A FINITE-ELEMENT METHOD FOR ANALYSIS OT TWO-DIMENSIONAL CONTINUOUS STRUCTURES

A.L. Woodhead

Abstract

Since the advent of the digital computer, finite-element methods have become increasingly popular as tools for the analysis of engineering structures. The basis of the finite-element involves the division of a continuum into a number of finite structural elements, connected at nodes. Although this concept is simple, the techniques needed to calculate the stiffness or flexibility matrices describing the behaviour of individual elements are complex and tedious.

The object of this dissertation is to show that it is possible to derive simple matrix equations describing the behaviour of structural finite elements. The nub of the problem is to use force and displacement variables on each side of the matrix equation. The resulting matrix will then consist of stiffness, flexibility, equilibrium and compatibility sub-matrices. Matrices are presented for plate bending and plane stress elements.

It turn out that it is also possible to derive mixed matrices to describe the bending behaviour of beams. This method has the advantage over conventional stiffness or flexibility methods in that joint loads are fixed-end moments. The matrices for this method are derived using simple beam theory and present a unified teaching approach from beam bending to framework analysis.