



Introduction to Theory and Numerics of PDEs – WiSe 2023/2024

Practical Exercises 6

Ausgabe: 18.01.2024, 12:00 Uhr

Abgabe: 01.02.2024, 12:00 Uhr

Homepage to the lecture:

<https://aam.uni-freiburg.de/agasa/lehre/ws23/tun0>

Exercise 1 (20 points). For $m \in \mathbb{N}_0$ and $j = 1, 2$, consider the subspaces $V_m^j \subset H_0^1(\Omega)$ for $\Omega = (0, 1)$ defined by

$$V_m^1 = \left\{ \sum_{0 \leq j+k \leq m} \alpha_{j,k} x^j (1-x)^k \right\}, \quad V_m^2 = \left\{ \sum_{0 \leq j \leq m} \beta_j \sin(\pi j x) \right\}.$$

Compute the Galerkin approximations of the Poisson problem $-u'' = 1$ in Ω and with Dirichlet boundary conditions $u(0) = u(1) = 0$. Comparatively, investigate numerically in Matlab the convergence of the methods and the properties of the linear systems of equations.