

Assignment-8

Problem-1: The equation for the simple Harmonic oscillator is given by

$$m \frac{d^2x}{dt^2} = -kx \quad (1)$$

where symbols have their usual meaning.
The energy of the oscillator is given by

$$E = \frac{p^2}{2m} + \frac{1}{2}kx^2 \quad (2)$$

Assume that $k = m = 1$ such that the angular frequency $\omega = 1$ and period $T = 2\pi$. Solve the simple Harmonic oscillator problem by using the Euler and RK-4 method to obtain

1. the total energy as a function of t/T and
2. the phase space trajectory in the $x - p$ plane.

Discuss the comparison between the two methods with figures and **submit a hardcopy** to the respective evaluator in the lab.

Initial conditions are $x(t = 0) = 1$ and $v(t = 0) = 0$.

Note: With this initial condition $2E = 1$ and hence the phase space trajectory is a circle of unit radius. Use a time step of $h = 0.02T$ so that it takes 50 time steps to complete one cycle of the oscillator.