

Explicit Iterative Methods of Second Order and Approximate Inverse Preconditioners for Solving Complex Computational Problems

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Abstract

Explicit Exact and Approximate Inverse Preconditioners for solving complex linear systems are introduced. A class of general iterative methods of second order is presented and the selection of iterative parameters is discussed. The second order iterative methods behave quite similar to first order methods and the development of efficient preconditioners for solving the original linear system is a decisive factor for making the second order iterative methods superior to the first order iterative methods. Adaptive preconditioned Conjugate Gradient methods using explicit approximate preconditioners for solving efficiently large sparse systems of algebraic equations are also presented. The generalized Approximate Inverse Matrix techniques can be efficiently used in conjunction with explicit iterative schemes leading to effective composite semi-direct solution methods for solving large linear systems of algebraic equations.

Keywords

Approximate Inverse Preconditioners, Iterative Methods, Second Order Iterative Schemes, Exact Inverse Methods, Approximate Inverse, Explicit Preconditioning, Conjugate Gradients, Convergence Analysis

1. Introduction

During the last decades, considerable research effort has been directed to the solution of complex linear and nonlinear systems of algebraic equation by using a class of iterative methods. This class includes the conjugate gradient method and its hybrid multi-variants. The conjugate gradient method originally introduced by Hestenes and Stiefel [1], was a direct solution method but later on has been extensively used as an iterative method for solving efficiently large sparse linear

Iterative Methods For Approximate Solution Of Inverse Problems

A.B. Bakushinsky, M.Yu. Kokurin



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this volume indicate the meaning of inverse methodology within various selected physical and medical contexts A scientific biography and a presentation of Helmholtz s epistemology indicate his outstanding position in natural philosophy Inverse Problems in Engineering Keith A. Woodbury,2000 **Computational Methods in Applied Mathematics** ,2004 **Nonlinearity** ,2007 **Moscow University Computational Mathematics and Cybernetics** Moskovskii gosudarstvennyi universitet im. M.V. Lomonosova,1995 Chinese Journal of Numerical Mathematics and Applications ,2001 **Cornelius Lanczos, Collected Published Papers with Commentaries** Cornelius Lanczos,1998 *Izvestiya, Russian Academy of Sciences* ,1998 *Inverse Problems in Engineering* Didier Delaunay,Yvon Jarny,Keith A. Woodbury,1998 Presents 79 papers from the June 1996 conference covering a wide range of topics in the areas of mathematics mechanics and heat transfer Presented by scientists mathematicians and engineers from the U S and Europe papers include treatments of bidimensional inversion in microwave radiometric imaging iteration schemes for inverse obstacle problems and inverse approach to plasto hydrodynamic lubrication Annotation copyrighted by Book News Inc Portland OR *IMACS '91* Robert Vichnevetsky,John James Henry Miller,1991 **Doklady** ,1993 Mathematical Reviews ,1999 **Advanced Technology Airfoil Research** ,1979 *NASA Conference Publication* ,1979 **Advanced Technology Airfoil Research, Volume 1, Part 1** ,1979

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