Functions of Matrices: Theory and Computation (Other Titles in Applied Mathematics)

Nicholas J. Higham

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The only book devoted exclusively to matrix functions, this research monograph gives a thorough treatment of the theory of matrix functions and numerical methods for computing them. The author s elegant presentation focuses on the equivalent definitions of f(A) via the Jordan canonical form, polynomial interpolation, and the Cauchy integral formula, and features an emphasis on results of practical interest and an extensive collection of problems and solutions. Functions of Matrices: Theory and Computation is more than just a monograph on matrix functions; its wide-ranging content including an overview of applications, historical references, and miscellaneous results, tricks, and techniques with an f(A) connection makes it useful as a general reference in numerical linear algebra. Other key features of the book include development of the theory of conditioning and properties of the Fréchet derivative; an emphasis on the Schur decomposition, the block Parlett recurrence, and judicious use of Padé approximants; the inclusion of new, unpublished research results and improved algorithms; a chapter devoted to the f(A)b problem; and a MATLAB® toolbox providing implementations of the key algorithms.

Audience: This book is for specialists in numerical analysis and applied linear algebra as well as anyone wishing to learn about the theory of matrix functions and state of the art methods for computing them. It can be used for a graduate-level course on functions of matrices and is a suitable reference for an advanced course on applied or numerical linear algebra. It is also particularly well suited for self-study.

Contents: List of Figures; List of Tables; Preface; Chapter 1: Theory of Matrix Functions; Chapter 2: Applications; Chapter 3: Conditioning; Chapter 4: Techniques for General Functions; Chapter 5: Matrix Sign Function; Chapter 6: Matrix Square Root; Chapter 7: Matrix pth Root; Chapter 8: The Polar Decomposition; Chapter 9: Schur-Parlett Algorithm; Chapter 10: Matrix Exponential; Chapter 11: Matrix Logarithm; Chapter 12: Matrix Cosine and Sine; Chapter 13: Function of Matrix Times Vector: f(A)b; Chapter 14: Miscellany; Appendix A: Notation; Appendix B: Background: Definitions and Useful Facts; Appendix C: Operation Counts; Appendix D: Matrix Function Toolbox; Appendix E: Solutions to Problems; Bibliography; Index.

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