



HAL
open science

How to choose a nonsymmetric preconditioner

Andy Wathen, Jennifer Pestana

► **To cite this version:**

Andy Wathen, Jennifer Pestana. How to choose a nonsymmetric preconditioner. International Conference On Preconditioning Techniques For Scientific And Industrial Applications, Preconditioning 2011, May 2011, Bordeaux, France. inria-00590770

HAL Id: inria-00590770

<https://inria.hal.science/inria-00590770>

Submitted on 6 May 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

How to choose a nonsymmetric preconditioner

List of authors:

Andy Wathen and Jennifer Pestana¹

For linear systems of equations with a real symmetric (or complex hermitian) coefficient matrix, there are standard iterative methods of choice: Conjugate Gradients for positive definite problems and MINRES for indefinite problems. For these methods there exist descriptive convergence theories based on eigenvalues, i.e. convergence bounds given in terms of polynomial approximation problems on the eigenvalue spectrum which are often reasonably tight. A key consequence is that it is clear what one is trying to achieve to get fast convergence via preconditioning in these cases, namely well distributed eigenvalues or reduced spectral condition number.

By contrast, existing convergence bounds for Krylov subspace methods such as GMRES for real nonsymmetric linear systems give little mathematical guidance for the choice of preconditioner. In this talk we will introduce a desirable mathematical property of a preconditioner which guarantees that convergence of GMRES will essentially depend only on the eigenvalues of the preconditioned system, as is true in the symmetric case.

¹Oxford University, UK