MasterWorks
Lecture Series

CASC

Tuesday, October 3, 2023

9:00AM – 10:00AM

B453 R1001 Armadillo Room

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Nonlinear Acceleration Techniques based on Krylov Subspace Methods

Abstract

There has been a surge of interest in recent years in general-purpose 'acceleration' methods that take a sequence of vectors converging to the limit of a fixed-point iteration and produce from it a faster converging sequence. A prototype of these methods that attracted much attention recently is the Anderson Acceleration (AA) procedure. We introduce the nonlinear Truncated Generalized Conjugate Residual (nlTGCR) algorithm, an alternative to AA which is designed from a careful adaptation of the Conjugate Residual method for solving linear systems of equations to the nonlinear context. The various links between nlTGCR and inexact Newton, quasi-Newton, and multisecant methods are exploited to build a method that has strong global convergence properties and that can also exploit symmetry when applicable. Taking this algorithm as a starting point we explore a number of other acceleration procedures including a short-term ('symmetric') version of Anderson Acceleration.

Biography

Yousef Saad is a Distinguished Professor of Computer Science and Engineering at the University of Minnesota. His research expertise spans iterative methods for solving large sparse linear systems and eigenvalue problems, sparse matrix computations, parallel algorithms in numerical algebra, numerical algorithms for materials science, and matrix methods for information sciences. He has been an active member of SIAM for 41 years, serving as an associate editor for the SIAM Journal on Numerical Analysis (1985 – 1993) and the SIAM Journal on Matrix Analysis (2008 – 2010). He also serves as an associate editor for Electronic Transactions of Numerical Analysis (2001 – present) and the Journal of Numerical Linear Algebra with Applications (1992 – present). He is a founding member of the biennial International Conference on Preconditioning Techniques for Scientific and Industrial Applications, and the recipient of numerous NSF research grants. He held the William Norris Land Grant Chair in Large-Scale Computing from 2006 to 2021 at the University of Minnesota. He was named a SIAM Fellow (2010) and a fellow of the American Association for the Advancement of Science (2010). Saad was awarded the 2023 John von Neumann Prize, the highest honor and flagship lecture of Society for Industrial and Applied Mathematics (SIAM), in recognition of his fundamental contributions to scientific computing.

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