

Homework Assignment for Week 13

Assigned Dec 09, 2011.

1. Section 7.4: Problems 2(c), 4, 7.
2. Construct the matrices A , B corresponding to the equations $v''(x) = f$ and $u(x) + u'(x) = g$, respectively. Verify numerically that the condition numbers depend on the size of the matrix, or on the grid size as $\kappa(A) = O(1/h^2)$ and $\kappa(B) = O(1/h)$, respectively.
3. Let A be the matrix resulted from discretizing

$$\begin{aligned} (\partial_x^2 + \partial_y^2)u(x, y) &= f(x, y), & (x, y) \in (0, 1)^2 \\ u &= 0, & \text{on the boundary of } (0, 1)^2 \end{aligned} \tag{1}$$

with uniformly spaced grids $0 = x_0 < x_1 < \dots < x_N = 1$, $0 = y_0 < y_1 < \dots < y_N = 1$, $x_i - x_{i-1} = y_j - y_{j-1} = h = 1/N$, using second order centered finite difference method.

Write a pseudo-code for solving $Au = f$ using Jacobi, Gauss-Siedel and SOR iteration, respectively (first study your class note for the 1D case and try to generalize it to this 2D case).