Direct Methods for Sparse Matrices
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Published in print: 2017 Published Online: April Publisher: Oxford University Press
2017 DOI: 10.1093/
Item type: book

Direct Methods for Sparse Matrices, second edition, is a complete rewrite of the first edition published 30 years ago. Much has changed since that time. Problems have grown greatly in size and complexity; nearly all our examples were of order less than 5,000 in the first edition, and are often more than a million in the second edition. Computer architectures are now much more complex, requiring new ways of adapting algorithms to parallel environments with memory hierarchies. Because the area is such an important one to all of computational science and engineering, a huge amount of research has been done since the first edition, some of it by the authors. This new research is integrated into the text with a clear explanation of the underlying mathematics and algorithms. New research that is described includes new techniques for scaling and error control, new orderings, new combinatorial techniques for partitioning both symmetric and unsymmetric problems, and a detailed description of the multifrontal approach to solving systems that was pioneered by the research of the authors and colleagues. This includes a discussion of techniques for exploiting parallel architectures and new work for indefinite and unsymmetric systems.