

THE COLLAPSE BEHAVIOUR OF LATTICE HYPERBOLIC PARABOLOIDS

P.A Hodgetts

Abstract

This thesis starts with a thorough literature survey on work carried out on both shell and lattice hyperbolic paraboloids, leading to the observation that further investigations of collapse behaviour is justified. Existing methods of analysis, including their development are also researched.

A suitable experimental program is drawn up, which involves the testing of four model structures. A detailed account of the rig design and the experimental procedure is given.

Against these findings an attempt is made to predict the behaviour of the model structures, using the linear membrane theory in conjunction with an appropriate shell analogy. It is found that what appears to be realistic boundary conditions, produces answers that are either nonsensical or totally unrealistic. Attempts at using more sophisticated methods of shell analysis are also unsuccessful, due to the huge algebraic complexities which quickly appear. Buckling predictions made by previous researchers are not validated by the experimentation.

A thorough numerical analysis is then carried out with success. It is found that advanced methods of iteration control are required for certain analyses.

A full discussion includes a detailed comparison between experimental results and those predicted by analysis. Reasons for discrepancies are given.

Finally, there is a last review the entire research work and the major conclusions drawn. A simplified design aid, suitable for preliminary design, is outlined, based on the findings of the research work. Suggestions for suitable further research are also given.