In the name of God

Department of Physics
Shahid Beheshti University

COMPUTATIONAL PHYSICS

Exercise Set 5

(Date Due: 1395/02/05)

1. For cooling differential equation, calculate analytical solution as well as numerical one. Then plot Δ as a function of discretization parameter.

2. Compute Temperature profile for position and time for a rod.

3. Solve Laplace's equation numerically. (relaxation method or finite difference method)

4. Solve the following integration numerically:

$$\langle v_z^2 \rangle = \int_{-\infty}^{+\infty} dv_x \int_{-\infty}^{+\infty} dv_y \int_{-\infty}^{+\infty} dv_z v_z^2 p_v(\vec{v})$$

here $p_v(\vec{v}) = \left(\frac{\beta m}{2\pi}\right)^{3/2} \exp\left(-\frac{\beta m \vec{v}^2}{2}\right)$. You can imagine any values for free parameters.

5. Write down a program to compute the rounding errors of your computer for single and double precisions.

6. Using Euler and RF4 methods, solve following initial value problem:

$$y''(t) + ay'(t) + \omega^2 y(t) = \cos(\omega_1 t)$$

with $y(0) = A$, $y'(0) = 0$ and take any arbitrary values for other free parameters.

Good luck, Movahed