

PREFACE

The objective of this book is to develop an understanding of the basic principles of the matrix methods of structural analysis, so that they can be efficiently implemented on modern computers. Focusing on the stiffness approach, *Matrix Analysis of Structures* covers the linear analysis of two- and three-dimensional framed structures in static equilibrium. It also presents an introduction to nonlinear structural analysis and contains the fundamentals of the flexibility approach.

The book is divided into ten chapters. Chapter 1 presents a general introduction to the subject, and Chapter 2 reviews the basic concepts of matrix algebra relevant to matrix structural analysis. The next five chapters (Chapters 3 through 7) cover the analysis of plane trusses, beams, and plane rigid frames. The computer implementation of the stiffness method is initiated early in the text (beginning with Chapter 4), to allow students sufficient time to complete development of computer programs within the duration of a single course. Chapter 8 presents the analysis of space trusses, grids, and space rigid frames, Chapter 9 covers some special topics and modeling techniques, and Chapter 10 provides an introduction to nonlinear structural analysis. All the relationships necessary for matrix stiffness analysis are formulated using the basic principles of the mechanics of deformable bodies. Thus, a prior knowledge of the classical methods of structural analysis, while helpful, is not essential for understanding the material presented in the book. The format of the book is flexible enough to enable instructors to emphasize topics that are consistent with the goals of the course.

Each chapter begins with a brief introduction that defines its objectives, and ends with a summary outlining its salient features. An important general feature of the book is the inclusion of step-by-step procedures for analysis, and detailed flowcharts, to enable students to make an easier transition from theory to problem solving and program development. Numerous solved examples are provided to clarify the fundamental concepts, and to illustrate the application of the procedures for analysis.

A computer program for the analysis of two- and three-dimensional framed structures is available on the publisher's website www.cengage.com/engineering. This interactive software can be used by students to check their answers to text exercises, and to verify the correctness of their own computer programs. The MATLAB® code for various flowcharts given in the book is available to instructors for distribution to students (if they so desire). A solutions manual, containing complete solutions to text exercises, is also available for instructors.

A NOTE ON THE REVISED EDITION

In this second edition, while the major features of the first edition have been retained, an introductory chapter on nonlinear analysis has been added because of

its increasing use in structural design. In addition, the sections on temperature changes and fabrication errors (Section 7.5), and nonprismatic members (Section 9.8), have been expanded via inclusion of additional examples. The total number of examples has been increased by about 10 percent, and the number of problems has been increased by about 15 percent to 255, of which about 40 percent are new problems. These new problems include some computer exercises intended to familiarize students with the use of the general-purpose structural analysis software. There are many other minor revisions, including some in the computer software, which has been upgraded to make it compatible with the latest versions of Microsoft Windows®. Finally, most of the photographs have been replaced with new ones, some figures have been redrawn and rearranged, and the page layout of the book has been redesigned to enhance clarity.

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