CHAPTER I

INTRODUCTION

1.1 Background

The revolution in the industrial world especially at section of science and technology can be sensed at this age. The sense of knowing the improvement of production which has better quality one step at the time and its application. During the moment, the fields of engineering is progressing rapidly. The education of mechanical technology needs to address the challenges of progress. The production process or the subjects studies Mechanical Technology, in case to acknowledge an understanding to be able to practice into the world of work, especially in production machinery. Within the needs of reverse engineering with significantly developing, the time comes to have more understanding and application.

Since the Industrial Revolution, manufacturing has been synonymous with factories, machine tools, production lines and economies of scale. So it is startling to think about manufacturing without tooling, assembly lines or supply chains. However, this is exactly what is happening as milling manufacture reaches individuals, small businesses and corporate departments.

End milling is a very common operation performed on both vertical and horizontal spindle milling machines or machining centers. For a vertical spindle end milling process, cutting a step in the workpiece. This cutter can cut on both sides and ends of the tool. If the operator was performing this operation on a block of metal, it would be the best to select a specific machine tool. Operator would has to determine how many passes (rough and finish cuts) were needed to produce the geometry specified in the design. Due to the number of passes determines the total cutting time for the job (DeGarmo, P. et al., 2008). The tool material and cutter geometry must be designed to withstand these conditions.

Some researches defined that energy consumption of machine tool has been the crucial issues in some years. Therefore to obtain the best result of energy consumption in machine tools and manufacturing systems is understanding and characterize them. In general, the energy consumption of spindle system is the majority of energy consumption of machine tool and varies instantly with various types of manufacturing activities. (Hu, S., 2010). The rate of feed, or the speed at which the workpiece passes the cutter, determines the time required for cutting a job. Thus, forces are exerted against the workpiece, the cutter, and their holding devices during the cutting process. The force exerted varies directly with the amount of metal removed and can be regulated by the feed and the depth of cut. (AIPD, 1988)

A classical approach has been to develop milling mechanics models that the geometric model must also include the cutting edge geometry along the flutes for analyzing the mechanics and dynamics of the milling process. The prediction of the cutting forces and vibrations require the coordinates, as well as rake, helix, clearance angles of the cutting edge point on the flute (Engin, S., 2016). Therefore, based on the description above, an amazing interest of modelling the tools which suites the most then simulation for manufacturing process in order for comparison of the best result.

1.2 Problem Statement

Finish machining is required in order to approach the perfection in manufacturing. The perfection of the cutting process may lead to the best quality of the product. Based on computer vision can be remarked in terms of speed and accuracy. The advantages this technology provides are diverse. Whereas tactile techniques characterize a linear track over the part surface, computer vision techniques allow characterizing wide areas of the part surface providing more information. Also, computer vision techniques take measures faster, since images

are captured in a very short time, and they can be in-machine implemented (Alegre, E. et al., 2016). As the 2, 3, and 4 flutes are provided and modeled, as seeking the best optimum feed rate and cutting depth shown by its force and temperature, will be simulate with Third Wave AdvantEdge Software and compared with the real experiment on finding the effect on tool wear.

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. Production process is only to surface finish machining with material AISI 1045
2. The cutting tools will be examined are tungsten carbide YT15 P10 flat end mill type 2T, 3T, 4T
3. Software used on checking total time and making program is UG NX10 and Fanuc system Oi Machine to real machining experiment.

1.4 Objective of Research

Regarding to background and problem statement in this report, the objectives of the research are:

1. Model the 2 Flute, 3 Flute, 4 Flute of End Mill Cutting Tool.
2. To simulate the manufacturing operation to show the tool wear occur in surface finish processes by Third Wave AdvantEdge Software.
3. To analyze temperature field distribution and thrust force along with wear of cutting tool, as feed rate and cutting depth.
4. Finally, in order to validate correlation of feed rate, spindle sped and cutting depth of cutting process toward surface roughness, specific experimental methods must be applied on workpiece material of AISI 1045.

1.5 Benefit

The benefits of research are expected after the experiments:

1. This could be the reference of other advanced research or experiment in order to have better performance on manufacturing and cutting process
2. This could save more time, reduce cost time and improve production on industrial world.
3. To acknowledge ourselves about Third Wave AdvantEdge software, specifically in milling process simulation.

1.6 Preface

A number of studies have investigated the wear mechanisms of cemented tungsten carbide tool under different cutting conditions. *Geetha Ramasamy and Jegatheswaran Ratnasingam* (2010) making a review of cemented tungsten carbide tool wear during wood cutting processes. It was reported that research has highlighted the gradual wearing of the cemented tungsten carbide tools when machining different raw materials under different conditions, in order to enhance economic and productivity.

According to *Pavel Kozmin et al.* (2010), finite element method in chip shape and cutting force prediction when drilling difficult to cut materials has proven that solid carbide wear when machining into AISI D3 tool steel is based upon results from analysis the geometry with larger point angle was manufactured and experimentally tested in order to evaluate the accuracy of numerical analysis with main observed parameters were chip formation, cutting forces – torque, thrust force and temperature field distribution.

Serafettin Engin and *Yusuf Altintas* showed in their research of Generalized Modeling of Milling Mechanics and Dynamics-Helical End Mills which predicted and measured cutting forces, surface roughness and stability lobes for ball, helical tapered ball, and bull nosed end mills are provided to illustrate the viability of the proposed generalized end mill analysis.

Optimization of cutting ,forces, tool wear and surface finish in machining of AISI 304 stainless steel material using taguchi's method is an approach which shown the optimal cutting temperature was obtained using the established wear model. Further cutting parameter optimization was conducted according to the optimal cutting temperature. The optimized Cutting parameters can be considered to increase tool life and machining efficiency.

In order to limit time-consuming and expenditure of many experimental approaches for studying treatment process that includes a wide range of tool geometry, processing parameters and materials, The Proper selection of finite element method software is very important for determining the scope and quality of analysis that will be performed. For the simulation processing is used software package Third Wave AdvantEdge.