

# PhD-course on Iterative Methods for Linear Systems of Equations

## Practical assignments day 3

In the third assignment we will develop a simple test program for iterative methods and will download some test-matrices from the internet. With this test program we will investigate the convergence behaviour of GMRES and FOM.

- Download the files `gmres.m` and `mmread.m` for reading MATRIX-MARKET matrices from the course homepage. Also download the following test-matrices from the MATRIX-MARKET collection from the internet: `add20`, `sherman4`, `sherman5`, `mahindas` and `plskz362`. Run the program `test_itr.m` on the test problems.
- Develop a matlab routine for (unrestarted) FOM. Use `gmres.m` as your starting point. Apply GMRES and FOM to your test matrices. Use as tolerance  $\|r\|/\|b\| < 1e^{-8}$ . Which matrices are 'easy'? If you compare the convergence curves of GMRES and FOM, when do peaks in FOM-convergence occur?
- Add the possibility to compute the Ritzvalues. Do you see a relation between the Ritzvalues and whether a matrix is 'easy' or 'difficult'?
- Add the possibility to restart after  $m$  iterations. Use restarted GMRES and FOM for solving the five test-systems. Restart after 30 iterations. For which test-problems do FOM and GMRES converge within 1000 iterations?