

## ABSTRACT

Fiber reinforced composite materials are used increasingly in many military and civil applications due to their excellent mechanical properties compared with their weights. One of the new application of using composites is in the manufacturing of tubes used for application with combination of mechanical loading.

In this work, a suggested analytical solution for static and dynamic analysis of (fiber-reinforced) Composite Cylindrical Laminated shell is presented using First order shear deformation theory and Experimental work involves fabrication and testing the mechanical properties of unidirectional E-Glass reinforced polyester. The dynamic analyses for equations of motion, for those theories are presented. Solution is solved by using the modal analysis of forced vibration.

The results are the response, stresses and deflection, by first order shear deformation theory "FSDT", for symmetric and anti-symmetric, cross-ply, and angle-ply, cylindrical laminated shell subjected to the static and dynamic loading conditions considered here is the sine, ramp and pulses while spatially, they are considered as central sinusoidal and uniformly distributed load for circular cylindrical laminated shell. In addition, the results for natural frequency, deflections, and stresses presented showing the effect of cylindrical shell, radius-to-thickness ratio, radius-to-length ratio, material orthotropy, fiber orientation, and lamination scheme and are confirmed with other solutions and finite element results.

The results obtained are the natural frequency increases with increasing of fiber orientation and decreases with increasing ratios "radius-to-length" and



"radius-to-thickness" and the deflection and stresses, are decreases with increasing the number of layer, fiber orientation (optimum angle  $\theta=45^\circ$ ), or thickness of laminated shell. In addition the experimental results show that increasing in pressure cause increasing in the strain.

The main conclusions which can be drawn from this study are that The suggested analytical solution is a powerful tool for static and dynamic analyses of Composite Cylindrical Laminated Shell. The amplitude values of deflection for angle-ply (45/-45/...) less than for cross-ply (0/90/...) simply supported Circular Cylindrical Laminated Shell. Increasing the number of layers (N), the modulus ratio ( $E_1/E_2$ ) and "radius-to-thickness" ratio ( $R/h$ ) of laminated shell decreases the deflection, and the last increase with increase the "radius-to-length" ratio ( $R/L$ ), In addition the stress increases with increasing the "radius-to-thickness" ratio.

The research is aimed also at development, design of an instructional program according to Engineering Animation Instructional for the dynamic analysis of composite tubing subjected to pressure to evaluate its effectiveness to help the learner master the cognitive and psychomotor skills in the application of the techniques.

The experimental design used one group Pre-Post Test design. Wilcoxon's Matched Pairs, Signed Test, and "Z" values for normal distribution were utilized as statistical means to verify the effectiveness of the program, and to make sure of the soundness of the results, Graphical presentation also used to compare the learners performance before and after the treatment" Pre-Post Tests".