In the name of God

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ADVANCED METHODS ON COMPUTATIONAL PHYSICS

Exercise Set 10

(Date Due: 1399/02/20)

1. Solve Laplace's equation ($\nabla^2\Phi(x,y) = 0$) numerically for a 2D area with 300×300 pixels. Suppose that $\Phi(0,y) = y^2$, $\Phi(x,0) = x$, $\Phi(L,y) = 0$ and $\Phi(x,L) = 1$ (relaxation method or finite difference method)

2. Linear Boundary value problem: Suppose numerically $y''(t) + 2y'(t) + y(t) = 0$ with $y(0) = 1$ and $y(1) = 3$ and compare it with exact solution.
(For more details see (secondDE.pdf). http://www.stewartcalculus.com/data/CALCULUS Concepts and Contexts 4th edition/upfiles/3c3-2ndOrderLinearEqnsStu.pdf (I have uploaded it in my webpage entitled secondDE.pdf)

3. Non-linear Boundary value problem: Solve numerically following equations:
A: $y''(t) = 2y(t)^3 - 6y(t) - 2t^3$ with $y(1) = 2$ and $y(2) = 5/2$. (The exact result is $y(t) = t + 1/t$).
B: $y^{(3)}(t) + y(t)y''(t) - y'(t)^2 + 1 = 0$, with $y(0) = 0, y'(0) = 0, y(1) = 0$.
C: $y^{(4)}(t) + y(t)^2 = \frac{t^{-5/2}}{16}(9 + 30t + 105t^2) + t^3(1-t)^4$, with $y(0) = 0, y'(0) = 0, y(1) = 0, y'(1) = 0,$. (The exact solution is $y(t) = t^{3/2}(1-t)^2$).

Good luck, Movahed