MMAN2300 Engineering Mechanics 2

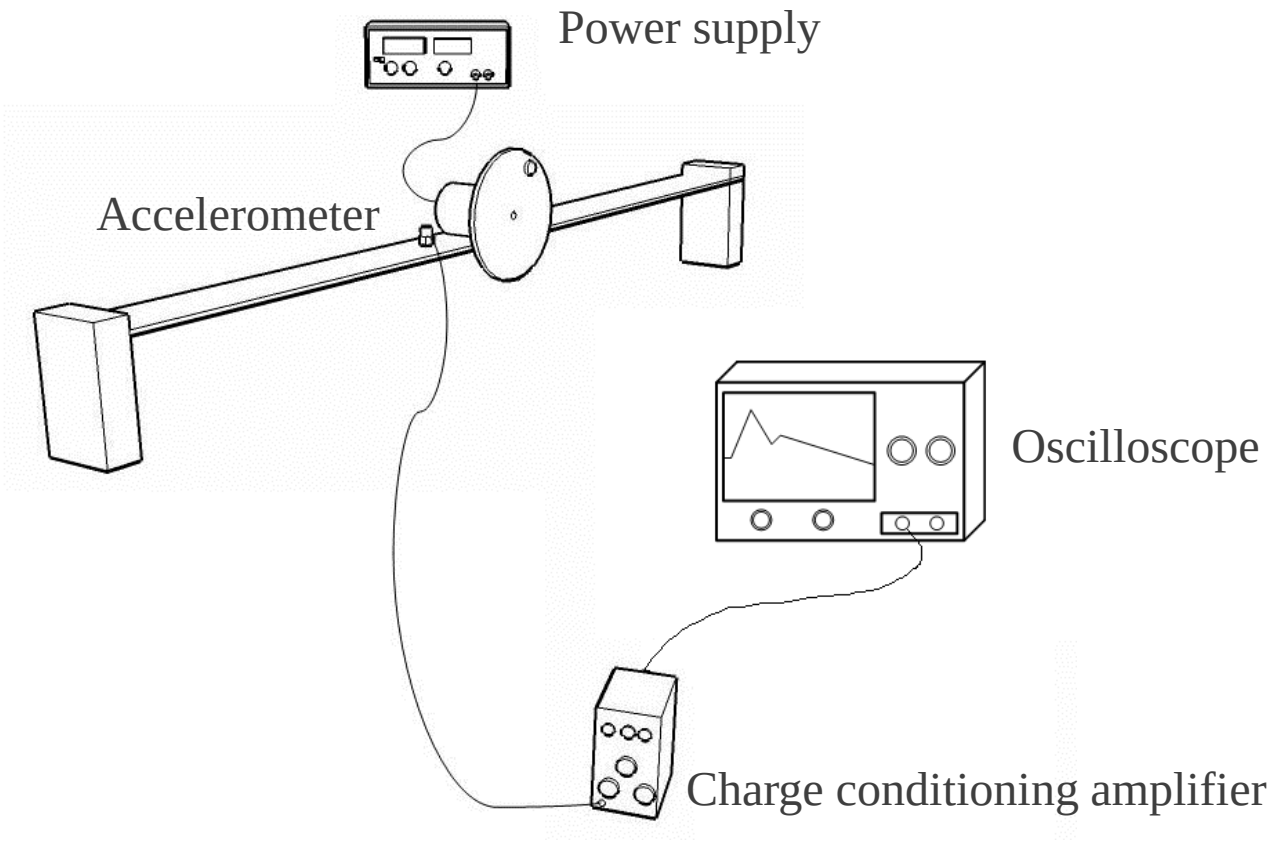
Part B: Vibration Analysis

Lab 1

Single DOF spring-mass-damper system in free and forced vibration

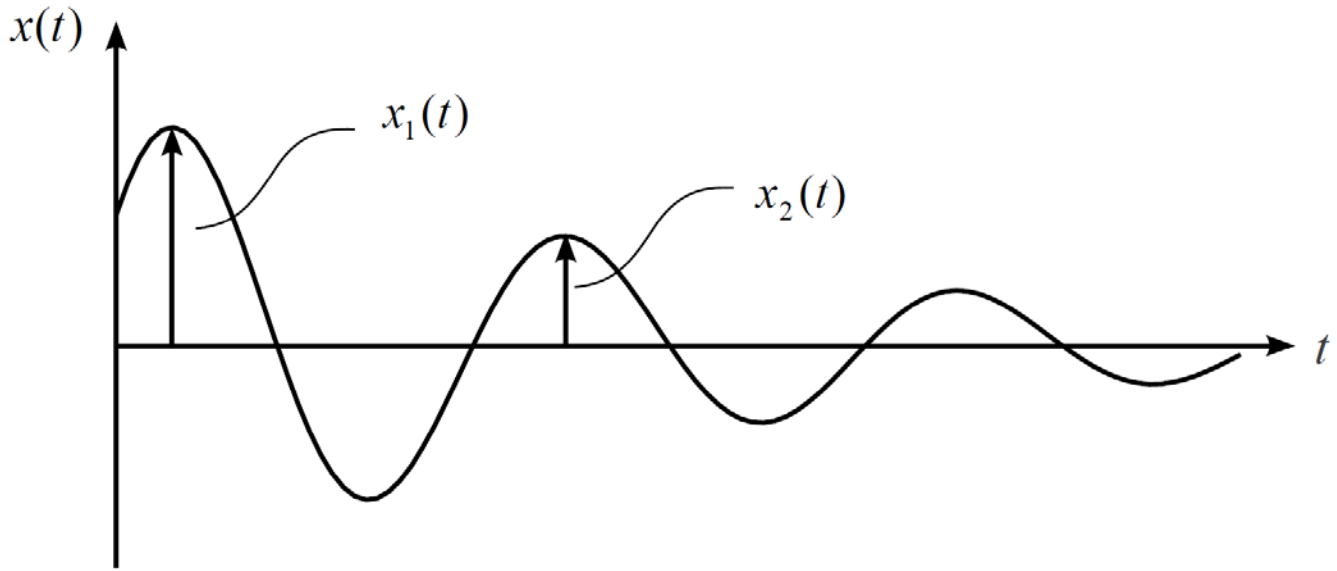
Aim

To investigate the dynamics of a lightly damped single DOF spring-mass-damper system under free and forced vibration



Procedure

- Use the oscilloscope to capture the free response of the vibrating beam
- From the time domain response, use the logarithmic decrement to determine the damping ratio
- Compare your results for 1 cycle and *N* cycles



Procedure

- Measure $\zeta = \frac{\delta}{\sqrt{4\pi^2 + \delta^2}}$ $T_d = \frac{2\pi}{\omega_d}$
- You can experimentally obtain ω_d using $\omega_d = \omega_n\sqrt{1-\zeta^2}$
- Analytically you can calculate ω_n using $\omega_n = \sqrt{\frac{k_{eq}}{m_{eq}}}$
- $k_{eq} = \frac{192EI}{L^3}$ is the equivalent stiffness
- $m_{eq} = M + \frac{13}{35}m_{beam}$ is the equivalent mass

Procedure

- Measure the amplitude of vibration for a number of frequencies above and below resonance
- Plot the amplitude for the different frequencies