain certain surface roughness. This project was conducted to study the effect of machining parameters on surface roughness. Variables include will be the cutting speed, feed rate and depth of cut. This project only covers for the lathe machine because it uses a single cutting point which is easy to measure or collect the data.

CHAPTER 2

LITERATURE REVIEW

2.1 Machinability

While it is common to assume that the various “-ability” terms also refer to specific material properties, they actually refer to the way a material responds to specific processing techniques. As a result, they can be quite nebulous. Machinability, for example, depend not only on the material being machined but also on the specific machining process; the condition of that process, such as cutting speed; and the aspects of that process that are of greatest interest. Machinability ratings are generally based on relative tool life. In certain applications, however, may be more interested in how easy a metal is to cut or how it performs under high-speed machining and less interested in the tool life or resulting surface finish. For other applications, surface finish or the formation of fine chips may be the most desirable feature. As a result, the term machinability may mean different things to different people, and it frequently involves multiple properties of a material interacting with the condition of a process [1].

2.1.1 Definition of Machinability

The term machinability includes all those properties that showed figure 2.1. which are relevant for the machining and cutting process [2]:

- the wear of tools
- the necessary cutting force
- the resulting form of the chips
- the quality of the surface produced

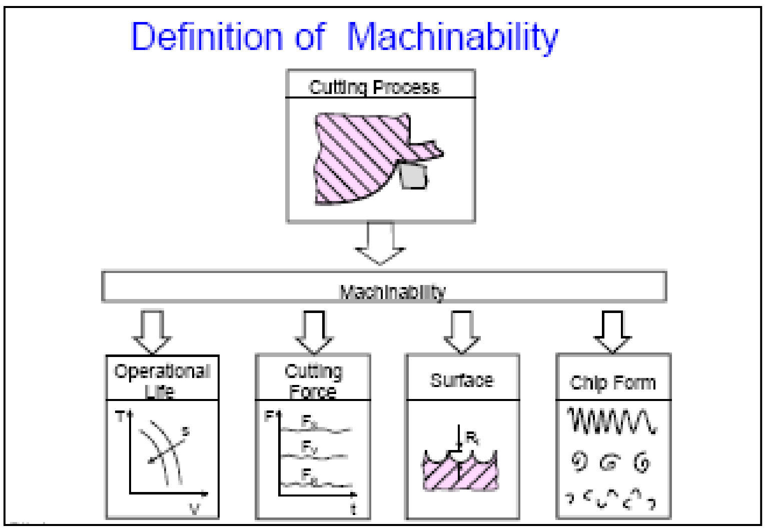


Figure 2.1. Definition of Machinability

2.1.2 The process of machining

Actually, arrangement of tool and workpiece is the most important criterion for the machining process and it will give big effect to the cutting tool and workpiece. In the machining processes, the machinability should be defined separately for turning, drilling and etc. In this project, it will show for turning process because of the clearly defined arrangements of tools and workpiece, the term machinability applies generally to the turning process. [2]

The result for the machining is depending to these parameters:

- Cutting parameters and tool geometry
- The machines used
- Material of the cutting tool

2.1.3 Form of chips

The form of chip is the important criterion in the machining because it will effect to the surface of workpiece. So, this part most important thing and it must concern with carefully. One of the technological parameters affecting the form of chips is the tool geometry. Thus, a reduced rake angle tends to form shorter chips in alloys which would otherwise deliver long chips. [3]

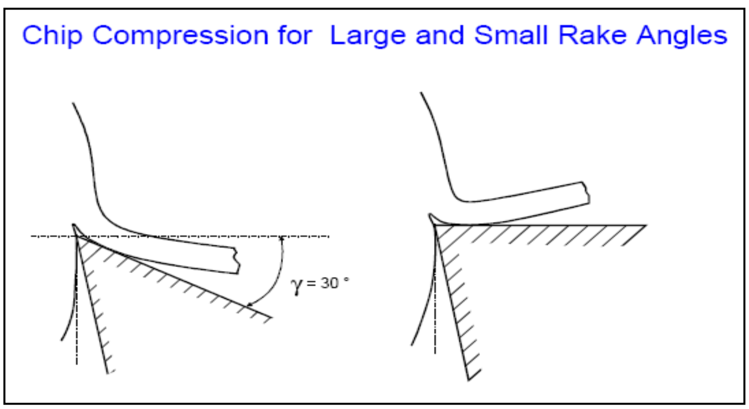


Figure 2.2. Chip Compression for Large and Small Rake Angles

2.1.4 Surface of Machining

In general, the quality of the surface produced by machining depends on three independent parameters:

• **The kinematical roughness**: This is the theoretical depth of roughness (peak-to-valley height), was calculated on the basis of the relative movement of tool and workpiece.

• **The machined surface roughness**: This reflects the separating behavior of the material, i.e. the typical characteristics of aluminium alloys in regard to surface quality.

• **External influences**: Such influencing parameters (stability of system, condition of cutting edges etc.) become extremely important especially when machining aluminium at very high speeds.

2.1.5 Tool Wear

The tool wear while machining aluminium occurs due to abrasion of the free surface. Consequently, the deciding criterion for measuring tool life objectively is the wear width VB. The wear of the free surface depends on the temperature and is caused mainly by abrasion. While using carbide-tipped tools one normally assumes an allowable maximum value of 0.3 to 0.5 mm for VB. [3]

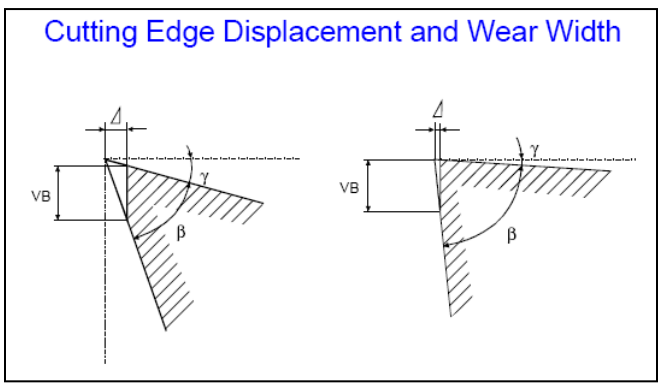


Figure 2.3. Cutting Edge Displacement and Wear Width

So, the material of the workpiece and the cutting parameters are important things to avoid tool wear when machining. Material of the workpiece give very influence, wear increases with the number of large hard particles which are embedded in the workpiece and wear also increase with the strength of material because hard particles embedded in a soft matrix can be gouged out easily but, if the matrix material is harder, inclusions cannot be removed easily, it will increasing tool wear. Finally, wear also depends on the wear resistance of the free surface of the tool.

2.2 Brass

Zinc is by far the most popular alloying addition, and the resulting alloys are generally known as some form of brass. If the zinc content is less than 36 %, the brass is a single-phase solid solution. Since this structure is identified as the alpha phase, these alloys are often called *alpha brasses*. They are quite ductile and formable, with both strength and ductility increasing with the zinc content up to about 36%. The alpha brasses can be strengthened significantly by cold working and are commercially available in various degrees of cold-worked strength and hardness. Cartridge brass, the 70% copper-30% zinc alloy, offers the best overall combination of strength and ductility. As its name implies, it has become a popular material for sheet forming operation like deep drawing.

With more than 36% zinc, the copper-zinc alloys enter a two-phase region involving a brittle, zinc-rich phase, and ductility drop markedly. While cold-working properties are rather poor for these high-zinc brasses, deformation can be performed easily at elevated temperature. [1]

2.2.1 Application of brass

Many applications of these alloys result from the high electrical and thermal ductivity coupled with useful engineering strength. The wide range of colors (red, orange, yellow, silver and white), enhanced by further variations that can be produced through the addition of a third alloy element, account for a number of decorative uses. Since the plating characteristics are excellent, the material is also a frequently used base for decorative chrome or similar coatings. Another attractive property of alpha brass is its ability to have rubber vulcanized to it without any special treatment except through cleaning. As a result, brass is widely used in mechanical rubber goods. [1]

2.2.2 Properties of brass

Most brasses have good corrosion resistance. In the range of 0 to 40% zinc, the addition of small amount of tin imparts improved resistance to seawater corrosion. Cartridge brass with tin becomes admiralty brass, and the 40% zinc Muntz metal with a tin addition is called naval brass. Brasses with 20 to 36% zinc, however, are subjected to a selective corrosion, known as *dezincification*, when the exposed to acidic or salt solutions. Brasses with more than 15% zinc often experience *season cracking* or *stress-corrosion cracking*. Both stress and exposure to corrosive media are required for this failure to occur (but residual stresses and atmospheric moisture may be sufficient). As a result, cold-worked brass is usually stress relieved (to remove the residual stresses) before being placed in service. [1]

Copper-based alloys are widely used in marine environments, due to their excellent electrical and thermal conductivity, good corrosion resistance and ease of manufacture. Brass alloys have wide industrial applications as condensers and heat exchanger systems in saline water. Pitting corrosion, dezincification and stress corrosion cracking and of brass in water have been widely studied. Dealloying, or dezincification, in brass may be readily observed with naked eyes because the alloy develops a reddish color that contrasts with its original yellowish color. Generally, there are two types of dealloying. Uniform or layer dealloying commonly occurs in high zinc alloys where the outer layer is dealloyed and becomes dark while the inside is not affected; plug dealloying is typified by the presence of the dealloyed dark plugs in the unaffected matrix of low zinc alloys and. Two theories have been proposed for dealloying of brass. One states that there is anodic dissolution of the brass (both copper and zinc) while the copper ions plate back from the solution on the remaining brass surface as a porous layer; the other states that the less noble alloying elements are selectively dissolved, leaving vacancies in the brass lattice structure resulting in skeletal copper with poor mechanical integrity[8].

2.2.3 Corrosion

There are a wide range of brass compositions, and the alloys with less than about 15% zinc have corrosion characteristics similar to those of pure copper. As the zinc content increases over 15%, the susceptibility to dezincification, and stress corrosion cracking increases. Dezincification is one of the most insidious forms of corrosion in brasses; it occurs in seawater, in neutral water at elevated temperatures, or when stagnant water conditions occur.

Brasses with less than 15% zinc do not dezincify. Alloy with greater than 15% zinc are susceptible to dezincification, and beta or alpha-beta brasses with over 37% zinc are very prone to dezincification, especially in seawater.

There is a corrosion advantage in using high-zinc brasses. The tendency for impingement attack is lower. Muntz metal, admiralty metal, naval brass, and other copper alloys with about 40% zinc are used for impingement resistant tubing in heat exchangers. High zinc content ever, increases tendencies for stress corrosion cracking. [7]

2.3.2 Calculation

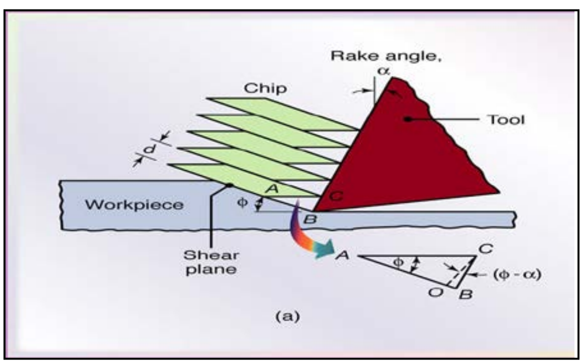


Figure 2.4. This is schematic illustration of the basic mechanism of chip formation by shearing.

Cutting Ratio

It can be seen that the chip thickness, $\boldsymbol{t_c}$ can be determined by knowing depth of cut, $\boldsymbol{t_o}$, and $\boldsymbol{\alpha}$ and $\boldsymbol{\varphi}$. The ratio of $\boldsymbol{t_o / t_c}$ is known as the **cutting ratio** or (chips-thickness ratio), $\boldsymbol{r}$, and is related to the two angle by following relationships:

$$\tan \emptyset = \frac{r \cos \alpha}{1 - r\, sin\, \alpha} \tag{2.1}$$

And

$$r = \frac{\sin \emptyset}{\cos(\emptyset - \alpha)} \tag{2.2}$$

Cutting speed

$$\boldsymbol{V = \frac{D_1 \pi N}{1000}} \qquad \textbf{(m/min)} \tag{2.3}$$

Where, D_1 is initial diameter, N is spindle speed

2.4 Feed rate

2.4.1 General about feed rate

Feed rate is defined as the distance the tool travels during one revolution of the part. Cutting speed and feed determines the surface finish, power requirements, and material removal rate. This is the volume of workpiece material (metal, wood, plastic, etc.) that can be removed per time unit. It is often expressed in units of distance per time (typically inches per minute [ipm] or millimeters per minute)

Cutting speed and feed determines the surface finish, power requirements, and material removal rate. The primary factor in choosing feed and speed is the material to be cut. However, one should also consider material of the tool, rigidity of the workpiece, size and condition of the lathe, and depth of cut. [4]

Feedrate is dependent on the:

- Surface finish desired.
- Power available at the spindle (to prevent stalling of the cutter or workpiece).
- Rigidity of the machine and tooling setup (ability to withstand vibration or chatter).
- Strength of the workpiece (high feed rates will collapse thin wall tubing)
- Characteristics of the material being cut, chip flow depends on material type and feed rate. The ideal chip shape is small and breaks free early, carrying heat away from the tool and work.

2.4.2 Calculation

$$\boldsymbol{Feed\,rate} = \boldsymbol{f} \times \boldsymbol{N} \qquad \text{(mm/rev)} \tag{2.4}$$

Where f is feed, N is spindle speed

2.5 Depth of cuts

2.5.1 Definition of depth of cuts

Depth of cut is the distance that the cutting tool is plunged into the workpiece. Depth of cut is typically measured in millimeters or inches. Cutting speed and depth of cut significantly influence tool life. Increased cutting speed and depth of cut result in increased temperatures at the cutting zone. In addition, noticed that when feed rate is increased, residual stresses change from compressive to tensile.

The depth of the cut and the feed rate will also affect the cutting speed, but not to as great an extent as the work hardness. These three factors, cutting speed, feed rate and depth of cut, are known as cutting conditions. Cutting conditions are determined by the machinability rating. Machinability is the comparing of materials on their ability to be machined. From machinability ratings we can derive recommended cutting speeds.

2.5.2 Calculation

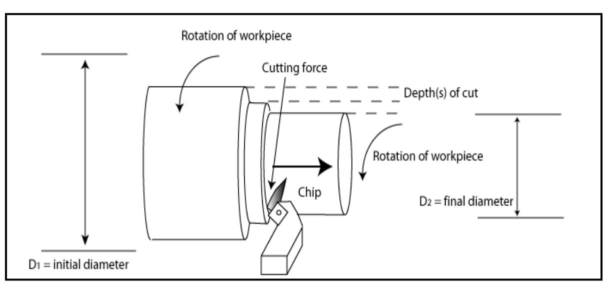


Figure 2.5. The relationship between initial diameter and final diameter

The depth of cut (DOC) is the distance that a tool penetrates into the workpiece. It is calculated in lathe operations as follows [4]:

$$\boldsymbol{DOC = \frac{D_1 - D_2}{2}} \tag{2.5}$$

2.6 Lathe machine

2.6.1 Introduction

Turning is the process of machining external cylindrical and conical surfaces. It is usually performed on a machine tool called a lathe, using a cutting tool. The workpiece is held in a workholder. Relatively simple work and tool movements are involved in turning a cylindrical surface. The workpiece is rotated and the single-point cutting tool is fed longitudinally into workpiece. [1]

2.6.2 What is lathe machine?

A lathe is a machine tool which spins a block of material to perform various operations such as cutting, sanding, knurling, drilling, or deformation such as metal spinning with tools that are applied to the workpiece to create an object which has symmetry about an axis of rotation.

Lathes are used in woodturning, metalworking, metal spinning, and glass working. Lathes can be used to shape pottery, the best-known design being the potter's wheel. Most suitably equipped metalworking lathes can also be used to produce most solids of revolution, plane surfaces and screw threads or helices. Ornamental lathes can produce three-dimensional solids of incredible complexity. The material is held in place by either one or two centers, at least one of which can be moved horizontally to accommodate varying material lengths.

2.6.3 Parts of Lathe machine

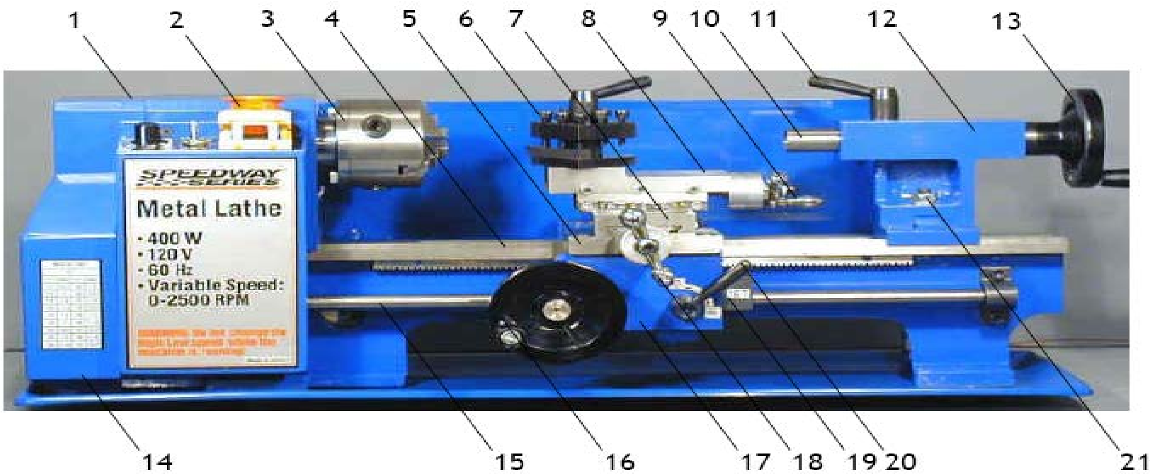


Figure 2.6. This figure showed the component of lathe machine.

1. Headstock
2. Motor controls
3. 3-jaw chuck
4. Bed ways
5. Carriage
6. Tool post
7. Cross slide
8. Compound rest
9. Compound rest feed handle
10. Tailstock quill
11. Tailstock quill locking lever
12. Tailstock
13. Tailstock quill hand wheel
14. Change gear cover
15. Lead screw
16. Carriage hand wheel
17. Apron
18. Cross slide feed handle
19. Threading dial
20. Power feed lever
21. Tailstock lock nut

2.6.4 Cutting tool for lathe

Most lathe operations are done using single-point cutting tools, such as the classic tool design. On right-hand turning (left-hand turning) and facing tools, the cutting tools, the cutting usually takes the place on the side of the tool; therefore, the side rake angle is of primary importance, particularly when deep cuts are being made. On the round-nose turning tools, cutoff tools, finishing tools, and some threading tools, cutting takes place on or near the tipoff the tools are used with relatively light depth of cut.

Because tool materials are expensive, it is desirable to use as a little as possible. At the same time, it is essential that the cutting tool be supported in a strong, rigid manner to minimize deflection and possible vibration. Consequently, lathe tools are supported in various types of heavy, forged steel tool holder. The high-speed steel(HSS) tool bit should be clamped in the tool holder with minimum overhang; otherwise tool chatter and a poor surface finish may result. [1]

2.7 Perthometer Measuring Machine

2.7.1 Introduction

Surface roughness is measure of surface texture. The most common surface roughness measuring instrument such as Perthometer is based of phonograph. An arm with reference rest is drawn across the surface, while a stylus follows the finer surface details. The surface profile can be recorded and various roughness characteristics computed. [6]

These following profiles a commonly used in surface roughness measurement:

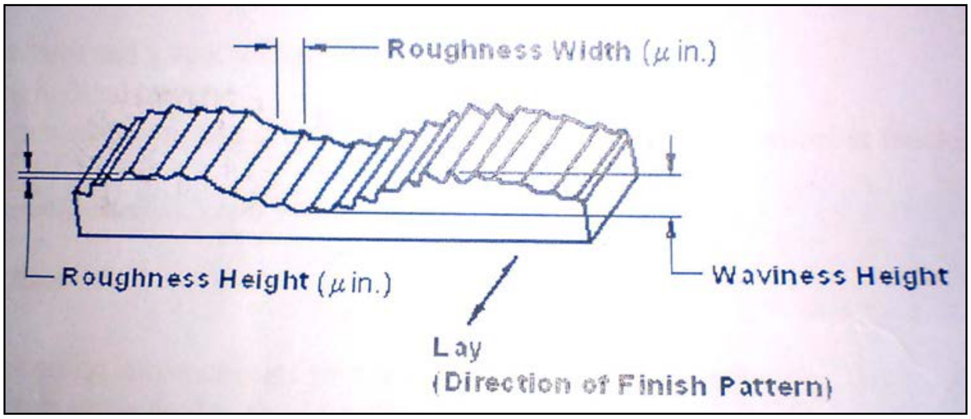
a) R_t is the maximum roughness height. It is important when the roughness is to be removed
b) R_a is the average deviation of mean surface in which

$$R_a = \frac{{y_1}^2 + {y_2}^2 + {y_3}^2 + \cdots + {y_n}^2}{n}$$

(2.6)

c) R_q is the root mean square value that is frequently preferred

$$R_q = \left(\frac{{y_1}^2+{y_2}^2+{y_3}^2+\cdots+{y_n}^2}{n}\right)^{1/2}$$



(2.7) Figure 2.7. The roughness of technical surfaces can be revealed by various techniques

2.7.2 Features

- Mobile measurement of roughness, waviness and profile depth with maximum precision according to the latest standards
- Mobile skidless tracing with motorized pick-up zeroing (patented) – as simple as skidded tracing
- Large, illuminated graphics display for profile and plain text indication
- Automatic function for setting standardized filters and tracing lengths
- Free choice of tracing lengths and filters for measurements over up to 120 mm
- Light-weight housing, < 3 kg (6.6 lbs) – for easy transport in case of on-site measurements
- Monitoring of calibration and maintenance intervals as well as of tolerance limits
- Memory card for measuring programs, profiles, results and software updates

CHAPTER 3

METHODOLOGY

3.1 Introduction

In methodology, all the process will be explained in details every chapter. This project involves many steps such as information gathering, planning, analysis and discussion. Those processes will be described in this chapter according to the flowchart.

3.2 Literature review

In this part, every data and information will be gathered and summarized according to the objective and scope of this project. The scope of this research is on machining parameters and brass. The literature review was done based on several sources such as journal, books and also information from legal source on internet and manual instructions of the machine. Every information being analyzed to get the overall idea of the process and suitability to meet the objective and scope of study.

3.3 Experimental

For the experiment, lathe machine together with the Tungsten Carbide as a cutting tool was selected. In this experiment, there are 3 parameters will be considered:-

a) Cutting speed
b) Feed rate
c) Depth of cuts

These parameters will be analyzed to show the effect of machining parameters on surface roughness. Perthometer will be used to measure the surface roughness.

3.4.1 Specimen

Figure 3.1. Specimen- Brass

3.3.2 Data

Table 3.1 The setting for the level and the parameters

Parameter / Level	Cutting speed (m/min)	Feed rate (mm/min)	Depth of cut (mm)
Level 1	80	0.1	0.25
Level 2	425	0.18	0.50
Level 3	815	0.28	0.75

Table 3.1 show that there are 3 parameters that will be considered in this study such as cutting speed, feed rate and depth of cut. For each parameter, there are 3 levels. In every experiment setting, one parameter will be varied and the rest will be set as constant. Each experiment setting will be repeated for nine times. By applying DOE method, overall number of experiment that will be ran is 27 times as shown in **Table 3.2**

Table 3.2 Table of experiment

No	Depth of cuts, *DOC* (mm)	Feed rate, *F* (mm/min)	Cutting Speed, *V*	Surface roughness, *Ra*
1	0.25	0.10	80	
2			425	
3			815	
4		0.18	80	
5			425	
6			815	
7		0.28	80	
8			425	
9			815	
10	0.50	0.10	80	
11			425	
12			815	
13		0.18	80	
14			425	
15			815	
16		0.28	80	
17			425	
18			815	
19	0.75	0.10	80	
20			425	
21			815	
22		0.18	80	
23			425	
24			815	
25		0.28	80	
26			425	
27			815	

3.4.3 Lathe Machine

3.5.3.1 Preparing the lathe for operation

1. Clean and lubricate the lathe. Use the lubricants specified by the manufacturer.
2. Turn the spindle by hand to make sure it is not locked in back gear. Set the drive mechanism to the desired speed and feed.
3 Place all guards in position.
4. Move the carriage along the ways; there should be no binding.
5. Inspect the cross-feed and compound rest slides. Adjust the gibs if there is too much play. Do not permit excessive overhang of the compound rest.
6. Inspect the tailstock if it is to be used for any portion of the operation. Check it for alignment and use a smooth dead center.
7 Place the proper work holding attachment on the headstock spindle. Clean the threads and apply a drop of oil.
8. Sharpen the cutter bit. Clamp it in the appropriate tool holder.

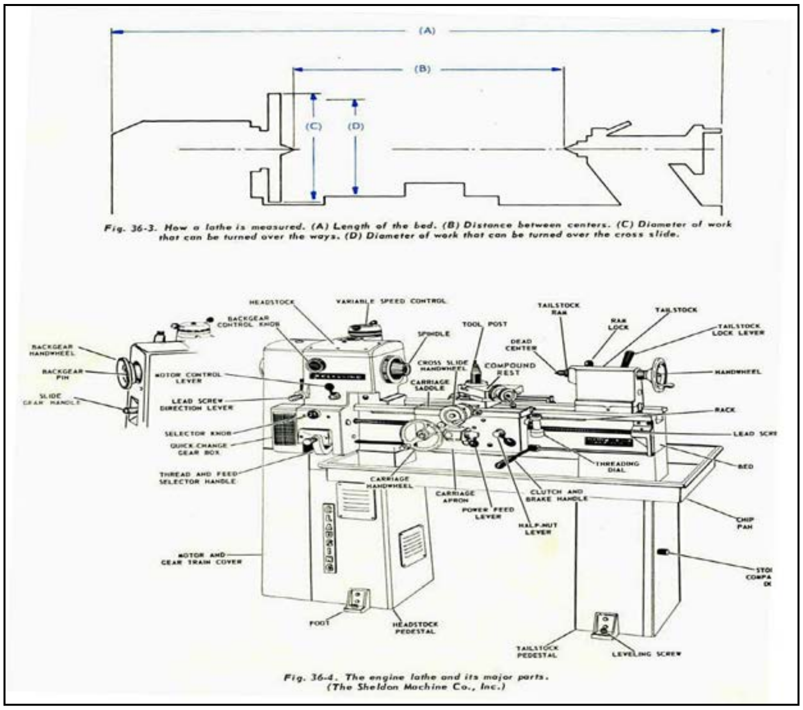


Fig. 36-3. How a lathe is measured. (A) Length of the bed. (B) Distance between centers. (C) Diameter of work that can be turned over the ways. (D) Diameter of work that can be turned over the cross slide.

Fig. 36-4. The engine lathe and its major parts. (The Sheldon Machine Co., Inc.)

Figure 3.1. Lathe machine and all the part of lathe machine

3.4.4 Perthometer Measuring Machine

3.4.4.1 Procedure

1) Switch on the Perthometer machine by pressing START button for approximately 1 second.

2) Place a sample on the platform.

3) Select the view “Measuring Station” by pressing M button.

4) Position the pick-up (stylus) approximately in the centre.

5) Start measurement by pressing START button.

6) For each sample, repeat the measurement three times so that averages could be calculated in order to minimize the variability.

3.5 Report Writing and Submission of Documentation

In this chapter all result will be organized into table, graph or figure. Result were discussed and compared to other journal or theory before the conclusion can be made. Report that has been completed conforming to FKM standard will then be submitted.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Result

Table 4.1 Table of parameter

Parameter / Level	Cutting speed (m/min)	Feed rate (mm/min)	Depth of cut (mm)
Level 1	80	0.1	0.25
Level 2	425	0.18	0.50
Level 2	815	0.28	0.75

Table 4.1 shows the level of experiment and the parameters. To complete this observation, the brass will be machined 27 times and it will be measure using Perthometer surface roughness. Each experiment, the measurement will be take 3 times with difference place and the average that 3 reading will be the result to make sure the result is accurate. All result was shown in **Table 4.2**.

Table 4.2 All the result for surface roughness after the experiment.

No	Depth of cuts, *DOC* (mm)	Feed rate, *F* (mm/min)	Cutting Speed, *V*	Surface roughness, *Ra*
1	0.25	0.10	80	2.063
2			425	2.421
3			815	2.643
4		0.18	80	2.101
5			425	2.156
6			815	2.048
7		0.28	80	3.093
8			425	2.394
9			815	3.152
10	0.50	0.10	80	1.628
11			425	2.295
12			815	1.892
13		0.18	80	1.717
14			425	2.304
15			815	2.293
16		0.28	80	3.337
17			425	2.717
18			815	2.733
19	0.75	0.10	80	1.573
20			425	1.969
21			815	2.045
22		0.18	80	2.333
23			425	2.453
24			815	2.304
25		0.28	80	2.876
26			425	2.606
27			815	2.424

4.2 Discussion

4.2.1 Introduction

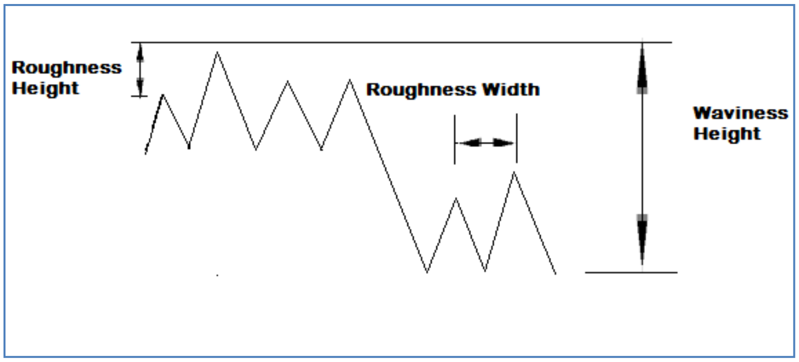


Figure 4.1 Structure and pattern on surface.

Surface roughness in turning process is depend on 3 factors or parameters like cutting speed, feed rate, and depth of cut. The feed rate will affect the distance of roughness width and the depth of cut will affect the roughness height and waviness height. If this 3 thing in the right value, it will produce a good surface roughness. But sometimes bad surface roughness was need for certain situation. A good surface roughness has small distance in width roughness, roughness height and waviness height.

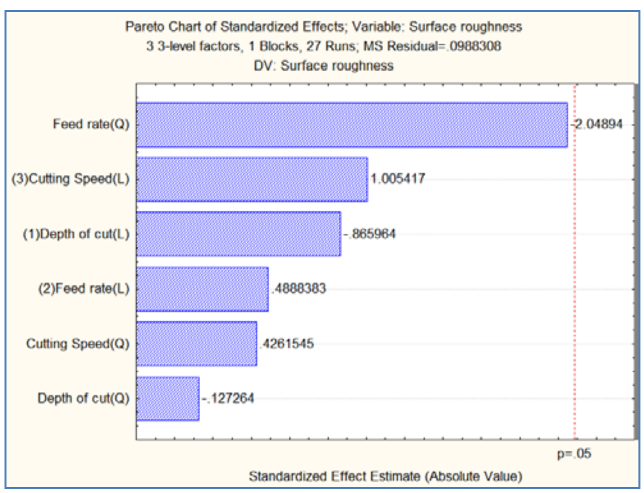


Figure 4.2 Standardized effects estimate

From the **Figure 4.2**, view of the result of main effect are clear where feed rate, contributes maximum effect as a main factor. Next is cutting speed depth of cut where he effect is small can be independent variables.

4.2.2 Graph Depth of Cut VS Surface Roughness

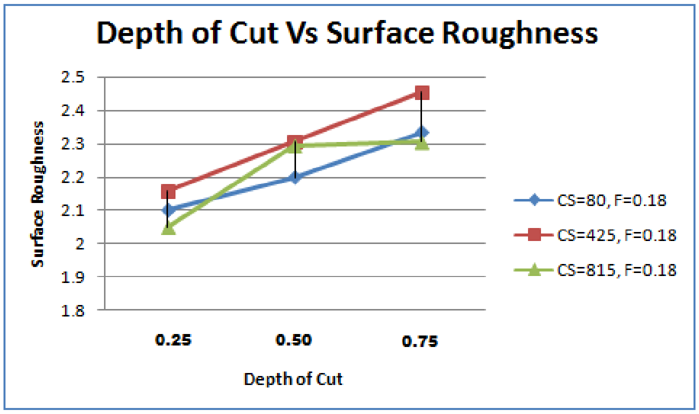


Figure 4.3

Figure 4.3 show that surface roughness will increase when the depth of cut was increase. But the difference between first reading and final reading not too big because depth of cut not much changed the structure on surface.

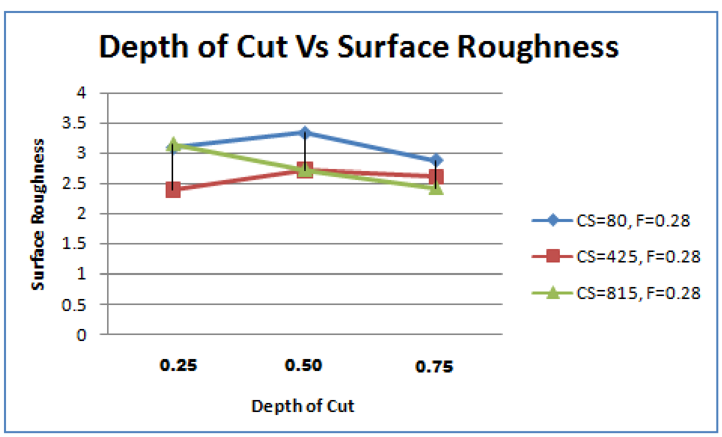


Figure 4.4

Figure 4.4 show that surface roughness decrease when increase the depth of cut but most of it just in horizontal line. In cutting speed 815rpm, the reading is decline obviously.

4.2.3 Graph Feed rate VS Surface Roughness

Feed rate is the second factors that affect the surface roughness. When feed rate higher, the surface roughness will increase because the higher feed rate will cause distance between peak to peak on the surface will be increase and all the reading is near between 3-3.5µm that show in **Figure 4.4**. But, when in higher cutting speed the affect of feed rate will be decrease because distance peak to peak becomes smaller and the reading nears 2.5-3 µm.

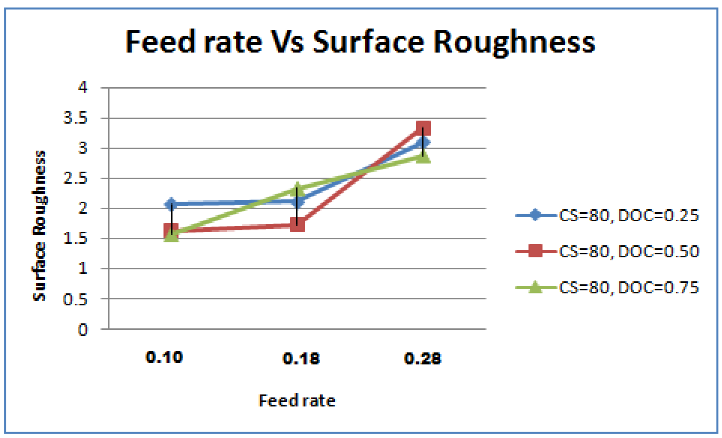


Figure 4.5

For the low cutting speed, the surface roughness is good and all the reading is below than 2µm, but it increases in big range. The difference between 1st and 3rd reading is 2µm, it`s cause rotation is too slow.

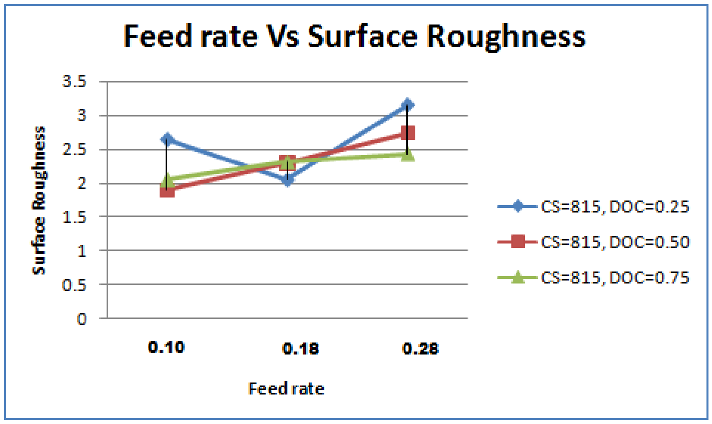


Figure 4.6

In **Figure 4.6**, it also shows that the surface roughness will be increase when feed rate was increase but the difference is small. Compare to **Figure 4.5**, the cutting speed is low but the difference between the first and the final reading is big. It show that when cutting speed increase, it can reduce the influence of feed rate.

4.2.4 Graph Cutting Speed VS Surface Roughness

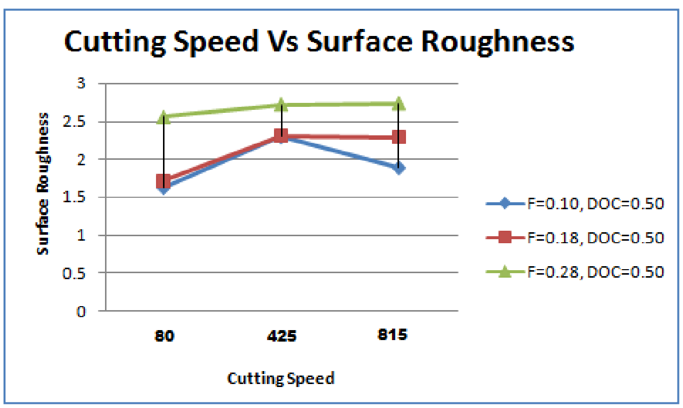


Figure 4.7

Figure 4.7 show that the surface roughness increase when cutting speed increase, but it`s not much. When feed rate was increase with cutting speed, the surface roughness increase.

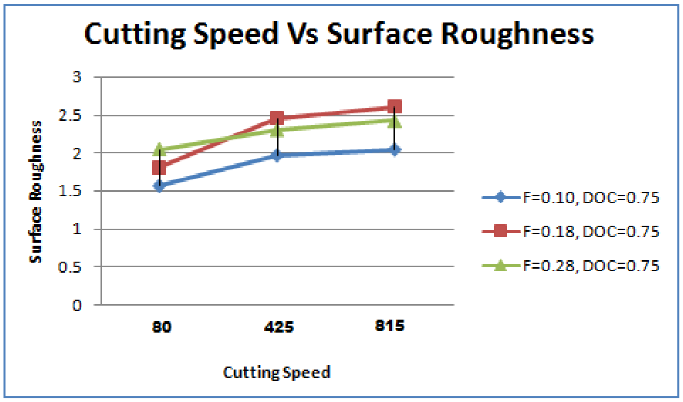


Figure 4.8

For **Figure 4.8,** it also shows that surface roughness proportional with cutting speed. But, in this figure the depth of cut was constant for 0.75mm, the surface roughness is quite good and all result below than 3µm.

CHAPTER 5

CONCLUSION & RECOMMENDATION

5.1 Conclusion

From this project, the outcome of the project can be summarized as below:

- The feed rate give the big influence on the brass surface roughness, then the second parameter that give more affect is depth of cut.
- The lower cutting speed will produce a good surface roughness.

5.2 Recommendation

This paper is related to the workpiece, machine, parameters and accuracy for all machines that have been used. So, all this things must be in the right value always calibrating before use it. This procedure cannot be ignore because to avoid mistake when taking a reading and result.

Beside that, the experiment must be using a method, like ANOVA or Taguchi Method to make this research more accurate. The level for all parameters must more than 3 or 4 because it will make the result more accurate and the graph will be form better and will near the theory.

REFERENCES

1. J T. Black & R. A. Kosher, Materials & Processes in Manufacturing, Wiley, 2008, Tenth Edition, page 50

2. P. Johne, Machining of Products, Aluminium, TALAT Lecture, 1994, Basic Level, pages 3-15

3. L. Froyen, Aluminium Matrix Composites Materials, TALAT Lecture, 1994, Advanced level 1. Pages 3-5

4. S. Kalpakjian-S. Schimd, Manufacturing Engineering and Technology, PEARSON, 2006, Fifth edition, pages 607-645

5. F. J. Hoose Jr., MiniLatheUserGuide, LittleMachineShop, 2002, 1st edition, pages 1-5.

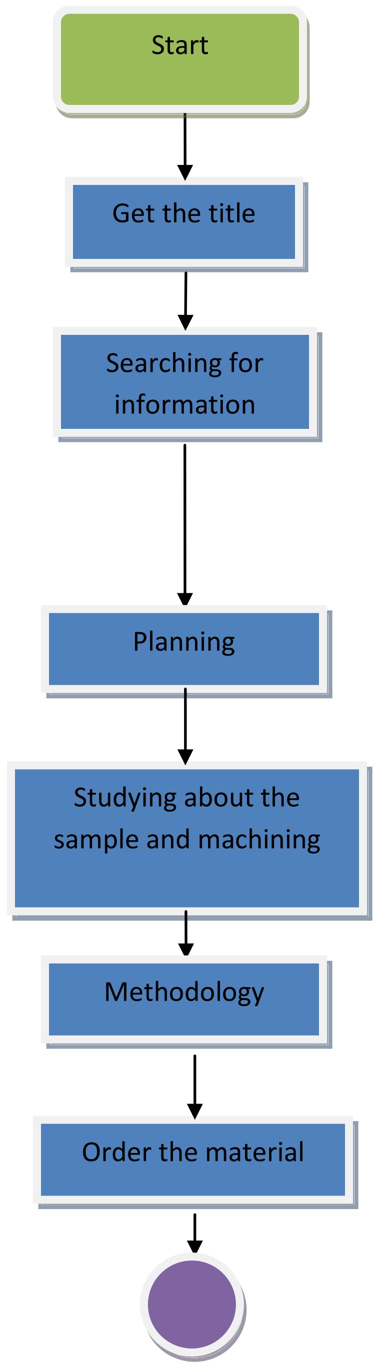
6. M. Azmir , Lab Sheet, Material Removal Process III : Grinding Operation, 2007

7. K. G.Budinski & M. K. Budinski, Engineering Materials Properties and Selection, Pearson Education,2002, seventh Edition, page 624.

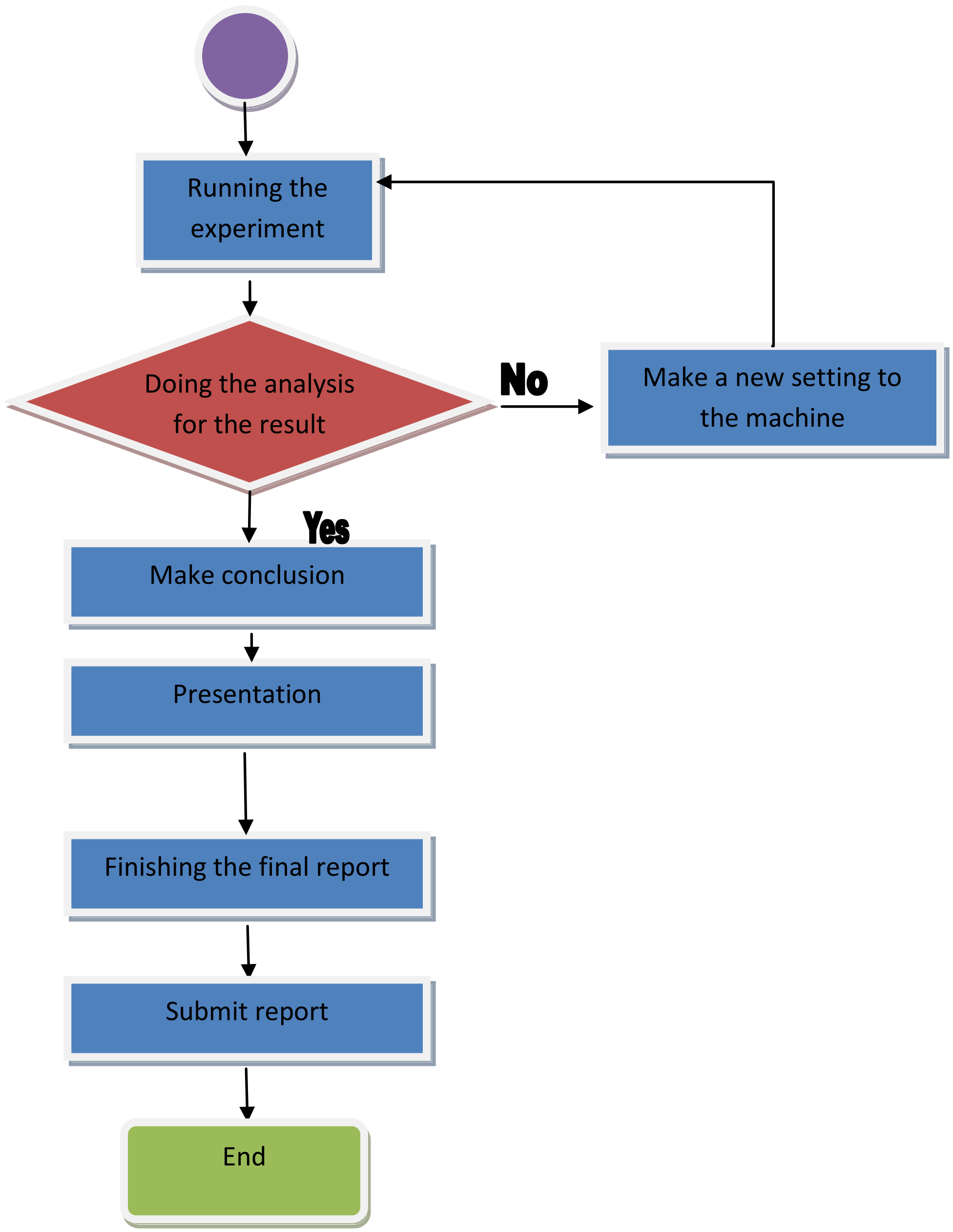
8. J.L. Chen, Z. Li and Y.Y. Zhao**,** Corrosion characteristic of Ce Al brass in comparison with As Al brass, Sceincedirect, 2008

APPENDIX A

APPENDIX A1 : Final Year Project 1 Flowchart



APPENDIX A2 : Final Year project 2



APPENDIX B

APPENDIX B1 : Gantt Chart for Final Year project

GANT CHART FOR FYP 1

	Project Activities	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
1	Determine the Objective, Scope and Project background	■	■													
2	Literature Review															
	• Searching for Information of Lathe Machine			■	■	■										
	• Determine the Problem Statement						■	■								
3	Methodology								■	■	■					
4	Submit Draft to Supervisor for Correction											■	■			
5	Write Report and Submit													■	■	
6	Presentation															■

GANT CHART FOR FYP 2

	Project Activities	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
1	Perform Experiment	■	■	■												
2	Data Collection				■	■										
3	Analysis Data						■	■								
4	Confirmation Test								■	■						
5	Final Result										■	■	■			
6	Presentation													■		
7	Submit Draft to Supervisor for Correction													■	■	
8	Write Report and Submit														■	■

APPENDIX C

APPENDIX C1 : Lab Form

FKM-LAB-001-002(1)

UNIVERSITY COLLEGE OF ENGINEERING & TECHNOLOGY MALAYSIA

FAKULTI KEJURUTERAAN MEKANIKAL
KOLEJ UNIVERSITI KEJURUTERAAN & TEKNOLOGI MALAYSIA
BEG BERKUNCI 12
25000 KUANTAN
PAHANG

NO. SIRI: 002028

BORANG PINJAMAN PERALATAN MAKMAL

Nama Pemohon :________________ Tarikh : ________

No. Pekerja/No. Matriks: ________________

Bil	Peralatan	Kuantiti	Stor	Catatan

*(Sila kembalikan borang ini sewaktu pemulangan barangan)

Nota :

Tandatangan Kebenaran :

Pemohon:	Disokong (Pensyarah/JP/PJP)	Pegawai Bertugas :
Tarikh :	Tarikh :	Tarikh :

Pemulangan

Diserah oleh:	Diterima oleh:
Tarikh :	Tarikh :

APPENDIX C2 : Work Order Form

UNIVERSITI COLLEGE OF ENGINEERING & TECHNOLOGY MALAYSIA

FAKULTI KEJURUTERAAN MEKANIKAL
KOLEJ UNIVERSITI KEJURUTERAAN & TEKNOLOGI MALAYSIA
BEG BERKUNCI 12
25000 KUANTAN
PAHANG

FKM-LAB-001-001(1)

NO. SIRI: 001667

ARAHAN KERJA/WORK ORDER

Nama Pemohon: RAJA MOHD. B. RAJA IDRIS.

Tarikh: ~~4/8/08~~ 04/09/08.

Kategori:

- [x] Pembelajaran
- [ ] Penyelidikan
- [ ] Bisnes
- [ ] Lain-lain (sila nyatakan) : ____________

No. Rujukan: ____________

Bil	Item	Deskripsi	Kuantiti	Kos
1.	Surface Roughness Perthometer		1	
2.	Image Analyzer		1	

Nota:

DISEDIAKAN OLEH:

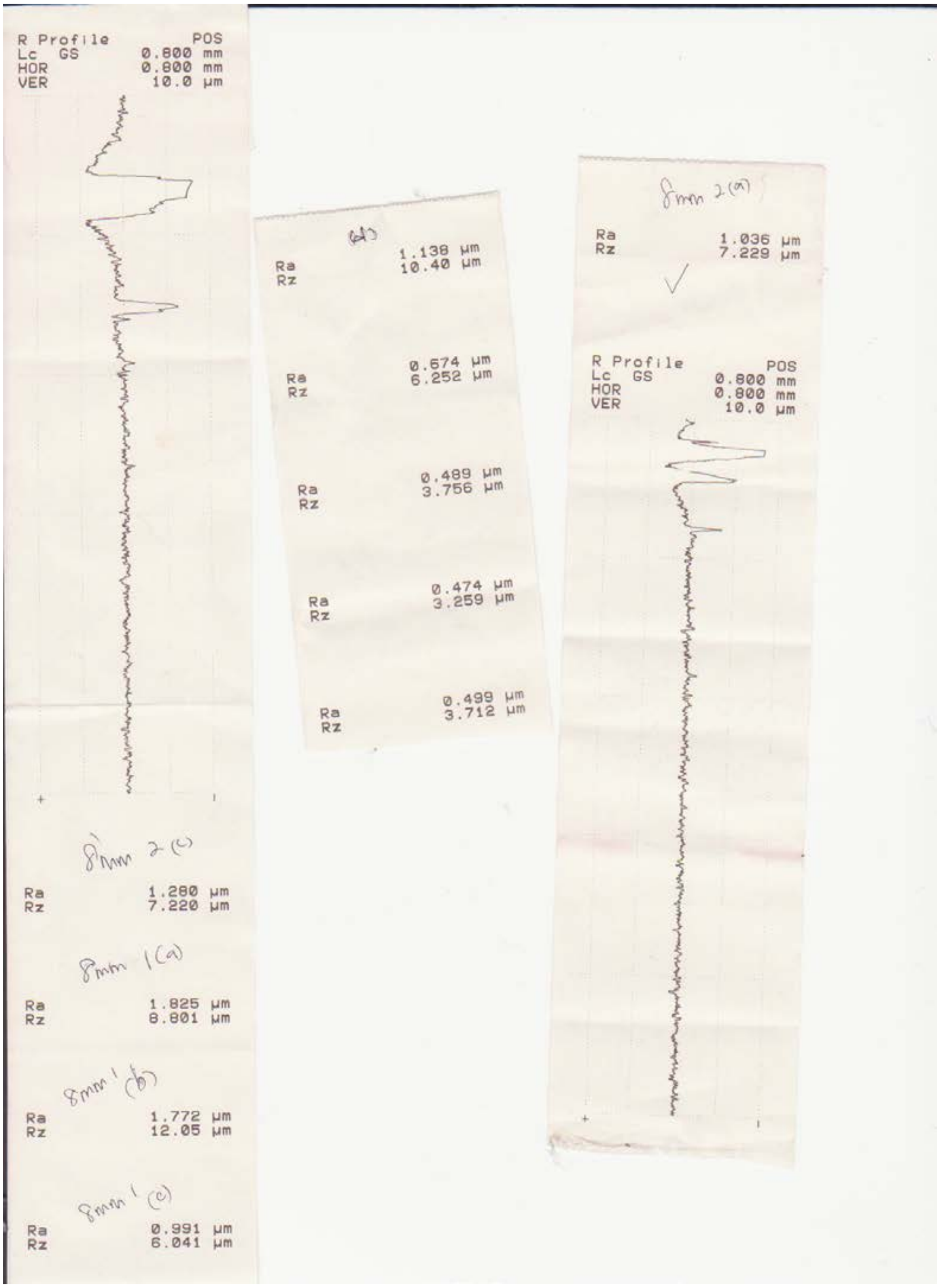
NAMA: ~~Ahd~~ RAJA MOHD. B. RAJA IDRIS
ID NO: ME 05005
TARIKH: 04/09/08.

DILULUSKAN OLEH:

NAMA: SALWANI SALLEH
ID NO: 0491
TARIKH: 04/09/08
COP: SALWANI BINTI MOHD SALLEH
LECTURER
FACULTY OF MECHANICAL ENGINEERING
UNIVERSITI MALAYSIA PAHANG
LOCKED BAG 12
25000 KUANTAN, PAHANG
TEL : 09-549 2249 FAX : 09-549 2244

APPENDIX D

APPENDIX D1 : Results



APPENDIX D

APPENDIX D1 : Pictures