THE OPTIMIZATION OF LAMINATION SCHEME AND PLY THICKNESS FOR LAMINATED COMPOSITE PLATES

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b. MMC – Metal matrix composite

c. CMC – Ceramic matrix composite

d. CCC – Carbon-Carbon composite

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a) Non metallic in non metallic composites

b) Metallic in non metallic composites

c) Metallic in Metallic composites.

d) Non metallic in Metallic composites

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ABSTRACT

This project is aimed to simulate the failure of selected fiber reinforced composite plates under sinusoidal transverse loading. A mathematical model and computational model are presented for the analysis. Higher Order Shear Deformation plate theory is utilized to predict the deformation of the plates. A failure criterion with the existence of coupling terms to determine the mode of failure for composite plates is employed to predict the failure. The selection of this criterion is made, because of its uniqueness that it includes the coupling terms, which relate the interaction between the longitudinal stress and the transverse stresses. Therefore, it allows the interaction between the fiber properties and the matrix properties in terms of the strength of the material, which other failure criteria have neglected. A program based on a finite element method is utilised using Fotran-90 to determine the lamina stresses. These stresses are then used in the present failure model to determine the First Ply Failure and Last Ply Failure. Finally, the First Ply Failure and Last Ply Failure results for various lay up and ply thickness composite plates are analysed to determine the weakest composite plate and the best lay up or ply thickness. Firstly, with different lay up of lamina for Carbon Epoxy, I simulated some results to find the best lay up for S-Glass Epoxy and Carbon Epoxy plates. Secondly, with different ply thickness for Carbon Epoxy, I simulated some results to find the best ply thickness Carbon Epoxy plates. Lastly, with constant ply thickness and different lay up of lamina for Carbon Epoxy; I simulated some results to find the best lay up for Carbon Epoxy plates.

CHAPTER 1

INTRODUCTION

Fortran is a mathematically oriented programming language, originally developed for computer applications that involve the manipulation of numerical data. Fortran is acronym for FORmula TRANslation. Fortran processing are available for practical all computers. The language is known and used by most engineers, scientist, mathematicians, statisticians and business analysis. I was applying the knowledge that I learn in semester 4 and 5 to obtain failure results for selected composite materials.

The most common and oldest method, in terms of finite element analysis for a laminated composite plate, is the standard laminate strength analysis, according to Tolson and Zabaras. However, the method neglects the local effects such as fiber misalignment, material discontinuities and free edge effects and assumes that the stiffness of the laminate receives no contribution from failed layers.