

Lab 11, Numerical Calculus

Linear Systems; Iterative Methods

Implement the Jacobi, Gauss-Seidel and SOR methods, in the form

$$[x, nit] = \text{Name}(A, b, x0, err, maxnit),$$

where

A is the system matrix,

b is the right-hand side of the system,

$x0$ is the initial solution,

err is the desired error,

$maxnit$ is the maximum number of iterations allowed,

x is the iterative solution of the system,

nit is the number of iterations.

Applications

Use all three methods to solve the linear systems from Lab 10:

1.

$$\begin{cases} 5x_1 - x_2 & = 4 \\ -x_{j-1} + 5x_j - x_{j+1} & = 3, \quad j = \overline{2, n-1} \\ -x_{n-1} + 5x_n & = 4 \end{cases}$$

2.

$$\begin{bmatrix} 5 & -1 & 0 & -1 & \dots & \dots & 0 \\ -1 & 5 & -1 & 0 & -1 & \dots & \dots & \vdots \\ 0 & -1 & 5 & -1 & \ddots & \ddots & \vdots & \vdots \\ -1 & & \ddots & \ddots & \ddots & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & -1 & 5 & -1 & 0 & -1 \\ 0 & \dots & \ddots & 0 & -1 & 5 & -1 & 0 \\ 0 & \dots & & -1 & 0 & -1 & 5 & -1 \\ 0 & \dots & & & -1 & 0 & -1 & 5 \end{bmatrix} x = \begin{bmatrix} 3 \\ 2 \\ 2 \\ 1 \\ \vdots \\ 1 \\ 2 \\ 2 \\ 3 \end{bmatrix}$$