

Fast Iterative Solvers

Prof. Georg May

Project 1 - Work Package 2

GMRES

- Implement the GMRES method *without* preconditioning. It will be easy to add preconditioning later. Use the algorithm derived in class (Lecture 4).
- It is recommended to implement the Gram-Schmidt procedure first. Orthogonality of the new basis vectors can easily be tested by carrying out the dot products.
- Then integrate the Givens rotations into the algorithm
- Finally, you need to implement a backward substitution algorithm to get the coefficient vector \mathbf{y}^* , which you use to assemble the solution. Do not explicitly compute the inverse matrix of the triangular matrix R !
- For debugging you might want to test your algorithm for a very small matrix, e.g., a 3×3 matrix, where you can work out all the steps analytically for comparison purposes.
- Another test you may want to do: It is relatively easy to implement the Minimal Residual (MR) method discussed in class. GMRES(1) should give the same residuals (up to machine accuracy) as MR.