CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Advanced composite materials such as fiber reinforced plastics (FRP) are recognized as excellent materials for some structural components and are being increasingly used in various applications such as aircraft, ships, automobiles, machine tool and sports equipment, due to their excellent properties such as high specific strength, high specific stiffness, high damping, low thermal expansion, good dimensional stability and an unusual combination of properties not obtainable with metal alloys. As structural materials, joining of composite structures could not be avoided. The efficiency of mechanical joint is largely dependent on the quality of machined holes [1].

The drilling parameters and specimen parameters evaluated were spindle speed, feed rate, and types of drill. A series of experiments were conducted using CNC milling center to machine the composite laminate specimens at various cutting parameters. The experimental results indicated that the types of tool, feed rate and cutting speed are reckoned to be the most significant factors contributing to the delaminating and other damages.

Using Design of Experiment, DOE, there have 27 number of test. Three types of tool was been selected that is High speed steel HSS, coated carbide and solid carbide. For every tool, there have 9 test of hole with different of machining parameters. In this experiment the output is the thrust force and delamination. By using Piezoelectric

Dynometer connected to the PC at CNC milling machine the value of thrust force and torque can get by install the Kistler software. The delamination can be analyzing using delamination factor. The delamination factor is the ratio of diameter delamination area to the diameter of hole. The size of diameter hole is equal to the diameter of drill 6mm.

Due to their anisotropy, and non-homogeneity, FRP cause some problems in drilling such as fiber breakage, matrix cracking, fiber/matrix debonding, fiber pull-out, fuzzing, thermal degradation, spalling and delamination. Among the defects caused by drilling, delamination is the most critical. Delamination can result in lowering of bearing strength and can be detrimental to the material durability by reducing the structural integrity of the material resulting in long-term performance deterioration [1]. The special attention damages to the hole quality is delamination, but in this experiment the other damages will be investigate.

Analysis of variance (ANOVA) is used to study the effect of process parameters on machining process. The purpose of the analysis of variance (ANOVA) is to investigate the design parameters significantly affect the quality characteristic of a product or process. To test the significant of the parameters on machining process the equation of the output must being created. Here only one output was been selected that is delamination factor, Fd. By using SPSS software, the Multiple Linear Regression equation will be created.

Damage that developed during drilling process has to simulate using User-Defined method. The optimization result will show the best condition to drilling glass fiber where at this condition the damages will be minimized.

1.2 PROBLEM STATEMENT

There is several problems from this research, normally to machining of fiber-reinforced composites is difficult due to diverse fiber and matrix properties, fiber orientation, inhomogeneous nature of the material. Thus, when drilling the fiber reinforced plastic composite may produce several kinds of damage. The most

seriously is the delamination. To investigate the damage effects of drilling an optimization technique is employed. Appropriate control parameters are chosen to narrow the scope of study such as spindle speed, feed rate and three types of tools and the main outputs investigated are thrust force and delamination.

1.3 OBJECTIVE

I. To get optimal condition for drilling glass fiber reinforced plastics.
II. To analyze the data of experiment by using Multiple Linear Regression
III. To analyze the damages occur at the hole with special attention is delamination.

1.4 SCOPE

A research about the damages at the hole of drilling glass fibre reinforced plastic composite and gets the optimal parameters to be used to drill glass fiber.