

THE DEVELOPMENT AND APPLICATION OF THE FINITE ELEMENT
METHOD AND FINITE STRIP METHOD IN ENGINEERING ANALYSIS

VOLUME I

By

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PREFACE

The 45 papers herein (Volume I) are divided into three major sections, the Finite Element Method of engineering analysis, the Finite Strip Method of engineering analysis, and general topics, with the arrangement of the papers within each section primarily chronological. Books and chapters in books are presented in the fourth section.

The Finite Element Method has by now been firmly established as the most powerful and versatile tool of analysis and is applicable to a wide range of problems in civil, mechanical, chemical, aeronautical, electrical and other engineering disciplines. I started research on the Finite Element Method in 1962, collaborated with Professor O.C. Zienkiewicz on the first book on Finite Element Method in 1967, and I have maintained my interest in its developments up to the present day. The earlier part of my work had been submitted for my D.Sc. degree from the University of Wales and therefore only publications from late 1972 onwards are included here. Most of the finite element papers are concerned with thick, multilayered structures (Section I - 4, 7, 9, 12, 14, 16, 18, 20), flow and heat transfer problems (Section I - 5, 6, 10, 11, 17, 22), basic developments (Section I - 15, 19, 21, 23, 25, 26), and industrial applications (Section I - 6, 8, 17). Paper 6 came out of a consulting project for the prediction of groundwater level for the Crowchild Trail, a freeway in the city of Calgary, Alberta, Canada. Paper 8 deals with the analysis of the Eckofisk Oil Storage Tank which is a two acre concrete island in the North Sea, and the whole consulting project took 1½ years to complete. Finally, paper 17 resulted from the cooperative effort between the Civil Engineering Department at the

University of Adelaide and the Victoria Electricity Trust on the investigation of a real engineering problem in production.

The Finite Strip Method is a semi-analytical method which is often regarded as a special form of Finite Element Method and is applicable to a special class of structures such as folded plates (Section II - 6, 9), plates (Section II - 1, 2), tall buildings (Section II - 3, 5, 7, 8, 10, 11), etc. (Section II - 4), in which the shape of the section does not change in one or two directions. The method is less general than the standard Finite Element Method, but has the great advantage of having much smaller degrees of freedom in the modelling of a structure, with the consequential reduction in computer cost and computer storage requirements. The method has been applied to bridge analysis and design extensively (see Report and User Manual of STRIP, Department of The Environment Bridge Design Computer Programs, March 1972), and recently it was applied to the wind load analysis of the 33 storeyed Sunning Plaza Office Block in Hong Kong.

The third section contains primarily state-of-the-art papers on finite element and finite strip methods as well as other numerical methods of analysis (Section III - 1, 2, 3, 4).

The fourth section contains books published during the period 1973 - 79, and forms Volume II of this thesis.



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Section IV - Books and Chapters of Books

(5 publications)

1. Y.K. Cheung, "Finite Strip Method in Structural Analysis", Pergamon Press, 1976, pp. 1-232.
2. Y.K. Cheung, (C.S. Desai and J.T. Christian (eds.)), Chapter 5 of "Numerical Methods in Geotechnical Engineering", McGraw-Hill, 1977, pp. 176-210.
3. Y.K. Cheung & M.F. Yeo, "A Practical Introduction to Finite Element Analysis", Pitmans Publishing Ltd., London, May 1979, pp. 1-180.