

Assignment 12. RK4 – 1st & 2nd order ODE

Marks 10

Posted on 23.10.2025 @ 2:30 pm and due on 23.10.2025 @ 6:00 pm

1. Use Runge-Kutta-4 method to solve and the following differential equation and compare with analytical form over the range $x \in [0, \pi/5]$. Use step sizes 0.1, 0.4, 0.8.

$$\frac{dy}{dx} = (x + y)^2 \quad \text{with } y(0) = 1 \quad \rightarrow \quad \tan^{-1}(x + y) = x + \frac{\pi}{4}$$

2. Use RK4 to solve the damped simple harmonic oscillator using the following initial values and parameters over a time range $[0, 40]$. Plot variation of x , v and total energy E with time t .

$$\ddot{x} + \mu \dot{x} + \omega^2 x = 0, \quad \text{with } x(0) = 1.0, \quad v(0) = 0.0 \quad \text{and } k = 1.0, \quad m = 1.0, \quad \mu = 0.15$$