



**FACULTY OF MECHANICAL AND MANUFACTURING  
ENGINEERING TECHNOLOGY**

**A PROJECT ON BALL AND CONCAVE JIG ATTACHMENT FOR  
LATHE**

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**Bachelors of Manufacturing Engineering Technology (Process and Technology) with  
Honours.**

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I hereby, declared this report entitled “A Project on Ball and Concave Jig Attachment for Lathe” is the results of my own research except as cited in references.

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Date : .....

## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

.....

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## ABSTRAK

*Projek ini bertujuan untuk mereka bentuk bahan kerja yang berbentuk bulat dan separa bulat akan direka dan difabrikasikan. Alat memotong ini digunakan untuk memotong bentuk bulat dan separa bulat. Walau bagaimanapun, ianya sukar dan mengambil masa yang agak lama untuk memotong bahan berbentuk bulat dan separa bulat. Kebiasaannya, proses untuk memotong bentuk bulat dan separa bulat adalah dengan menggunakan mata alat yang istimewa dimana ia memerlukan orang yang mahir. Tujuan projek ini adalah untuk mencadangkan alat pemotong khas untuk memotong bahan kerja berbentuk bulat dan separa bulat. Objektif projek ini adalah untuk mereka bentuk dan menghasilkan alat memotong yang baru yang boleh digunakan untuk mesin pelarik supaya ia akan dapat mengurangkan masa. Untuk mencapai objektif projek ini, dimulakan dengan mengkaji alat memotong yang berbeza dan menghasilkan beberapa konsep untuk menyelesaikan pernyataan masalah. Reka bentuk alat pemotong telah dilakarkan dengan menggunakan perisian "Solidwork". Beberapa proses yang terlibat dalam fabrikasi adalah proses pelarik, kimpalan, penggerudian, pengisaran dan pemesinan pelepasan elektrik dawai. Projek ini akan menghasilkan alat pemotong untuk bahan kerja berbentuk bulat dan separa bulat, ianya dapat mengurangkan masa sewaktu pemasangan dan proses pemesinan dijalankan.*

## **ABSTRACT**

In this project, the new turning cutting tool for ball and concave of workpiece will be designed and fabricate. The cutting tool for turning is used to cut the ball and concave workpiece. However, it is difficult and take time to cut the ball and concave. A usually process for cutting ball and concave is by using a special cutting tool which it need skillful person. The purpose of this project is to propose the specific turning cutting tool which is to cut the ball and concave workpiece. The objective of this project is to design and produce new turning cutting tool that can be used for lathe machine so that it will be able to reduce time. To achieve the objective of this project, starting with concept generations where different patterns of the cutting tool was study and develop several concepts to solve the problem statement. Design of the turning cutting tool was sketched by using Solidwork software. The processes involve in fabrication are milling, turning, welding, drilling, grinding and EDM wire cutting. The project will have outcome of turning cutting tool for ball and concave of workpiece that will reduce time when setup the cutting tool also during machining process.

## **DEDICATIONS**

I dedicate this essay to my beloved mothers, my fathers, my brothers and my friends. People who have always been there to support me and always show me the best path to follow. To my parents, I will never finish thank you for everything you do.

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## LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

HSS	High-Speed Steel
ANSI	American National Standards
OD	Outside Diameter
ID	Inside Diameter
EDM	Electrical Discharge Machining
RPM	Revolution Per Minute
PFD	Process Flow Diagram



# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

This chapter is about explanation of the introduction and the objective of the project. This chapter is important to know the background project before start the project fabrication. This chapter will cover the introduction, project background, problem statement, objective and project scope.

### 1.1 Project Background

This cutting tool jig is specializing to cut the ball and concave shape material of workpiece. Usually, it used the tool post of cutting tool to cutting face of the work piece and need skillful person to handle the tool post of cutting tool at the machine. In addition, this ball and concave jig attachment for lathe machine can reduce time to setting the angle of tool post. Virtually this cutting tool come up with the correct angle to perfectly cut the radius shape of work piece and to run the cutting tool with half automated jig.

This project is about to fabricate and produce the cutting tools to cut the workpiece into the radius shape. However, there are no specific cutting tool to cut the radius shape workpiece which before this usually the machinist using the tool post that is hard to setting the angle and cannot be moved to any way while in process.

In order to make the specific turning cutting tools about to this project, it is also to design the cutting tool jig or holder. This is because the existing product, there is tool holder that clamp at tool post during machining. This new design has been made to get the accurate scale so that the workpiece cannot move or vibrate and easy to handle when machining process. The probability of making mistakes in the machining process is higher when used the tool post that manually to setting the angle of radius shape of workpiece and this project created to prevent mistake during machining process.

The other thing of software that will be used to design the tool is by using SOLID WORKS which is to design this product. This software can be used for designing and dimensioning of product. This software is very useful to create the design of this product and to help to manufactured the product.

### **1.3 Problem Statement**

We know that cutting tool is used to cut or feed the raw material. Doing the setting angle of tool post to make the concave or ball shape is easy. It will give the problem of time taken because the tool post jig might be problem to make movement on post jig. However, this operation still need to be perform to some application. That's why this cutting tool is design.

## **1.4 Objective**

From the background and the problem statement that have been stated, the objectives of this project are:

1. To design the jig attachment of cutting tools for turning machine.
2. To fabricate jig attachment cutting tool easy to performed the cutting operation for radius shape on the turning workpiece
3. To be able to cut workpiece for half automated working by individually with this tools.

## **1.5 Project Scope**

To achieve this project objective, a few design will be design and types of material will be used for doing this project. Some of machining are used as the process to made this project. Also the cutting tool of carbide are used as the cutting tool attach to the special jig tool. Other than that, the project of rate of feed, cutting tool, cutting speed and surface finishing will give guidelines for machinist.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

This chapter is about the literature review that an important thing which is to review the fundamental ideas from the research to focused the project. It is unavoidable to study on journal that relate to the project. To complete this project the knowledge is needed with the fact to sustain the project. This chapter consist about turning process, lathe machine, type of lathe, turning cutting tool, tool holder and tool post, standard operation of lathe, grinding machine and lastly is fabrication.

#### 2.1 Turning Process

The process is removal the material to become a shape is produce from the turning process. The turning process is related with lathe machine that makes the material workpiece to become a shape applied with the cutting tool. The material of feed is depends on the rotating speed of workpiece (Krishna Madhavi, Sreeramulu and Venkatesh, 2017).

The turning process know as the process is using a single cutting tool related to the rotating workpiece and generated the chip. The result in a chip caused by cutting tool and the original surface of each other and can cause damage to the tool (Mia *et al.*, 2018).

The important thing in this turning process is the feed motion of cutting tool and the rotation of workpiece there is in the main movement of process. Cutting tool is process of

single cutting edge to material from work piece to become a cylindrical shape (Bar-Hen and Etsion, 2017).

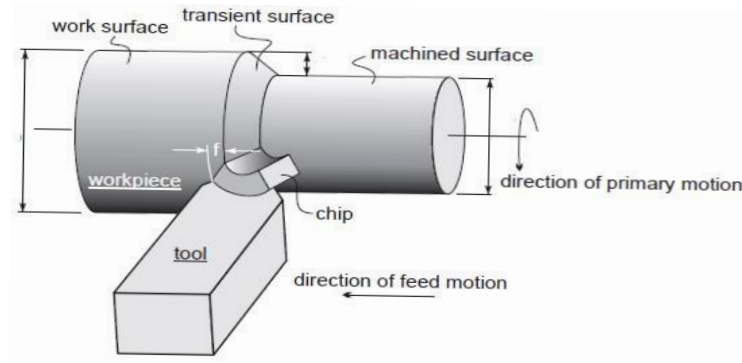


Figure 2. 1: Schematic depiction of turning operation

[Source:< [http://nptel.ac.in/courses/112101005/downloads/Module\\_3\\_Lecture\\_5\\_final.pdf](http://nptel.ac.in/courses/112101005/downloads/Module_3_Lecture_5_final.pdf)

>]

## 2.2 Lathe Machine

Lathe machines are often used to produce a result of a raw material on a cylindrical surface. The task is carried on the chuck attached to the head of machine or between the centers of tailstock and headstock of the lathe machine. The cutting tool is held up on the tool holder that place at compound rest. Compound rest are provides adjustable mounting fit for cutting tools. The workpiece is moved according to the speed on the dependent headstock on the speed panel (RPM). The cutting tool moved along with a straightforward direction to the workpiece with assistance carriage with cross slide and compound rest. The chip form removed from the workpiece is produced from the desired quantity of metal (Machine, n.d.).

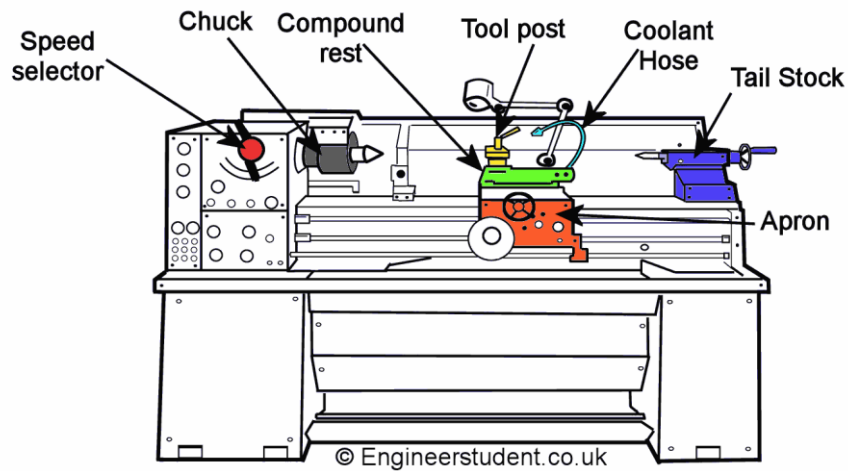


Figure 2. 2: Lathe Machine

[Source:< [http://www.engineerstudent.co.uk/Images/lathe\\_diagram\\_L.png](http://www.engineerstudent.co.uk/Images/lathe_diagram_L.png)>]

### 2.3 Types Of Lathe Machine

There are various types of lathe machine that has been used in this technology world. The machine is classified based on the types of operation that have done on the workpiece. Besides that, material that used for shaped cylindrical also can influence the types of machine that want to be operation (Lathes, Lathes, Lathe, & Lathe, 2016).

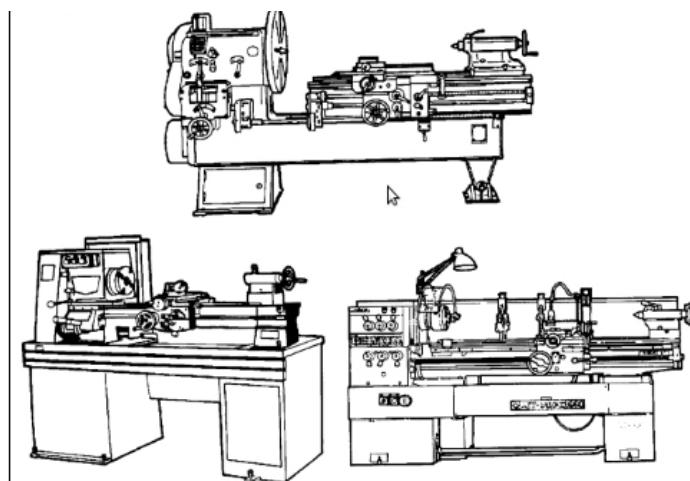


Figure 2. 3: Type Lathe Machine

[Source:< <https://smithy.com/machining-handbook/chapter-3/page/18>>]

### 2.3.1 Bench Lathe

The bench lathe is simple machine that built into a bench to reduce the material become a shape. This bench lathe is used for small and precision work. The bench lathe machine create to held the block at two point at the chuck and allow the user to produce the material to a new shape (Andrew Gellman, 2015).



Figure 2.3. 1: Bench Lathe Machine

[Source:< <https://www.garagejournal.com/forum/showthread.php?t=369002&showall=1>>]

### 2.3.2 Engine Lathe

The most typical types of lathe machine is engine lathe. This engine lathe available in various length. It is created for low power and high power operation. This engine lathe is normally seen in everywhere engineering shop. The length of this machine can be up to 60 feet and can operates at wide range of speed ratios. The types of material that can be machines is all various type (Andrew Gellman, 2015).



Figure 2.3. 2: Engine Lathe Machine

[Source:< <https://basicmechanicalengineering.com/types-of-lathe-machines/> >]

### 2.3.3 Turret Lathe

Turret machine is a best of quick operation machine. On the single structure the tool post mounted have a various type tool post. On this machine has been provided several tools, so the task can be completed faster and assisted by a single setup. The position of next tool is used based on capstan wheel. Without moving the workpiece by using turret lathe in sequential machining process and this will eliminates the error.