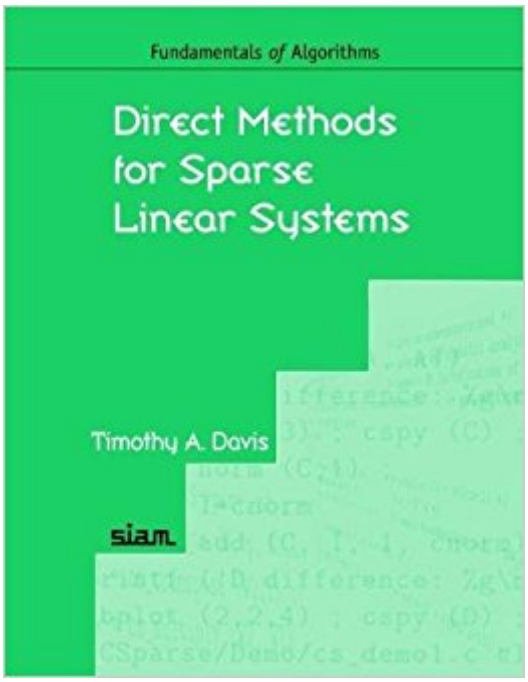
Direct Methods For Sparse Linear Systems (Fundamentals Of Algorithms)



Synopsis

Fundamentals of Algorithms 2 Computational scientists often encounter problems requiring the solution of sparse systems of linear equations. Attacking these problems efficiently requires an in-depth knowledge of the underlying theory, algorithms, and data structures found in sparse matrix software libraries. Here, Davis presents the fundamentals of sparse matrix algorithms to provide the requisite background. The book includes CSparse, a concise downloadable sparse matrix package that illustrates the algorithms and theorems presented in the book and equips readers with the tools necessary to understand larger and more complex software packages. With a strong emphasis on MATLABÂ® and the C programming language, Direct Methods for Sparse Linear Systems equips readers with the working knowledge required to use sparse solver packages and write code to interface applications to those packages. The book also explains how MATLAB performs its sparse matrix computations. This invaluable book is essential to computational scientists and software developers who want to understand the theory and algorithms behind modern techniques used to solve large sparse linear systems. The book also serves as an excellent practical resource for students with an interest in combinatorial scientific computing. Preface; Chapter 1: Introduction; Chapter 2: Basic algorithms; Chapter 3: Solving triangular systems; Chapter 4: Cholesky factorization; Chapter 5: Orthogonal methods; Chapter 6: LU factorization; Chapter 7: Fill-reducing orderings; Chapter 8: Solving sparse linear systems; Chapter 9: CSparse; Chapter 10: Sparse matrices in MATLAB; Appendix: Basics of the C programming language; Bibliography; Index. "Overall, the book is magnificent. It fills a long-felt need for an accessible textbook on modern sparse direct methods. Its choice of scope is excellent.." John Gilbert, Professor, Department of Computer Science, University of California, Santa Barbara.

Book Information

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Customer Reviews

"Everything you wanted to know but never dared to ask about modern direct linear solvers." --Chen Greif, Assistant Professor, Department of Computer Science, University of British Columbia.

An essential guide for computational scientists and software developers who want to understand the theory and algorithms behind modern techniques used to solve large sparse linear systems. The book also serves as an excellent practical resource for students with an interest in combinatorial scientific computing.

This books provides a decent library of sparse matrix functions. However, it can be difficult to understand the code at times because the author chose to use cryptic variable names.

Good book for handling sparse matrix.

Overall, I would say this is a pretty good book. I picked it up looking for something a bit deeper (and hopefully faster-executing) than what is found in the usual numerical analysis books, and that is what I got. Davis carefully steps through the code he developed, CSparse, from the bottom to the top. Sometimes the explanations are hard to follow, but I think that is because I’m an engineer, not a computer scientist, so my background really isn’t on par with what it should be before reading this book.The code (in C and/or Matlab) that is presented is very terse, and seems to combine as many operations per line as possible. If it weren’t for the text, trying to understand what is going on in the code would be impossible. Spartan coding has its place, surely, but not in textbooks.The book is missing two things. One, parallelism. Seriously- its 2008 (the fact that the book came out in 2006 doesn’t change my claim)- multicore processors are everywhere, and clusters are becoming cheaper and more ubiquitous. If a reader is interested enough in this topic to want to take advantage of sparsity, chances are they want to solve large sparse linear systems. Second, the proof that’s in the pudding is in the tasting. Davis only ever mentions the theoretical execution times of the various algorithms and pieces of algorithms. I would like to see a graph (that is, an x-y plot) of

run time vs matrix size for the various methods (as well as the theoretical predictions). Not only that, but let's see it for a finite element problem with an unstructured mesh over a non-trivial geometry....you know, a real problem.If nothing else, this book is a concise reference for the modern methods for treating sparse linear systems. The last book exclusive to the topic was some 20 years ago, and a lot of research has happened since then. If the algorithms presented in the book don't help you (which I doubt), then at least Davis cites several references to point you in the right direction.

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