THE ULTIMATE STRENGTH OF LOCALLY BUCKLED COLUMNS OF ARBITRARY LENGTH

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Abstract

The dissertation is concerned with the ultimate strengths in compression of columns up of thin plates. The columns are proportioned in such way that local buckling occurs when the section is still entirely elastic. The ultimate average stress of short columns is then primarily determined by the plastic yielding of the plates in their post-buckled range, but in the case of longer columns, this ultimate stress is somewhat reduced because of a tendency towards overall buckling.

The dissertation is divided into two parts, the first containing an account of the theoretical derivation of ultimate stresses, the second, a description of the experimental research carried out to support the theory.

The theory has involved essentially the development of two computer programs. The first predicts the post-buckled behaviour of a short thin-walled rectangular column under uniform axial compression, giving information about the regions of plasticity within the plates at various applied strains and evaluating the ultimate stress. The second obtains the internal bending moment – curvature relationship if the column at stages in its post-buckled range. From the variation of this latter parameter with the average applied axial stress the interaction curve of ultimate stress versus slenderness-ratio for the column may be derived. Interaction curves are presented for sections with various values of yield stress, and the effect of initial geometrical imperfections is also demonstrated.

Experimental interaction curves have been obtained by performing tests on model columns cut from square-section thin-walled drawn tubing and they appear to be in good agreement with the theoretical curves.