CHAPTER I

INTRODUCTION

1.1 Background

In today's manufacturing industry, the progress of developments in technology and science taking very rapidly. Everything shloud requires sophisticated tools and better technological qualities. Besides that, with this rapid development it should be offset by knowlegde of mechanical technology. Production process are the one of sebject in Mechanical Technology to understanding the able of practice into land of works, especially in production machinery.

Surviving in today's highly competitive world is not an easy task, contemporary technology updates and heavy investments are needed in state of the art machinery and modern cutting tool systems (Keshari A., 2010). Cause of the must to be compete with other industries with a better quality and reduce any of cost and time also. The method to improving quality and productivity that should be done is by experimentation and research of simulation. By experiments and researching, it hopes that all the worst and mistakes possibilities will be avoided (Singh, Y.K., 2006).

End mills are basically most used operation of performing production, not too far from end mill theres must be a milling. Milling is one of the most universal and one of the most complicated machining methods. However, the material removal rate in milling is high and the possibilities of obtaining a good finish at surface are excellent (Najiha, M.S. et al., 2013). As we knows, in manufactured products qualities are determined by their surface quality. The fact is high friction between tool and work piece effect to high temperatures, tool wear, and poor surface quality, so the works is can not get best outcome (Chockalingan, P., 2012).

P20 is include to P group steel, commonly known to be use in mold or dies because of have low resistance to softening at elevated temperatures (Moore, D., 1997). Therefore, because of lower absorbing of temperature many studies have try to observe and defined the efectivity of machine tool to obtain the best result

of reduce failure in every aspects. (Buana B.R., 2017). But the problem is current machining processed and cutting tool designs are languid and too conservative, leading to high cost and significant waste.

Approach has been develop to milling mechanics models that the geometric model should including the cutting edge of geometry along the flutes for analyzing the mechanics and dynamics of the milling process (Engin, S., 2016). In the P.J Agnew paper said “when doing a slotting operation, unless doing a light cut of about 2D or less, it is best to use a two- or three-fluted end mill. The reason for this is the venerability of chip packing that can lead to destruction of the end mill.

Finally, based on the description above, all of amazing interest of modelling the tools which suites the most of simulation for manufacturing process in order for finding optimization efecient and comparison of the best result.

1.2 Problem Statement

To know the the best tools is by doing by an experimentation of the end mill. Experiment based on computer software could be more advancing and precisely, the reason is because that can be revamp and simulated easily with. Since as the aim to get best result of effectiveness according to optimal depth of cut, cutting force and temperature outputs in the simulations here would be shown with Third Wave AdvantEdge software with some parameter include, then would be compared with real experiments to finding the best of group of end mill.

1.3 Problem Limitation

In order on narrowing the problem limitation, here are some the problems to have more pre-cautions to avoid problem expenditure:

1. The process had the use depth of cut parameters suggested are 0.5 mm and 1 mm on material P20 steel.
2. All of end mills are use carbide tools Cemented Carbide YT15 end mill type.
3. The software used to model the part is Catia V5.
4. The Software used to checking the model FEM and making program experiment simulation is Third Wave Advant Edge and Tecplot.

1.4 Objective of Research

Based on the background and problem statement in this report, the objective of the research are:

1. Model the end mills with 2 and 3 flutes with diameter of each end mill 6 mm, 8 mm, and 10 mm.
2. Simulate with the Third Wave Advant Edge program FEM modeling and milling simulations with the model parameters.
3. To analyze optimal of depth of cut (DOC), cutting force, and temperature outputs the to get the best group of milling parameters and end mills.

1.5 Benefit

The benefit of the research are expected after the experiments are:

1. This could be reduce some cost, times, and also improve production on the industrial world.
2. Reduced trial and error testing interactions to the next researcher.
3. To advise ourselves about Third Wave AdvantEdge software, specifically on milling process simulation.
4. This could referenced to other advanced research or experiment in order to have better performance on manufacturing and cutting process.

1.6 Preface

Some studies have been reference of this research. Those are researches about optimization end mill but for Milling of Ti-6Al-4V with analyze and simulation. *Vinod Kumar et al.* (2014) make researches about analyze conducted for optimally designing end mill cutters through verifying the cutting tool and then the CAD models of the end mills and used Finite Element Method to verify the cutting forces for milling.

According *Madan Varmma a/l Suparmaniam & Ahmad Razlan Yusoff* (2016), investigate the effects of varying combination of depth of cut and feed rate to tool wear rate length using metallurgical microscope and surface roughness using portable surface roughness tester after end milling of Aluminium and P20 steel.

Results showed that feed rate significantly influences the surface roughness value while depth of cut does not as the surface roughness value keep increasing with the increase of feed rate and decreasing depth of cut. The experiment also proves that, material removal rate strongly contribute to tool wear rate because when the material removal rate was kept constant for both experiments, the tool wear rate too almost kept unchanged. In nutshell, high speed milling technique can be implementing in conventional milling machine with high feed rate, shallow depth of cut since there is no significant influence to tool wear rate by making material removal rate constant.

The other reseracher does the experiment about FEM simulation and analyze is *Eric Segebade et al.* (2017). Generaly makes comparations with some cutting simulator programs, but in this work, the software simufact. forming, which is not one of those few programs widely in use, has been employed for 2D and 3D chip formation simulations. The research present also cutting experiments with AISI4140 were conducted and subsequently modeled, including the cutting edge radius. The results were analyzed with regard to how well chip formation and the resulting process forces in 2D and 3D can be depicted.

In order to limit time lost consumed and expenditure of many experimental approaches for knowing treatment process that includes a wide range of tool geometry, processing parameters and materials, The Proper selection of finite element method software is very influential for decide quality of analysis that will be operate. For the simulation processing as used software package Third Wave AdvantEdge.