

Introduction to Week Six

Numerical Solutions of PDEs

Direct Solution of Boundary Value Problems

Iterative Solution of Boundary Value Problems

Time-stepping Methods for Initial Value Problems

✔ **Video:** Explicit Methods for Solving the Diffusion Equation | Lecture 69
13 min

✔ **Reading:** Using a Second-Order Time-Stepping Method
10 min

✔ **Reading:** FTCS Scheme for the Advection Equation
10 min

✔ **Video:** Von Neumann Stability Analysis of the FTCS Scheme | Lecture 70
14 min

✔ **Reading:** Von Neumann Stability Analysis of the FTCS Scheme for the Advection Equation
10 min

✔ **Video:** Implicit Methods for Solving the Diffusion Equation | Lecture 71
8 min

✔ **Reading:** Implicit Discrete Advection Equation
10 min

✔ **Video:** Crank-Nicolson Method for the Diffusion Equation | Lecture 72
13 min

✔ **Reading:** Lax Scheme for the Advection Equation
10 min

✔ **Video:** MATLAB Solution of the Diffusion Equation | Lecture 73
11 min

✔ **Reading:** Difference Approximations for the Derivative at Boundary Points
1 min

🔗 **Ungraded External Tool:** The Diffusion Equation with No-Flux Boundary Conditions
30 min

Quiz

Programming Assignment: Two-dimensional Diffusion Equation

Farewell

Difference Approximations for the Derivative at Boundary Points

(a) Derive a second-order method for the x -derivative at boundary points. When x is a boundary point on the left, use the Taylor series

$$y(x + h) = y(x) + hy'(x) + \frac{1}{2}h^2y''(x) + O(h^3),$$

$$y(x + 2h) = y(x) + 2hy'(x) + 2h^2y''(x) + O(h^3).$$

When x is a boundary point on the right, use the Taylor series

$$y(x - h) = y(x) - hy'(x) + \frac{1}{2}h^2y''(x) + O(h^3),$$

$$y(x - 2h) = y(x) - 2hy'(x) + 2h^2y''(x) + O(h^3).$$

(b) No-flux boundary conditions sets $\partial u / \partial x$ equal to zero on the boundaries. Using the results of Part a), determine boundary conditions for u_1^l and $u_{n_x}^l$.

✔ Completed Go to next item

👍 Like 💬 Dislike 🚩 Report an issue

