PhD-course on Iterative Methods for Linear Systems of Equations

Practical assignments day 1

In the first assignment we will develop the Gauss-Seidel method for the normal equations. The method is applied to the Nolet problem.

- The file nolet.m defines a test-problem from geophysics. Run the test problem. It will show you the 'true' solution and the least-squares minimum norm solution.
- Implement the Gauss-Seidel algorithm that you defined as a theoretical assignments. Your algorithm should be called as follows:
  ```
  [x_it er res] = gauss_seidel( A, b, m_iter, eps );
  ```
  .
  The input parameters are:
  - `A`: the system matrix,
  - `b`: the right-hand side,
  - `m_iter`: maximum number of iterations,
  - `eps`: (true) error tolerance.

  The output parameters are:
  - `x_it`: Iterative solution,
  - `er`: estimate for the error $\|x - x_k\|$ in every iteration, (use the estimate you have derived as a theoretical assignment)
  - `res`: residual norm $\|b - Ax_k\|$ in every iteration.
- Remove the `return` statement from the file nolet.m. Use your algorithm to solve the Nolet problem. Plot after every iteration the approximate solution by adding the call `plotsol(x_it)`.
- (Optional) add noise to the right-hand-side vector `b`. Solve the resulting system.