Worksheet 2

Problem 1 Numerically integrate the damped oscillator using RK4

$$\frac{d^2\theta}{dt^2} + 2\lambda\omega_0\frac{d\theta}{dt} + \omega_0^2\theta = 0 \tag{1}$$

where $\omega_0 = \sqrt{k/m}$ and $\lambda = \gamma/(2\sqrt{m\ k})$ with γ the viscous damping. Vary λ and numerically determine the critical damping value λ_c.

Problem 2 Now consider a damped and driven oscillator

$$\frac{d^2\theta}{dt^2} + 2\lambda\omega_0\frac{d\theta}{dt} + \omega_0^2\theta = \frac{F_0}{m}\sin(\omega t). \tag{2}$$

Integrate and plot *steady-state* amplitude as a function of relative frequency ω/ω_0 for different γ. Numerically determine the resonant frequency $[\omega_r = \omega_0\sqrt{1-2\gamma^2}]$.