

STABILITY ANALYSIS OF RING STIFFENED SHELLS OF
REVOLUTION USING FINITE ELEMENT METHOD

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In Fulfilment of the Requirements of
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(i)

CERTIFICATE

This is to certify that the thesis entitled
Stability Analysis of Ring Stiffened Shells of Revolution
Using Finite Element Methods , being submitted by
J. Subbiah to the Indian Institute of Technology, Delhi (India)
for the award of the degree of Doctor of Philosophy in
Applied Mechanics Department is a record of bonafide research
work carried out by him under our supervision and guidance.
The thesis work, in our opinion, has reached the standard
fulfilling the requirements for the Degree of Doctor of
Philosophy. The research report and the results presented
in this thesis have not been submitted in part or in full
to any other University or Institute for the award of any
degree or diploma.



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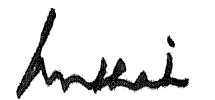
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ABSTRACT

Structural design of submarine pressure hulls is mainly governed by elastic stability requirements. Two of the most important modes of collapse, interframe buckling and general instability, have been studied by several authors using analytical methods. Several shortcomings of the existing literature have been overcome in the present research programme using Finite Element methods.

A finite element formulation based on linear bifurcation buckling method is presented in the first part of the thesis. The method can be used to obtain collapse pressures for stiffened shells of revolution subjected to external hydrostatic pressure. The same program will give collapse pressures in both general instability and interframe buckling mode. The effect of boundary conditions and type of stiffening on the collapse pressure had been studied and discussed. A sophisticated theoretical model has been presented to treat the hydrostatic pressure as a load system with follower force effects and its influence on the collapse pressure is also reported.

In the second part of the thesis, a non-linear large deformation finite element formulation is presented. The effect of initial geometric imperfection on the load displacement response and general instability is reported. The effect of inclusion of second order geometric non linearities is also reported.

In the third part of the thesis, a new procedure which is a combination of both non-linear large deformation and linear bifurcation buckling method is presented. Using this procedure, the imperfection sensitivity of stiffened cylinders under various boundary conditions and type of stiffening has been recorded. The results obtained from the quadratic eigen value problem have been compared with the traditional linear eigen value problem.

Several sophisticated computational details developed during the course of the research together with comparative CPU Times are also reported.

Consideration has been given to the application of the programs developed during the three phases of the work to the design of submarine pressure hulls.

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