

Exercises 26.05.2015

1. Implement the two-grid scheme as described in the lecture for the standard centered finite difference discretization of

$$\partial_{xx}u(x) = f, \quad u(0) = 0, u(1) = 0$$

on $[0, 1]$ in a programming language of your choice. Perform a numerical study of the convergence behavior for different initial guesses and compare the number of iterations required to reach a certain tolerance to the Gauss-Seidel iteration.

Note: you can use a direct solver (such as the Matlab backslash operator for the problem on the coarser grid).

2. Replace the weighted Jacobi iteration in the implementation of 1. by a domain decomposition approach that partitions $[0, 1]$ into 10 subdomains of equal size. Investigate the convergence behavior as a function of the overlap.