



**FIRST PLY FAILURE ANALYSIS ON SYMMETRIC LAMINATE**

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## ABSTRACT

The main objective of this project is to analyze and simulate the first ply failure of selected symmetric composite laminates. Finite element computational models are developed using NASTRAN software. Various elements and number of meshes are employed to ensure result accuracy. Several lamination schemes are modeled and analyzed and the stress distributions for each lamination scheme are simulated. Failure analysis procedure is performed to determine the first ply failure load. If no failure occurs, the load is increased until first ply failure occurs. The results are validated and compared with other computational results. The results of the first ply failure load are then compared for several lamination schemes. The failure behaviours of the laminates are studied. The results show good agreement with other computational results. This shows that the procedure failure analysis performed could be used to determine first ply failure load accurately and reliable. Thus, the objective of this project is achieved successfully.

**Keyword:** Finite element analysis, first ply failure load, symmetric laminates

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## CHAPTER I

### INTRODUCTION

#### 1.1 Introduction

Nowadays, the composite material has been used widely in the various applications. Therefore, the study of its behavior due to various loading and lamination is important. This project is purposely done to find the maximum stress on the first layer of the composite plate by performing the analysis using finite element method with NASTRAN software. Then, the obtained result is compared with the result of other computational result.

Many researches has been done in order to study the behavior of the composite material and to improve its properties. In 1997, John Morton and friends had performed the scaling effects on damage development, strength and stress-rupture life of laminated composite in tension. The damage development and strength of ply-level scaled carbon / epoxy composite laminates having stacking sequence of  $[+\theta_n / -\theta_n / 90_{2n}]$ , where constraint ply angle,  $\theta$ , was  $0^\circ$ ,  $15^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ , and  $75^\circ$ , and size was scaled as  $n = 1, 2, 3$ , and  $4$ . First-ply failure of the midplane  $90^\circ$  plies depended on the stiffness of constraint plies and size.

In 2000, V Surya Jagdesh and friends had performed the deflection statistics of composite laminates with random material properties under transverse random loading. The study uses first order perturbations to handle the dispersions in the