



DIPARTIMENTO
MATEMATICA

SEMINARS

ONE DAY ON NUMERICAL LINEAR ALGEBRA

JUNE 14, 2017

9:30 - 10:30

G rard Meurant, Paris (France)



An optimal Q-OR method for solving nonsymmetric linear systems

In [Eiermann, Ernst - 2001] it is shown that most Krylov methods for solving linear systems with nonsymmetric matrices can be described as so-called quasi-orthogonal (Q-OR) or quasi-minimum (Q-MR) residual methods. There exist many pairs of Q-OR/Q-MR methods. Well-known examples are FOM/GMRES, BiCG/QMR and Hessenberg/CMRH. These pairs mainly differ by the different bases of the Krylov subspace they used. In this lecture we will first recall the generic properties of the Q-OR methods that were studied in [Tebbens, Meurant - 2016]. Then, we will show how to construct a non-orthogonal basis of the Krylov subspace for which the Q-OR method yields the same residual norms as GMRES up to the final stagnation phase. Therefore, for a given Krylov subspace, this is the optimal Q-OR method for the residual norms. We will also establish some properties of this new basis that will help us simplifying the implementation of the proposed algorithm. We will illustrate the performances of the new algorithm with numerical experiments. In particular, for many linear systems, this new method gives a better attainable accuracy than GMRES using the modified Gram-Schmidt algorithm as well as GMRES using Householder reflections.

10:30 - 11:00

COFFEE BREAK

11:00 - 12:00

Claude Brezinski, University of Lille (France)



Shanks sequence transformations and Anderson acceleration

In this talk we present a general framework for Shanks transformations of sequences of elements in a vector space. It is shown that the Minimal Polynomial Extrapolation (MPE), the Modified Minimal Polynomial Extrapolation (MMPE), the Reduced Rank Extrapolation (RRE), the Vector Epsilon Algorithm (VEA), the Topological Epsilon Algorithm (TEA), and Anderson Acceleration (AA), which are standard general techniques designed for accelerating arbitrary sequences and/or solving nonlinear equations, all fall into this framework. Their properties and their connections with Quasi-Newton and Broyden methods are studied. The talk then exploits this framework to compare these methods. In the linear case, it is known that AA and GMRES are 'essentially' equivalent in a certain sense while GMRES and RRE are mathematically equivalent. We discuss the connection between AA, the RRE, the MPE, and other methods in the nonlinear case.

Joint work with Michela Redivo Zaglia and Yousef Saad

12:00 - 14:30

LUNCH BREAK

14:30 - 15:30

Lothar Reichel, Kent State University (USA)



Generalized Krylov subspace methods for l_p - l_q minimization with application to image restoration

This talk presents new efficient approaches for the solution of l_p - l_q minimization problems based on the application of successive orthogonal projections onto generalized Krylov subspaces of increasing dimension. The subspaces are generated according to the iteratively reweighted least squares strategy for the approximation of l_p and l_q -norms or quasi-norms by using weighted l_2 -norms. Computed image restoration examples illustrate the performance of the methods discussed.

15:30 - 15:45

COFFEE BREAK

15:45 - 16:45

Concluding remarks and discussion

Organizers: M. Redivo Zaglia and F. Tudisco

TORRE ARCHIMEDE - AULA 2AB40
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