# **Tutorial 2**

**Exercice 1 :**

1. For a mass spring system without damping, having the following parameters m=62.5g, k=200 N/m and . The initial conditions are and . Calculate and display the displacement, velocity and acceleration of the system. (Use a sampling frequency equal to --i.e. time step of 0.01s and display it between t=0 to t=2s)
2. Implement a function « free\_response » that takes the mass , the stiffness , the time axis and the initial conditions and , and returns the displacement of the free response
   1. Evaluate the response for For m=60g and k=200 N/m. Use the same initial conditions as before
   2. Display the responses for different mass (m=30,60 and 100g) for the same k=400 (this can be easily calculated). How the mass affects the response ?
   3. Display the responses for different stiffness (k=100, 200 and 400 N/m). How the stiffness affects the response ?

**Exercice 2 :**

1. For a mass spring system with damping, having the following parameters m=62.5g, k=200 N/m and and the damping factor is . The initial conditions are and . Calculate and display the displacement. (Use a sampling frequency equal to --i.e. time step of 0.01s and display it between t=0 to t=20s)
   1. Optional : Compute the velocity and acceleration of the system. Comment the result.
2. Implement a function « free\_response\_damping » that take the mass, the stiffness, the damping factor and the initial conditions and , and returns the free response (i.e. the displacement )
   1. Display the solution for different damping factor . Display the results between t=0 and t=20. Comment the results.

**Exercice 3 : mass-spring-damper free response**

1. For a mass spring system with damping, having the following parameters m=62.5g, k=200 N/m and and the damping factor is . The system is excited by a force . Calculate and display the displacement of the system. (Use a sampling frequency equal to --i.e. time step of 0.01s and display it between t=0 to t=2s)
   1. Optional : Compute the velocity and acceleration of the system. Comment the result.
2. Implement a function « Forced\_response\_damping » that take the mass, the stiffness, the damping factor, the amplitude and the angular frequency of a cosine forcing function , and returns the Forced response (i.e. the displacement )
   1. Display the solution for different reduced frequency . Display the results between t=0 and t=2. Comment the results