SYNOPSIS

In the present studies, computer program COMP. FOR based on finite element technique has been developed for the analysis of laminated composite plates. Most of finite element programs available on laminated composite plates do not cater for pronounced effects of transverse shear. A few of authors have attempted such programs using various models for transverse shear effects.

The program developed in the present studies accounts for transverse shear effects using Vinson's model. The finite element formulation has been developed using 8 - noded isoparametric elements having five degrees of freedom at each node. For the ease of understanding and adoption of the program by working engineers in the fields of design and consultation, exhaustive manual is presented.

Using the program, standard reference problems from the literature have been analysed and results compared with those given by other authors using different models for transverse shear effects.

The total work was divided into two parts:

i. development of computer program

ii. experimental verification

After the program was developed, it was decided to verify the analytical results with the experimental findings. For this, an experimental set-up was made using a plate structure for which transverse shear moduli are significantly lower than in-plane Young's modulus to highlight the role of Vinson's weighting function used in the program developed. A plate of size 1000 mm x 600 mm made of 10 layers and fabricated by Hand lay-up technique using Glass fibre (Woven-mat) of density 3.6 N/m² and General Purpose Polyester resin, with two opposite ends simply supported and central concentrated loads increasing from 10 N to 70 N in steps of 10 N was tested.

To verify analytical results with experimental values, the material properties given to the program must be similar to those of material used in the experimentation. To determine these properties, plate of same material was taken and specimens were cut to determine various material properties required in the program developed. For tensile properties, three tension specimens of
size 400 mm x 25 mm x 4 mm and for shear moduli, six flexural specimens of size 500 mm x 40 mm x 4 mm were tested.

The values of deflections at 15 nodes have been measured by dial gauges and strains recorded by Data-logger at four gauss point locations to calculate stress-resultants. Since creep is one of the inherent weaknesses in plate made of fibre reinforced plastic, therefore creep effects have been studied in respect of deflections only using dial gauges. The deflections measured at time t = 0 under creep studies and stress-resultants calculated from measured strains have been correlated with those obtained analytically by executing the program.

The difference between computed and measured values (corrected for creep effects) of displacements is approximately 5% for load levels higher than 20 N except at the central load location where the difference is around 10%. The difference between computed and measured stress-resultant $M_x$ is higher than that in case of deflections because strain values to calculate stress-resultant have not been corrected for creep effects.