THE FINITE ELEMENT METHOD APPLIED TO PLATE FLEXURE

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Abstract

Dual finite element methods are developed from variational principles. The choice of redundants in force method is shown to be complementary to the choice of displacement parameters in the displacement method. The process of choice in both methods are similarly formalised. Parameters in the displacement method can be divided into those extra to, and those essential to equilibrium representation in the infinitesimal element. The nature and advantages of parameter dependence and the use of extra parameters is illustrated in the case of bending elements. Rectangular and right-angled triangular plate bending element stiffness matrices are developed using compatible displacement fields, as a special case of a general 3-dimensional element. The design value of bounds bracketing the strain energy is emphasised. A method is suggested for eliminating the deficiencies of assumed displacement functions.

The two stiffness matrices are evaluated in comparisons with other matrices, previously accepted as the best available. The number of free parameters is used as a basis for the comparisons. The rectangular element stiffness matrix is shown to give the most consistently satisfactory than any other rectangular or triangular element stiffness matrix, previously published.