Faculty of Mathematics
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Magdeburg, 26.10.2003

Exercises to the classes
Numerical Methods in Sciences and Technics

Exercises no. 3

to 03.11.2003

The solution of exercise 3 is to submit in the exercise classes on Monday, 03.11.2003 !

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_ω be the iteration matrix of the damped Jacobi iteration. Show that S_ω has the same eigen vectors as the matrix of the model problem.

2. Write a matlab script for the SOR iteration. Consider the model problem with $a = 0$ and $f = 0$ on a mesh with $N = 128$. Do 100 iterations with the damping factors $\omega = 1$ and $\omega = 1.9$ 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 $\|e^{100}\|_\infty$.

3. Consider the $k-th$ Fourier mode, $N/2 < k < N$, on a grid Ω^h with N intervals. Show that this mode is represented on the grid Ω^{2h} (with $N/2$ intervals) as the negative of the $(N-k)$-th mode on Ω^{2h}.