

<<Toeplitz系统预处理方法>>

图书基本信息

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前言

Toeplitz systems arise in a variety of applications, for instance, numerical differential equations, numerical integral equations of convolution-type, stationary auto-regressive time series, system identification problems, and image restoration problems [24, 28, 40, 47, 56, 61, 73], to mention just a few. In this book, we give an elementary introduction to preconditioning techniques developed recently for solving Toeplitz systems. The use of the preconditioned conjugate gradient (PCG) method with circulant preconditioners to solve Toeplitz systems was proposed in 1986 [74, 81]. One of the main results of this iterative method is that the complexity of solving a large class of n -by- n Toeplitz systems $Tx = b$ is only required $O(n \log n)$ operations. A lot of different preconditioners have been proposed, used, and analyzed since then. Within limited space and time, we mainly study some well-known preconditioners from a theoretical viewpoint. An application of preconditioners to systems of ordinary differential equations (ODEs) is also discussed. The book is organized into seven chapters. In Chapter 1, we provide some background knowledge of numerical linear algebra that will be used throughout the book. Two important Krylov subspace methods, the conjugate gradient (CG) method and the generalized minimum residual (GMRES) method, are introduced. A basic knowledge of the development in using the CG method with circulant preconditioners for solving Toeplitz systems is also given.

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内容概要

The use of the preconditioned conjugate gradient method with circulant preconditioners to solve Toeplitz systems was proposed in 1986. In this short book, the author mainly studies some well-known preconditioners from a theoretical viewpoint. An application of preconditioners to systems of ordinary differential equations is also discussed. The book contains several important research results on iterative Toeplitz solvers obtained in recent years. It could be accessible to senior undergraduate students who, in various scientific computing disciplines, have a basic linear algebra, calculus, numerical analysis, and computing knowledge. The book is also useful to researchers and computational practitioners who are interested in fast iterative Toeplitz solvers. Dr. Xiao-Qing Jin is a Professor at the Department of Mathematics, University of Macau. He is the author of 4 books and over 70 research papers. He is also a member of the editorial boards of Journal on Numerical Methods and Computer Applications, Numerical Mathematics: Theory, Methods and Applications, and East Asia Journal of Applied Mathematics.

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