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Comparative Analysis of Composite Materials Based on Stress and Vibration by using Experimental Approach

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Abstract - *Composites are most promising materials for components of current and future engineering structures, with a significant demand at present in aircraft and aerospace industries. Modal analysis is the study of the natural characteristics of structures. Understanding both the natural frequency and mode shape helps to design any structural system for noise and vibration applications. In this paper analysis of free vibration of cantilever beam for the composite as well as steel material are carried out. Natural frequency and mode shape of the plates has been determined using FFT analyzer. Also comparative study of Steel, E glass epoxy and FRP is done for stress analysis with the help of UTM. These materials are used for vibration analysis to observe the effect of a modal parameters of cantilever beam subjected to free vibration is analyzed with the help of FFT analyzer in experimental setup. From this work we found the behavior of structures or mode shapes obtained from FFT analyzer can be utilized to validate results obtained from FEM for mode shapes. Natural frequencies of vibrating structures are susceptible to change under influence of depth & location, where its magnifying views allow getting an idea of significant changes at location. E-glass Epoxy material is the good material as comparatively steel and FRP material.*

Key Words: Fast Fourier Transformer, ANSYS, UTM, Composite, Fiber reinforced plastic, Finite Element Method.

1. INTRODUCTION

In structural acoustics, recent work in sound transmission through laminated structures has shown that the fundamental frequency is a key parameter. The natural frequencies are sensitive to the orthotropic properties of composite plates and design-tailoring tools may help in controlling this fundamental frequency. The understanding of prediction models facilitates the development of such tools. Due to the advancement in computer aided data acquisition systems and instrumentation, Experimental Modal Analysis has become an extremely important tool in the hands of an experimental. Variation of natural frequency with different parameter is studied. E glass is the primary reinforced material of wind turbine blades, having low cost and good applicability. It is a better match with many resins, and the molding process. However, as the density of the E-type fiber is large, it is generally used in smaller blades. Composite materials are gaining popularity because of high strength, low weight, resistance to corrosion, impact resistance, and high fatigue strength. Other advantages include ease of fabrication, flexibility in design, and variable material properties to meet almost any application. Use of composite materials in various construction elements has increased substantially over past few decades. A variety of structural components made of composite materials such as turbine blades, vehicle axles, robot arms, aircraft wings, and helicopter blades can be approximated as laminated composite beams. Materials are particularly widely used, where a large strength-to-weight ratio is required. Fiber Reinforced Plastics (FRP) are commonly used in aircraft structure, high speed, military equipment's, civilian products, automotive and or engineering applications mainly because of high strength-to-weight ratio, high stiffness, good resistance to fatigue, and corrosion resistance advantages include ease of fabrication, flexibility in design, and variable material properties to meet almost any application. Thus vibration technique can be suitably used as a non-destructive test for detection of component to be tested Vibration analysis, which can be used to what types of changes occur in vibration characteristics, The combination of different materials has been used for many thousands of years to achieve better performance requirements. The strength of the composites depends primarily on the amount, arrangement and type of fiber and particle reinforcement in the resin.

2. LITERATURE REVIEW

Yin Li et al, a new way is proposed in this work to reveal the damage evolution law of impacted carbon fiber reinforced polymer (CFRP) laminate under compression-compression fatigue load based on thermo graphic images. Firstly, several specimens are began with impact testing with different energies, followed by compression-compression fatigue testing with different load amplitudes and monitored by infrared camera. Then, the thermo graphic images gathered by infrared camera are analyzed. Finally, the damage area is introduced to quantitatively reveal the damage evolution law of these impacted specimens. The obtained results show that combining appropriate image processing methods, the damage area can be used as an effective damage index to quantitatively reveal damage evolution law of impacted CFRP laminate under compression-compression fatigue load with excellent accuracy [1].