Structure and Infrastructure Engineering, Vol. 5, No. 1, February 2009, 67

Taylor & Francis
Taylor & Francis Group

Book Review

Optimal structural analysis, by A. Kaveh, Chichester, England, John Wiley & Sons Ltd., second edition, 2006, 512 pp., £70 (€105), hardback, ISBN 0-470-03015-1

During the last few decades, all fields of computational structural analysis have been massively explored, and a large variety of problems related to modelling techniques and numerical methods have now found a complete solution. On the other hand, the need for applying computational methods to large-scale problems of increasing complexity is continuously demanding computational structural analysis tools with greater accuracy, efficiency, and speed. The book authored by Professor Kaveh, meets this need by presenting efficient and practical methods for the optimal analysis of structures. This book is somewhat original, perhaps in a sense unique, as it combines the basic concepts from structural mechanics, matrix structural analysis, and graph theory, with advanced computational techniques for numerical conditioning, ordering methods, and parallel computing. In this context, many classical textbooks on matrix structural analysis fail by neglecting the crucial importance of the algorithmic translation and numerical implementation of theoretical formulations. Conversely, textbooks on numerical methods are usually far from focusing on structural analysis problems. In this sense, the book by Professor Kaveh contributes to filling a gap in the literature on structural engineering and mechanics.

The book is composed of nine chapters and two appendices. Chapter 1 introduces some of the most important concepts and theorems related to structural analysis. Chapter 2 provides methods for determining the degree of static indeterminacy and connectivity properties of structures. Chapter 3 focuses on the force method and provides efficient procedures for developing highly sparse and well-conditioned flexibility matrices. In a dual way, chapter 4 focuses on the displacement method and formation of well-conditioned stiffness matrices. Chapters 5 and 6 deal with ordering methods and propose banded, variable banded, and frontal solution schemes. In chapters 7 and 8, graph theory is used to develop decomposition methods for structural models and finite element meshes suitable for parallel processing. Finally, chapter 9 is devoted to methods for efficient calculation of eigenvalues and eigenvectors for decomposition and ordering of structural models. The closing appendices cover basic graph theory definitions and concepts, as well as the use of matroids in structural mechanics. Several examples presented throughout the book help the reader to appreciate the theory. Extensive reference to literature in the field is also provided; it is worth noting that, in a total of 237 listed references, 40 are contributions from the author.

Optimal structural analysis is the welcome culmination of three decades of research work by Professor Kaveh. This book is written in a very readable and teachable way, with minimal text and profuse use of concise notation. I believe it could be a helpful and interesting textbook for post-graduate students in civil and mechanical engineering, as well as a valuable source of useful information for researchers and professional engineers involved in the development of finite element programs, or in the numerical investigation of advanced structural engineering problems.

Fabio Biondini
Politecnico di Milano, Italy
biondini@stru.polimi.it

Structure and Infrastructure Engineering
ISSN 1573-2479 print/ISSN 1744-8980 online © 2009 F. Biondini
http://www.tandf.co.uk/journals
DOI: 10.1080/15732470701817106