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Numerical Mathematics III – Partial Differential Equations

Exercise Problems 04

Attention: The approach for getting a solution has to be clearly presented. All statements have to be proved, auxiliary calculations have to be written down. Statements given in the lectures can be used without proof.

1. *Comparison lemma.* Prove the comparison lemma (Corollary 2.22).
2. *An eigenvalue problem connected to the five point stencil.* Show that the vector $v_k = (v_{k,0}, \dots, v_{k,n})$ with

$$v_{k,0} = v_{k,n} = 0, \quad v_{k,i} = \sqrt{2} \sin(\pi k x_i),$$

solves the eigenvalue problem

$$v_{k,i-1} + (\lambda_k h^2 - 2) v_{k,i} + v_{k,i+1} = 0$$

with

$$\lambda_k = \frac{2}{h^2} (1 - \cos(\pi k h)) = \frac{4}{h^2} \sin^2\left(\frac{\pi k h}{2}\right).$$

Remind the programming problem from Exercise Problems 03!

The exercise problems should be solved in groups of two or three students. The written parts have to be submitted until **Thursday, May 16, 2019** to A. Jha. The executable codes have to be send by email to A. Jha.