

roduction of computers has been accompanied by a decrease in cost plus an increase in accuracy. This book goes a long way in perfecting the solution of beam and frame problems.

This revised edition revamps a number of sections, consolidates others, and makes the topic more homogeneous and palatable to study. A number of new sections have been added to enhance the value of matrix methods employed in solving frame and beam problems.

The initial chapter introduces the basic concepts of framed structure and includes superposition procedure, introduction to flexibility and stiffness matrices. New sections include energy concepts, theory of vertical work, and equilibrium of joint loads. There is an update of one of the examples. This is a good introductory chapter which could be read by all interested.

Chapter II delves into flexibility method. Although used less frequently now than in previous years it is still one of the foundations of stiffness method. Contained herein are discussions on joint displacements, support reactions, and flexibility of prismatic members. A new added section in this edition is the formalization of the flexibility method.

Chapter III extends the stiffness method of the first edition by consolidating a number of sections that were previously scattered. This chapter introduces the rudiments of stiffness matrices and methods. Considered are the stiffness of prismatic members, alterations due to temperature, prestrains, support displacements plus the formalization of the stiffness method. This chapter is mandatory reading for those wanting to learn and understand the rudiments of the stiffness method.

Chapter IV leads us by proper formulation of the stiffness method via computer-oriented techniques. The direct stiffness method represents the finite element that we now use and understand. This homogeneous chapter considers such topics as complete member stiffness matrices, formation of load vectors, rotation of axes in two dimensions, analysis of plane frames, grid member stiffnesses, space truss member stiffnesses, and space frame analysis. This is a lengthy chapter but everything is well explained. Plaudits to the authors for their lucid description of a well put-together chapter.

The authors revamp the computer programming from the previous edition. Fortran programming and flow charts are explained. The explanation includes preparation of data plus a vivid description of the computer programs applied to continuous beam, plane truss, plane frame, space truss, and space frame. The neophyte as well as the experienced analyst would surely benefit from reading this chapter.

The last chapter, which varies little from the first edition, concludes the book with additional topics on the stiffness method. This chapter includes rectangular framing, support displacement, elastic supports, translation of axis, non-prismatic members, and elastic connections. Though this is a very important chapter, the reviewer would have preferred seeing an expanded section on elastic connections.

The appendices consider displacement of framed structures and end actions for restrained members. A complete new section on computer routines for solving equations has been incorporated including sub-programs, a decided plus.

In summary, this is not an ordinary book on matrix methods. It includes a number of salient points in understanding the fundamentals of the stiffness method. The reviewer would have preferred seeing an introductory chapter on finite elements in two-dimensional plate problems. A chapter on dynamic analysis of beams and frames would add greatly to this book. The reviewer recommends the book to those interested and actively engaged in direct displacement method. The authors must be congratulated for having written a well-put-together book.

Matrix Structural Analysis. by W. McGuire and R. H.

Gallagher, John Wiley & Sons, New York, 1979. Price: \$24.95.

Reviewed by H. Saunders

The "master" has done it again: In partnership with R. H. Gallagher, W. McGuire has co-authored one of the better books on the fundamentals and introduction to finite element analysis. The book dwells upon static analysis at the expense of dynamics, elasto-plastic, and large deflection analysis.

The first three chapters discuss the introduction and history of structure analysis accompanied by various basic terms necessary for matrix structural analysis, i.e. degrees of freedom, coordinate system, and axial force relationships. Discussion on formation of global equations, which are one of the prime requisites for direct stiffness (finite element) method, follows directly.

Chapters IV and V delve deeply into stiffness analysis of frames via stress strain relationships, reciprocity, flexibility-stiffness transformation, and complete element stiffness matrix. Progressing from the simple to the more complex, we encounter coordinate transformations, transformations of energy via matrix manipulations, plus methods of loading stated in matrix form. Thermal strain is covered in a very brief fashion.

Chapter VI is an excellent chapter on statics and kinematics, and the authors are to be congratulated for their lucid explanation.

Chapter VII deals with the flexibility method that has been supplemented by the stiffness matrix method. Nevertheless, it should be learned by all students of matrix structural analysis.

Chapter VIII is a most vivid chapter explaining virtual work principles and their use in formulating the stiffness equations. This is executed via virtual strain energy and principles of virtual displacement. The chapter concludes with examples illustrating these concepts.

Chapter IX extends the virtual work concept to framework analysis employing the shape function and deriving the standard stiffness matrix for axial, torsional, and flexural elements. The chapter concludes with application of virtual forces in the formulation of force-displacement equations.

Chapter X ventures forth into more advanced topics rarely seen in an elementary text. The authors discuss condensation; give a brief description of substructuring, constraints, and reanalysis techniques, including artificial supports; and discuss the concept of symmetry as a cost-saving feature in computation costs. The chapter concludes with too brief an explanation of the transfer matrix approach.

Chapter XI deals with solutions of linear algebraic equations with special reference to the Gaussian elimination and Cholesky method and the wave front or frontal solution. Again, the latter is seldom seen in elementary texts. The chapter concludes with a terse section on error analysis applied to solution of linear equations.

The concluding chapter dwells briefly upon finite analysis of plate structures (rectangular and triangular) and how it is placed in global coordinate form. Isoparametric elements and triangular plate bending elements are mentioned, but no applications are furnished.

In summary, this is an excellent book. The reviewer would have preferred seeing a section each on dynamic analysis and solution of transient equations, and a brief introduction to inelastic analysis. An appendix on matrix fundamentals, which would provide better understanding to those unfamiliar with the topic, should have been included. This book is recommended to those interested and intending to be interested in finite element analysis and should be available at their beck and call. It is an excellent primer for the more advanced aspects of finite element.

The matrix method of analysis is an important topic in the field of structural engineering. A proper knowledge in this area is necessary to understand advance topics like finite element method, structural dynamics, structural stability, etc. This book deals with analysis of structures using matrix methods. It is designed as an easy-to-read textbook for an introductory course in matrix methods of structural analysis for senior undergraduate and postgraduate students of civil engineering. Menon, D., Advanced Structural Analysis, Narosa, New Delhi, 2009. Przemieniecki, J.S., Theory of Matrix Structural Analysis, Dover Publications, New York, 2012. Rajasekaran, S., and Sankarasubramanian, G., Computational Structural Mechanics, Prentice-Hall of India, New Delhi, 2012. Rao, S.S., The Finite Element Method in Engineering, Fifth Edition, Elsevier, New Delhi, 2013. Rubinstein, M.F., Matrix Computer Analysis of Structures, Prentice-Hall, New Jersey, 1966. Matrix Structural Analysis Second Edition William McGuire Professor of Civil Engineering, Emeritus Cornell University Richard H1. Gallagher Late Professor and President Clarkson University Ronald D. Ziemian Associate Professor of Civil Engineering Bucknell University Matrix formulation of dynamic analysis of structures, calculation of vibration frequencies and modes, and dynamic response of undamped and damped structural systems are included. Furthermore, structural synthesis, nonlinear effects due to large deflections, inelasticity, creep, and buckling are also discussed. The examples illustrating the various applications of the theory of matrix structural analysis have been chosen so that a slide rule is sufficient to carry out the numerical calculations. Matrix Structural Analysis – the Stiffness Method. Mechanics of Structures, 2nd year, Mechanical Engineering, Cairo University. Matrix structural analysis – the stiffness method.2. – Matrix structural analyses solve practical problems of trusses, beams, and frames. The stiffness method is currently the most common matrix structural analysis technique because it is amenable to computer programming. It is important to understand how the method works.