ANALYSIS OF STIFFENED PLATES CONSIDERING NON-LINEAR MATERIAL AND GEOMETRIC BEHAVIOUR

T. MOAN, T. SØREIDE

Institutt for Skipskonstruksjoner, Norges Tekniske Høgskole, Universitetet i Trondheim, N-7034 Trondheim, Norway

SUMMARY

The paper describes structural analysis of stiffened plates including material and geometrical non-linear effects.

The incremental form of the virtual work equation is used to derive the force-displacement relationship.

A total Lagrangian formulation (equivalent to Von Kárman equations) for the geometric nonlinearity is used. The elasto-plastic material behaviour is represented by the flow theory giving the constructive stress-strain relation on incremental form. Calculations have been made using an isotopic hardening law. However, due to modal coding, other hardening rules may be easily incorporated in the program.

The solution is performed by the finite element method and the incremental stiffness is computed by means of numerical integration. A triangular element with "nearly" complete cubic out of plane displacement and linear or quadratic in-plane displacement assumption is used. Selective integration of flexural and extensional energy can be chosen by an option. The set of non-linear equations is solved by a step-by-step method with iteration within each step.

A theoretical discussion of the accuracy of mathematical, numerical modelling and computer calculations are given.

Numerical examples are included both to illustrate accuracy of the method, and the applicability of the present code to solve practical problems.