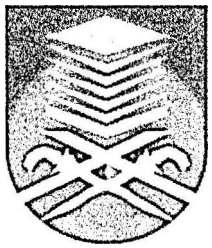

NOTCHED STRENGTH OF FIBER-REINFORCED POLYMER

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A thesis submitted in partial fulfilment of the requirements for the award of Bachelor Engineering (Hons) (Mechanical)

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APRIL 2005

ACKNOWLEDGEMENT

In the name of Allah S.W.T, The Most Gracious, that has given me strength and ability to complete this project. All perfect praises belong to Allah S.W.T, Lord of Universe. May His blessing be upon the Prophet Muhammad S.A.W and members of the family and the Prophet's companions.

We especially would like to express our deepest appreciation to my project advisor, Associate Professor Mr. Yakub Md Taib and to our project's co-advisor, Mrs. Zuraidah Salleh for all of his advises and guidance given to me.

We also would like to thank Encik Ziyadi Zamri for his guidance and help in using the equipments in the strength of materials laboratory, Encik Adam Mukhlas for the assistance in the machining workshop, Encik Hayub Ta, who guided me in using the equipments in the Metallurgy Lab, and also to those who were involved either directly or indirectly towards completing this project.

Lastly, we also would like to express highest appreciation to UiTM for providing us useful information for our future references.

ABSTRACT

This project involved in the study of notched strength reduction and determination of damage zone, a_o, of E-glass, Kevlar and Carbon Fiber/Epoxy composite laminates. The specimen configuration used for this project was 101.6 mm×101.6 mm with 30 mm diameter central hole and was subjected to bi-axial loading condition using a special grip and fixture.

The damage zones, a_o was determined experimentally using optical microscope. Using the values a_o, the notched strength of the laminates were then determined using both Average Stress Criterion (ASC) and the Fracture Mechanics Criterion (FMC). These calculated values of notched strengths were then compared with that determined through experimentation.

In this project, the results indicated that the notched strengths of the glass fiber/epoxy using the Average Stress Criterion and Fracture Mechanics Criterion are comparable. However, the notched strength predicted by the Fracture Mechanics Criterion was about 50% indifference with the Average Stress Criterion for Kevlar and carbon fiber/epoxy. This might be due to the determination of fracture toughness, K_c, using isotropic solution may not be suitable for these materials.

Experimental values of the notched strengths of the laminates under bi-axial loading in the experiments cannot be acceptable due to the problems occurred at the grip. Further improvements are needed to overcome the grip problems or new fixture should be designed and constructed in order to obtain better results in the future.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Composite can be defined as a combination of two or more materials on a macroscopic scale to form a useful third material. Since the materials are combined at macroscopic scale, the components can be easily identified with naked eye. The purposes of combining those materials are among others, to improve strength, stiffness, wear resistance, fatigue life, corrosion resistance, thermal conductivity, thermal insulation and attractiveness.

The history of composite maybe dated as far as Mesopotamian boats which were made from reed bundles reinforced with bitumen, pre-history mud bricks reinforced with straw, American Indian wood and mud structures, etc., to a major topic of present-day materials science. The modern day applications of composite materials include aerospace, sporting goods, automotive, military, communications, prosthetics, and building infrastructure among others. Theories have been developed to predict the behavior of both particulate and fibrous composites. In recent years, a number of man-made fibers have been developed for polymeric-matrix composites.

"Continuous fiber-reinforced polymeric composites" are materials that consist of continuous reinforcing fibers held together by a surrounding polymer binder. The fibers bear the structural loads, and are called the "reinforcement". The polymer transfers the load from fiber to fiber, and is called the "matrix". The orientation and