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N. Spillane : Convergence and acceleration of GMRES for solving linear systems

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The GMRES linear solver, introduced by Y. Saad et M. H. Schultz is the go-to solver for non-symmetric systems that are too large to be factorized. For general matrices, the convergence behaviour of GMRES is not fully understood. Theoretical analysis is a challenge in itself but it also has very important practical implications.

In this talk I will present some existing convergence results for GMRES as well as their limitations. For matrices that have positive-definite symmetric part, I will analyze GMRES in a way that makes explicit the influence of three GMRES accelerators:
- weighting (i.e., changing the inner product),
- preconditioning (i.e., providing a cheap approximate inverse of the matrix),
- deflation (i.e., solving exactly the problem on part of the solution space).

These results provide us with a strategy for accelerating GMRES in the case of positive-definite problems.

This is joint work with Daniel Szyld from Temple University in Philadelphia.