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

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

$$y(x+2h) = y(x) + 2hy'(x) + 2h^2y''(x) + \mathrm{O}(h^3).$$

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

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

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

(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