

In the name of God

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COMPUTATIONAL PHYSICS

Exercise Set 10

(Due Date: 1402/02/31)

1. Decaying simulation: suppose the probability of decaying are $p = \lambda\Delta t$ and $p = \lambda\Delta t/t$. For both of them write down programs that simulate these phenomena.
2. Using Stone throwing method, compute the value of pi (π). Check your algorithm for various values of sampling, N .
3. 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 $p_v(\vec{v}) = \left(\frac{\beta m}{2\pi}\right)^{3/2} \exp\left(-\frac{\beta m \vec{v}^2}{2}\right)$. Suppose that $\beta m = 2$. Could you estimate your result before doing integration?

4. Based on Variational theorem in the quantum mechanics, write a variational Monte-Carlo program to estimate the ground state of 1D harmonic oscillator.

Good luck, Movahed
