

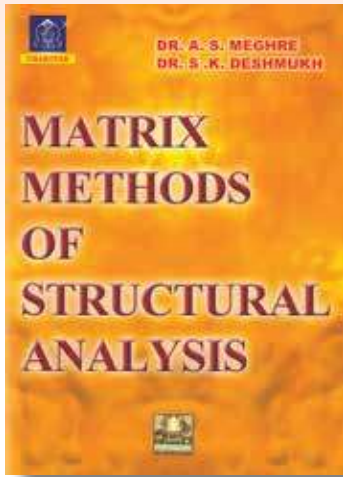
MATRIX METHODS OF STRUCTURAL ANALYSIS

[THEORY, EXAMPLES AND PROGRAMS]



By

Dr. A. S. Meghre, S. K. Deshmukh



Edition : 2nd Edition : 2016 (First Reprint)
ISBN : 9788192869278
Size : 170 mm × 235 mm
Binding : Paperback
Pages : 540 + 12 = 552



₹ 400.00 **BUY**

ABOUT THE BOOK

This book is intended for a beginner with elementary knowledge of structural mechanics and Fortran Programming. Stiffness and flexibility methods are commonly known as matrix methods. Of these, the stiffness method using member approach is amenable to computer programming and is widely used for structural analysis.

The emphasis in the book is on explaining basic fundamentals of this approach and on developing programs. This is achieved through extremely simple style of presentation in lucid language and proceeding in stages from simple to complex structures. Unified theory with a single complex program is totally avoided. Instead, each skeletal structure is discussed in a separate chapter with simple, short and transparent program. Theory is presented in matrix notations along with clear mention of scalar components for proper understanding of the physical quantities. Illustrative solved examples explain data preparation, data file and interpretation of the results. Alternate possibilities of data preparation are mentioned and used. The information about data generation, skyline storage, variable dimensioning and frontal technique is intentionally presented separately at a later stage to help reader in modifying initial simple programs.

The treatment of flexibility and direct stiffness method is limited to introduction of elementary concepts. Transfer matrix method, plastic analysis by stiffness method and sub-structure method are included as additional topics of interest. A chapter is devoted to present an alternate view of stiffness method as a variational approach. Non-linear structural behaviour and techniques commonly adopted to evaluate non-linear response are discussed. Formulae for displacements in beams and restraining actions are included in Appendices A and B. Appendix C discusses various methods of solution of simultaneous algebraic equations. Exercises are included at the end of each chapter.

The book will be useful to undergraduate and postgraduate civil engineering students and also to those preparing for competitive examinations.

CONTENT

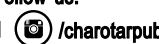
- 1 : INTRODUCTION
 - 2 : FLEXIBILITY METHOD
 - 3 : STIFFNESS METHOD
 - 4 : PLANE TRUSS
 - 5 : SPACE TRUSS
 - 6 : PLANE FRAME
 - 7 : GRID
 - 8 : SPACE FRAME
 - 9 : ADDITIONAL TOPICS – I
 - 10 : ADDITIONAL TOPICS – II
 - 11 : ADDITIONAL TOPICS – III
 - 12 : NON-LINEAR ANALYSIS
- APPENDIX A
APPENDIX B
APPENDIX C
BIBLIOGRAPHY
INDEX

Catalogue Checklist

Charotar Publishing House Pvt. Ltd. Opposite Amul Dairy, Civil Court Road, ANAND 388 001 India

☎ +91 2692 256237, 240089, 📠 +91 99249 78998 ✉ charotar@cphbooks.com, 🌐 https://cphbooks.in

Follow us:



/charotar

/cphpl1511

/charotarpub

/in/charotar

**MATRIX METHODS OF STRUCTURAL
DETAILED CONTENTS**

Chapter 1 INTRODUCTION

- 1-1 General
- 1-2 Classification of structures
- 1-3 Conditions of structural analysis
- 1-4 Methods of analysis
- 1-5 Degree of static indeterminacy
- 1-6 Degree of kinematic indeterminacy
- 1-7 Force and displacement
- 1-8 Force displacement relations
- Exercises I

Chapter 2 FLEXIBILITY METHOD

- 2-1 General
- 2-2 Flexibility method
- 2-3 Calculation of displacements
- 2-4 Examples of statically indeterminate structures
- 2-5 General approach in flexibility method
- 2-6 Examples
- 2-7 Concluding remarks
- Exercises II

Chapter 3 STIFFNESS METHOD

- 3-1 General
- 3-2 Continuous beam (I)
- 3-3 Frames without sway and axial deformations
- 3-4 Total joint load
- 3-5 Bar assembly
- 3-6 Spring assembly
- 3-7 Shaft
- 3-8 Continuous beam (II)
- 3-9 Concluding remarks
- Exercises III

Chapter 4 PLANE TRUSS

- 4-1 General
- 4-2 Stiffness matrix of a member
- 4-3 Joint equilibrium equations
- 4-4 Member force
- 4-5 Examples
- 4-6 Member stiffness matrix – alternate approach
- 4-7 Preliminaries to program
- 4-8 Flow chart
- 4-9 Data
- 4-10 Data file
- 4-11 Results
- 4-12 Computer program TRUSS1.FOR
- 4-13 Listing of program TRUSS1.FOR
- 4-14 Stiffness matrix in half band form
- 4-15 Computer program TRUSS2.FOR
- 4-16 Examples using TRUSS2.FOR
- 4-17 Listing of program TRUSS2.FOR
- 4-18 Reactions and boundary conditions
- 4-19 Data type II
- 4-20 Computer program TRUSS3.FOR
- 4-21 Examples using TRUSS3.FOR
- 4-22 Listing of program TRUSS3.FOR
- 4-23 Analysis of symmetric trusses
- 4-24 Inclined support
- Exercises IV

Chapter 5 SPACE TRUSS

- 5-1 General
- 5-2 Stiffness matrix of a member
- 5-3 Equilibrium of a joint
- 5-4 Axial force in member
- 5-5 Illustrative example

- 5-6 Computer program STRUSS.FOR
- 5-7 Listing of program STRUSS.FOR
- 5-8 Examples using program
- 5-9 Stiffness matrix of a member – alternate approach
- 5-10 Establishing member axes
- Exercises V

Chapter 6 PLANE FRAME

- 6-1 General
- 6-2 Stiffness matrix of a member
- 6-3 Joint equilibrium conditions
- 6-4 Member forces
- 6-5 Numerical example
- 6-6 Flow chart
- 6-7 Computer program PFRAME.FOR
- 6-8 Listing of program PFRAME.FOR
- 6-9 Examples using program
- 6-10 Internal hinge in member
- 6-11 Neglecting axial deformations
- 6-12 Inclined roller support
- 6-13 Cable supported beam
- Exercises VI

Chapter 7 GRID

- 7-1 General
- 7-2 Stiffness matrix of a member
- 7-3 Joint equilibrium conditions
- 7-4 Member forces
- 7-5 Torsion constant
- 7-6 Examples
- 7-7 Computer program GRID.FOR
- 7-8 Listing of program GRID.FOR
- 7-9 Examples using program
- Exercises VII

Chapter 8 SPACE FRAME

- 8-1 General
- 8-2 Stiffness matrix of a member
- 8-3 Joint equilibrium conditions
- 8-4 Fixed end reactions
- 8-5 Member end forces
- 8-6 Data type III
- 8-7 Computer program SFROME.FOR
- 8-8 Listing of program SFROME.FOR
- 8-9 Example
- 8-10 Examples using program SFROME
- Exercises VIII

Chapter 9 ADDITIONAL TOPICS – I

- 9-1 General
- 9-2 Half band width
- 9-3 Joint-code relations from fixity data
- 9-4 Joint load data and load vector
- 9-5 Groupwise data
- 9-6 Data generation
- 9-7 Storage schemes and memory requirement
- 9-8 Out-of-core methods
- 9-9 Frontal solution method
- 9-10 Variable dimensioning
- Exercise IX

Chapter 10 ADDITIONAL TOPICS – II

- 10-1 Effects of member loads, temperature and lack of fit in trusses
- 10-2 Elastic supports
- 10-3 Direct approach in stiffness method
- 10-4 Super element
- 10-5 Sub-structure method of analysis

**MATRIX METHODS OF STRUCTURAL
DETAILED CONTENTS**

- 10-6 Plastic analysis
- 10-7 Transfer matrix method
- Exercises X

Chapter 11 ADDITIONAL TOPICS – III

- 11-1 Stiffness method as a variational approach
- 11-2 Strain energy
- 11-3 Potential of loads
- 11-4 Total potential energy
- 11-5 Minimum potential energy theorem
- 11-6 Loaded member – strain energy and potential of loads
- 11-7 Equilibrium equations and energy minimisation conditions
- 11-8 Interpolation and shape functions
- 11-9 Member stiffness matrix using assumed displacements
- 11-10 Equivalent joint loads using shape functions
- 11-11 Introduction to finite element method
- 11-12 Triangular element for plane stress analysis
- Exercises XI

Chapter 12 NON-LINEAR ANALYSIS

- 12-1 Linear and non-linear response
- 12-2 Secant and tangent stiffness matrices
- 12-3 Non-linear analysis
- 12-4 Non-linear behaviour of a truss
- 12-5 Non-linear analysis of truss
- 12-6 Program steps for non-linear analysis of truss
- Exercise XII

APPENDIX A

- (A1) Slopes and deflections in beams
- (A2) Combination of standard formulae

APPENDIX B

- (B1) Restraining actions in restrained member

APPENDIX C

- (C1) Simultaneous linear algebraic equations
 - (a) Determinant method
 - (b) Elimination methods
 - (b1) Gauss elimination method (rowwise)
 - (b2) Row exchanges in Gauss elimination method
 - (b3) Gauss elimination for half banded matrix [HA]
 - (b4) Gauss-Jordan elimination method
 - (b5) Gauss method – columnwise reduction of symmetric matrix [A]
 - (b6) Column wise reduction in skyline storage
 - (c) Methods based on decomposition of [A]
 - (c1) Cholesky square root decomposition
 - (c2) Cholesky decomposition of half banded matrix
 - (c3) Gauss-Doolite decomposition of symmetric [A]
 - (c4) Gauss-Doolite decomposition of [HA]
 - (c5) Gauss-Doolite decomposition of [ASKY]
 - (d) Iteration methods
 - (d1) Gauss-Seidel iteration method
 - (d2) Iteration method with half banded matrix [HA]
 - (e) Use of inverse
 - (f) Multiple and subsequent right sides

**Bibliography
Index**

