

FINITE PLASTIC DEFORMATIONS OF SPHERICAL SHELLS

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Abstract

A detailed theoretical and experimental study of the behaviour of copper, aluminium and steel hemispherical shells tested under concentrated loads at the apex and under water pressure is presented. These shells are not “perfect”, but obtained commercially. The description of loading apparatus designed to test shells under the above conditions, and suitable for use in a small laboratory, is given in Chapter I. Chapter III deals specifically with the starting point of the present investigation – the work of Reissner and Ashwell.

The result of 39 tests on shallow and deep shells are given. Short notes on the shells written during each experiment comprise of Chapter II. Theoretical load-deflexion relationships are derived in Chapter IV on the basis of several postulated collapse mechanisms, and reasonable agreement is obtained for some of the theoretical analyses. The need for a convenient method of designing shells has also been borne in mind.

Close attention is paid to the way in which, a shell deforms under increasing load, and it is shown that the work done on thick shells at least is plastic almost from the very beginning. A cine-film has been obtained, showing the outward propagation of circular yield-hinges along the shell from the apex.

Finally in Chapter V, some observations are made on the problem of the inextensional large-deflexion behaviour of spherical shells.