Iterative Methods for Poisson and Laplace Equations

The Poisson equation is:

The Laplace equation is the homogeneous Poisson equation:

We only consider the two-dimensional Poisson equation

We will compare the various iterative methods to solve the Poisson equation using the following example

The boundary conditions are set as along all four sides of square domain. This problem has an analytical solution given by the following expression:

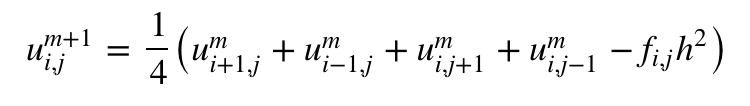
Discretization

Assuming , we can write the discretised Poisson equation in the following manner:

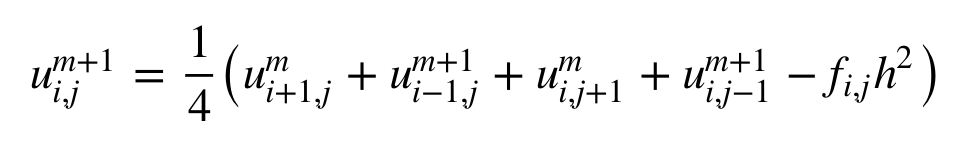
Rearrange in the form of a recurrence relationship:

By choosing the values of the terms at certain iterations, we can form all the iterative schemes that we will discuss later. In all the cases, we will take .

Jacobi Iteration Method



Gauss-Seidel Iteration Method



Successive Over-Relaxation [SOR[ Iteration Method

