Faculty of Mathematics
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Exercises to the classes
Numerical Methods in Sciences and Technics

Exercises no. 2

to 27.10.2003

The solution of exercise 4 is to submit in the exercise classes on Monday, 27.10.2003 !

Statements given in the lecture can be used in the solution of the exercises without proof. All other statements have to be proved.

1. Let S be the iteration matrix of a fixed point iteration and e^m the error after iteration step m. Derive equation (1.3.4) given in the lecture
$$Se^m = e^{m+1}.$$

2. Let $\rho(A)$ be the spectral radius of the matrix $A \in \mathbb{R}^{n\times n}$. Show
$$\rho(A^m) = \rho(A)^m, \quad m \in \mathbb{N}.$$

3. Derive the formula (1.3.7) of the damped Jacobi iteration from formula (1.3.3) for a general damped iteration.

4. Write a matlab script for the damped Jacobi iteration. Consider the model problem with $a = 0$ and $f = 0$ on a mesh with $N = 128$. Do 100 iterations with the damping factor $\omega = 2/3$ and the initial guess $u_0 = (u_1^0, \ldots, u_{N-1}^0)^T$ with
$$u_j^0 = \sin\left(\frac{jk\pi}{N}\right), \quad j = 1, \ldots, N-1$$
for $k \in \{1, 3, 10, 64\}$. Compute the error $\|e^{100}\|_\infty$.