

In the name of God

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ADVANCED METHODS ON COMPUTATIONAL PHYSICS

Exercise Set 9

(Date Due: 1399/02/10)

1. Compute Temperature profile for position and time for a rod according to  $\partial T/\partial t = K\partial^2 T/\partial x^2$ . The boundary values are  $T(t, x = 0) = 100$ ,  $T(t, x = 10) = 25$  and  $T(t = 0, x) = e^{-x/5}$ . In addition suppose Thermal diffusivity as  $K = 197$  for Aluminum. What happens if the rod has insulated endpoint?

2. 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.

3. 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.

4. For previous equation, use finite difference method to solve  $y$  as a function of  $t$ . Suppose the  $t_{initial} = 0$  and  $t_{final} = 10$  with  $N = 1000$ . compare your result with your solution computed in previous equation.

Good luck, Movahed

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