

Abstract

The accurate estimation of deformations, stresses, and vibration characteristics of composite plates is a paramount in the pursuit of the design improvements necessary for minimization of the machine failures and obtaining minimum weight at low cost.

The main purpose of the present work is to investigate the vibration characteristic of composite plates with and without holes ,manufactures of fiber glass+ polyester in the presence of steel layers reinforcement , stiffeners subjected to various load conditions and constraints (simply supported and clamped).

An experimental programme was also conducted in order to obtain the material properties of the used plates and study the plate behavior under static load and measuring the strain and deflection from which the structures are obtained and compared with the numerical results .

An analytical solution to static and dynamic problems of (fiber-reinforced) composite laminated thin plate is developed by using the single layer theory, which is first-order shear deformation theory (FSDT). The equations of motion are solved by using modal analysis from which the dynamic stresses and deformations are obtained .

A computer program in FORTRAN language (with Power Station 2000 package) was built to solve the equations of symmetric and anti-symmetric cross-ply, simply supported and clamped thin laminated plates. The finite element solution is also adopted using (ANSYS V.8) package for all cases. The analytical results were confirmed with those obtained numerical and experimental methods. These above approaches use (FSDT) which includes the effect of shear deformation, and the solution is compared with the other solutions from the previous researches.

The research programme covers the determination of dynamic stresses and deformation taking into consideration the effects of layer types and their arrangements, number of stiffeners, number and size of holes and their distance from plate edge, plate thickness, fiber orientation and type of support conditions.

An instructional site was built depending on the (ADAPT) model, which covers selection process, quick practice, spot quiz, exam, discussion, and contact us. The composite plates, finite element, stress analysis, and (ANSYS V.8) lessons are displayed on this site with assistance of FrontPage, PowerPoint programs.

The main conclusions which can be drawn from this study are:

The developed analytical solution was proved to be an efficient the dynamic characteristic of composite plates subjected to general dynamic loading and a good agreement was obtained between the analytical and numerical results . It was seen that the deflection and bending strain are increased with increased of aspect ratio while the inter lamina shearing stress at the middle plates decrease with the increase of aspect ratio . The reinforcement has an important effect on the value of strain and deflection in addition the dynamic load factor (D.L.F.) values for most cases (the ratio dynamic deformation to static deformation) doesn't overcome (2%), where the minimum value was(1.054) and it is considered the important factor in structural design . Finally the Internet learning method has an important effect on achieving engineering learning by increasing learner's comprehension and skill building.