INDIAN INSTITUTE OF TECHNOLOGY PATNA

PH103 : Physics
Tutorial 10

1. Consider the system of 3 masses connected via springs (with spring constant k) as shown in figure below. If x_1, x_2 and x_3 are the displacements of the masses from equilibrium position, obtain the normal mode frequencies by using matrix method.

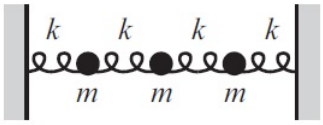

Figure 1: The 3 mass system

2. Consider two pendula which are coupled together with a spring (having constant k) as shown in figure below. Assume that the displacement from the equilibrium positions are small enough that small angle approximation could be used and motion is approximately only in the x-direction. Find the normal modes and normal co-ordinates for this system

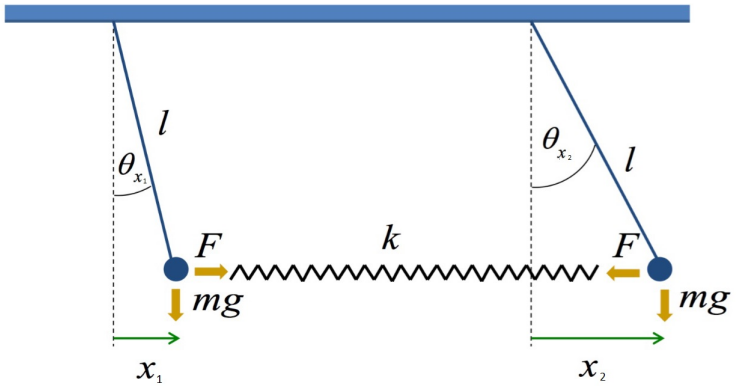

Figure 2: The coupled pendulum

3. Consider 2 masses connected via springs (having spring constants k). Assume this coupled oscillator is immersed in a fluid so that both masses feel a damping force, $F_f = -bv$. Solve for $x_1(t)$ and $x_2(t)$. Assume underdamping. See figure given in the next page.

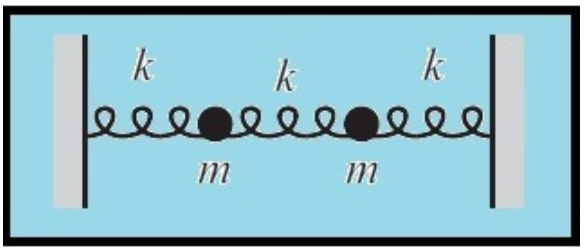

Figure 3: Damped coupled oscillator

4. Consider the coupled oscillator, for which left mass is subjected by a driving force $F_d \cos(2\omega t)$ and the right mass by a force $2F_d \cos(2\omega t)$. Find the solution for $x_1(t)$ and $x_2(t)$

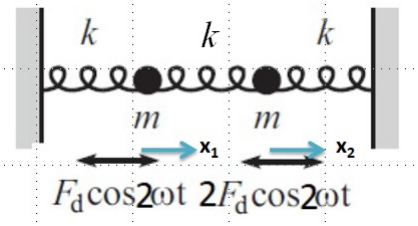

Figure 4: Driven coupled oscillator