CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter gives a short description of the project background including several approaches. It then introduces objectives, scopes, problem statement of this project on prediction of surface roughness in turning operation of low-carbon steel AISI 1018.

1.2 PROJECT BACKGROUND

Surface finish is an important factor in evaluating the quality of products. Surface roughness ($R_a$) is mostly used as an index to determine the surface finish in the machining process. Modeling techniques for the prediction of $R_a$ can be classified into three groups which are experimental models, analytical models and Artificial Intelligence (AI)-based models (Benardos & Vosnaikos, 2003).

Surface roughness measurement presents an important task in many engineering applications (Whitehouse, 1997). Every surface has some form of texture that takes the form of peaks and valleys. These peaks and valleys vary in height and spacing and have properties inherent in the way the surface was produced or utilized. For this purpose, the response surface methodology RSM is utilized.
RSM is a group of mathematical and statistical techniques that are useful for modeling the relationship between the input parameters (cutting conditions) and the output variables (surface roughness) (Montgomer, 2001). RSM saves cost and time on conducting metal cutting experiments by reducing the overall number of required tests. In addition, RSM helps describe and identify, with a great accuracy, the effect of the interactions of different independent variables on the response when they are varied simultaneously. RSM has been extensively used in the prediction of responses such as tool life, surface roughness and cutting forces.

Start from design the experiments, create DOE by use RSM method in MINITAB software. After that, run the experiments use lathe machine and measure the surface roughness use perthometer. After get the experimental data, use RSM method to develop first and second order mathematical models to predict the surface roughness. Lastly, analysis the result and make the conclusion.

1.3 PROBLEM STATEMENT

Surface roughness has a major economic impact, as it is estimated that (in United States alone) the total cost of replacing worn parts and re machining cost to get the better surface finished (Kalpakjian, S. and Schmid, S., 2006). The factors that cause this problem are the operator workers didn’t use the right and suitable condition and parameters such as cutting speed, feed rate, and depth of cut during machining the work piece.

Thus, this research will give the solution to overcome this problem with modeling technique for the prediction of surface roughness by using response surface methodology (RSM) to develop prediction first and second mathematical model for surface roughness during turning low-carbon steel AISI 1018.
1.4 **OBJECTIVES**

i. To develop prediction first and second mathematical model for surface roughness using response surface methodology (RSM) when turning low-carbon steel AISI 1018.

ii. Investigate the relationship between cutting parameters (cutting speed, feed rate and depth of cut) with surface roughness of low carbon steel AISI 1018.

1.5 **PROJECT SCOPES**

In order to achieve the objectives of this project, the scopes are list as below:

i. Evaluate on the surface roughness by using the Mahrsurf XR 20 Perthometer S2 to measure the surface roughness of low-carbon steel AISI 1018 after machining using lathe machine.

ii. The constant parameters for the turning process are work pieces use is low-carbon steel AISI 1018, cold drawn, high temperature. Depth of cut, \( d \) (1.0, 1.5, 2.0) mm, tool material CVD Coated Carbide Tips, feed rate (\( f_r = 0.20, 0.24, 0.28 \)) mm/rev, and the range of cutting speed \( V_C = (400 \text{ to } 600) \text{ m/min} \).

iii. Analysis the result (surface roughness) using response surface methodology (RSM) in MINITAB version 14 software.