

Possible Project List

1. Pendulum:

$$\begin{aligned}\theta'(t) &= \omega(t), \\ \omega'(t) &= -\frac{g}{L} \sin \theta(t)\end{aligned}$$

2. Predator and Prey:

$$\begin{aligned}\frac{dr}{dt} &= ar - grw, \\ \frac{dw}{dt} &= -bw + hrw,\end{aligned}$$

where a, b, g, h are positive constants.

3. Predator and Prey (Red tide:

$$\begin{aligned}\frac{dP}{dt} &= rP\left(1 - \frac{P}{K}\right) - \alpha PZ, \\ \frac{dZ}{dt} &= \beta PZ - \mu Z - \frac{\theta P}{\gamma + P}Z,\end{aligned}$$

where P and Z represent the density of phytoplankton and zooplankton population respectively, $\alpha(> 0)$ is the specific predation rate and $\beta(> 0)$ represents the ratio of biomass consumer per zooplankton for the production of new zooplankton, $\mu(> 0)$ is the mortality rate of zooplankton, θ is the rate of toxin production per phytoplankton species and γ is the half saturation constant.

4. Mass-and-spring oscillator

$$\begin{aligned}\frac{dx}{dt} &= v, \\ \frac{dv}{dt} &= -x - \mu v^3,\end{aligned}$$

5. Coupled Oscillator

<http://focus.aps.org/story/v6/st15>