

TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Friday, 2 April 2010, 2:30 p.m.

Vector Extrapolation and Applications

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Abstract.

The convergence of iterates determined by a slowly convergent iterative process often can be accelerated by extrapolation methods. In this talk, we give a survey of vector extrapolation methods such as the reduced rank extrapolation (RRE) of Eddy and Mesina, the minimal polynomial extrapolation (MPE) of Cabay and Jackson, the modified minimal polynomial extrapolation (MMPE) of Brezinski and Pugachev, and the topological ϵ -algorithm (TEA) of Brezinski. Using projectors, we derive a different interpretation of these methods and give some theoretical results.

The second part of this talk is devoted to some numerical applications of the vector extrapolation methods to some problems involving linear and nonlinear systems of equations obtained from finite-difference or finite-element discretization of continuum problems. The truncated singular value decomposition (TSVD) is a popular solution method for small to moderately sized linear ill-posed problems. The truncation index can be thought of as a regularization parameter; its value affects the quality of the computed approximate solution. The choice of a suitable value of the truncation index generally is important, but can be difficult without auxiliary information about the problem being solved. We describe how vector extrapolation methods can be combined with TSVD, and illustrate that the determination of the proper value of the truncation index is less critical for the combined extrapolation-TSVD method than for TSVD alone. The last application discussed is the steady-state Navier-Stokes equations.