关于数值方法的附加作业8

Homework

1. Consider the Poisson equation

$$\nabla^2\varphi(x, y) = -\rho(x, y)/\varepsilon_0$$

from electrostatics on a rectangular geometry with $x \in [0, L_x]$ and $y \in [0, L_y]$. Write a program that solves this equation using the relaxation method. Test your program with:

(a) $\rho(x, y) = 0$, $\varphi(0, y) = \varphi(L_x, y) = \varphi(x, 0) = 0$, $\varphi(x, L_y) = 1\text{V}$, $L_x = 1\text{m}$, and $L_y = 1.5\text{m}$;

(b) $\rho(x, y)/\varepsilon_0 = 1\ \text{V/m}^2$, $\varphi(0, y) = \varphi(L_x, y) = \varphi(x, 0) = \varphi(x, L_y) = 0$, and $L_x = L_y = 1\ \text{m}$.

2. Solve the time-dependent Schrodinger equation using the Crank–Nicolson method. Consider the one-dimensional case and test it by applying it to the problem of a square well with a Gaussian initial state coming in from the left.