Computational Mathematics Seminar Series

Filtered Anderson Acceleration for Nonlinear PDE

Sara Pollock, Associate Professor

University of Florida

Digital Media Center 1034
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Abstract:

Anderson acceleration (AA) has become increasingly popular in recent years due to its efficacy on a wide range of problems, including optimization, machine learning and complex multiphysics simulations. In this talk, we will discuss recent innovations in the theory and implementation of the algorithm. AA requires the storage of a (usually) small number of solution and update vectors, and the solution of an optimization problem that is generally posed as least-squares and solved efficiently by a thin QR decomposition. On any given problem, how successful it is depends on the details of its implementation, including how many and which of the solution and update vectors are used. We will introduce a filtered variant of the algorithm that improves both numerical stability and convergence by selectively removing columns from the least-squares matrix at each iteration. We will discuss the theory behind the introduced filtering strategy and connect it to one-step residual bounds for AA using standard tools and techniques from numerical linear algebra. We will demonstrate the method on discretized nonlinear PDE.

Speaker's Bio:

Sara Pollock is an Associate Professor in the Department of Mathematics at the University of Florida. She obtained her Ph.D. in Mathematics with a specialization in Computational Science from UC San Diego in 2012, an MS in Applied Mathematics from the University of Washington in 2008 and a BS in Mathematics from the University of New Mexico in 2007. Her research is focused on the design and analysis of efficient and accurate numerical methods for nonlinear and multiscale partial differential equations and for eigenvalue problems. She has been funded by multiple grants from the NSF including a CAREER award in 2021. Her work on PDE includes well-posedness and efficient solvers for nonlinear discrete problems arising from physical and multi-physical systems. Recently her work has included advances in the understanding and implementation of Anderson acceleration for numerical PDE, and the development of novel extrapolation methods for matrix and tensor eigenvalue problems. Since joining UF in 2018, she founded and co-mentors the UF student chapter of the Association for Women in Mathematics (AWM), and she currently serves as the secretary of the SIAM activity group on computational science and engineering (CSE).

This lecture has refreshments @ 03:00 pm

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