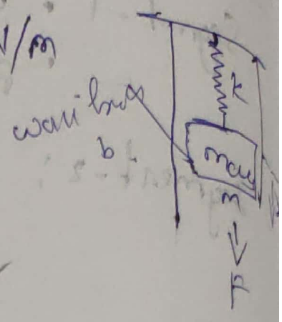
Assigment-1

equation ⟵ $M\frac{d^2x}{dt^2} + b\frac{dx}{dt} + kx = F$

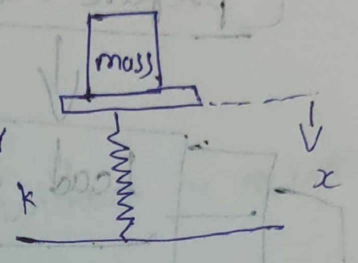
where

$m = 10$ kg, $b = 50$ N-s/m, $k = 100$ N/m



$$\boxed{m\frac{d^2x}{dt^2} = F - b\frac{dx}{dt} - kx}$$ eq

Assignment-2



initial condition

$x(0) = 1$

Equation $$\boxed{m\frac{d^2x}{dt^2} + kx = F \Rightarrow m\frac{d^2x}{dt} = F - kx}$$ eq

where

$m = 20$ kg, $k = 10$ N/m.

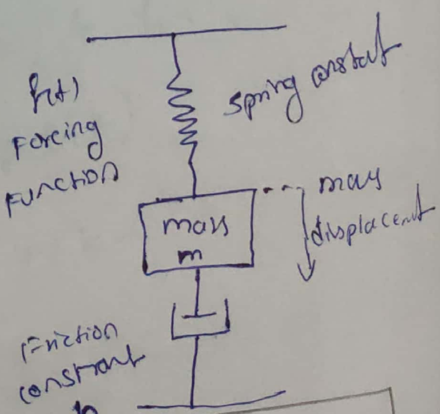
Assignment-3

$m = 10$ kg, $K = 1$ N/m $b = 0.5$ N-sec/m. output is about 1.8

initial condition $y(0) = 1.8$.

equations:-

$m\frac{d^2y(t)}{dt^2} + b\frac{dy(t)}{dt} + ky(t) = f(t)$



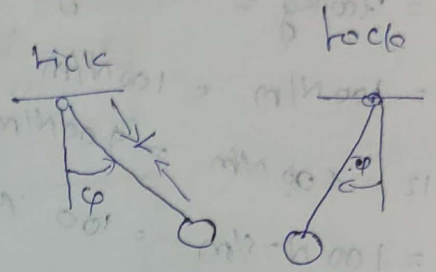
$m\frac{d^2y(t)}{dt^2} + b\frac{dy(t)}{dt} + ky(t) = f(t)$

eq $m\frac{d^2y(t)}{dt^2} = f(t) - b\frac{dy(t)}{dt} - ky(t)$

Assignment - 4 ; clock pendulum

$\frac{d\phi}{dt}$ is 2 seconds.

Assume small angles, ϕ, in the analysis so that $\sin\phi \approx \phi$ and $\cos\phi \approx 1$.



Equation

$$mL^2 \frac{d^2\phi}{dt^2} + mgL\phi = F$$

where

$m = 1\,kg$, $L = 0.9939\,m$, $g = 9.81\,m/s^2$

$$mL^2 \frac{d^2\phi}{dt^2} + mgL\phi = F$$

$$\boxed{mL^2 \frac{d^2\phi}{dt^2} = F - mgL\phi}$$

where

$m = 1\,kg$

$L = 0.9939\,m$

$g = 9.8\,m/s^2$

$L^2 = 0.9878$

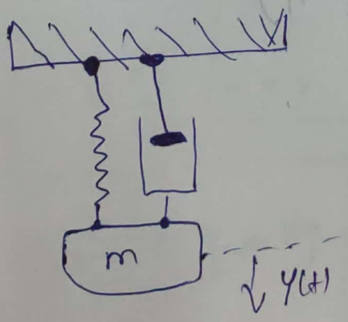
$mgL\phi$

Assignment - 5

Critically Damped system

mass $m = 80\,kg$ Spring constant $k = 1000\,N/m$.

damping coefficient is $c = 178.89\,N\text{-}s/m$ initial displacement 2 m.



$$m\frac{d^2y(t)}{dt^2} = 0 - y(t)K - c\frac{dy(t)}{dt}.$$

Equation -

$$m\frac{d^2y(t)}{dt^2} + c\frac{dy(t)}{dt} + ky(t) = 0.$$

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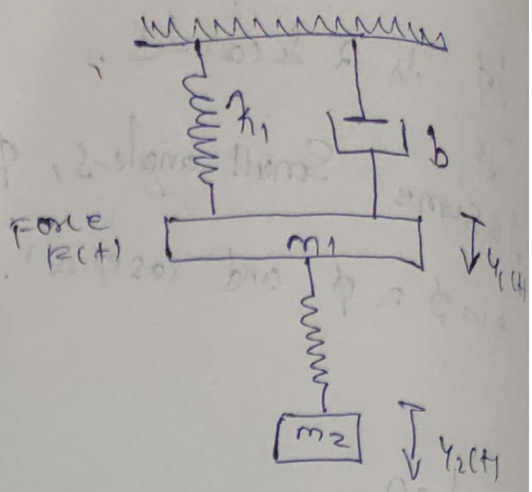
Vibration Absorber

August - 6



where

$m_1 = 20kg = 20000g$

$m_2 = 200kg = 200000g.$

$K_1 = 100 N/m = 100 N/m$

$k_{12} = 400 N/m = 400 N/m$

$b = 100 N\text{-}s/m = 100 N\text{-}s/m.$

equation :-

$\longrightarrow$ ① $m_1\frac{d^2y_1}{dt^2} + k_{12}(y_1-y_2) + b\frac{dy_1}{dt} + k_1 y_1 = F(t)$

$\longrightarrow$ ② $m_2\frac{d^2y_2}{dt^2} + k_{12}(y_2-y_1) = 0$

$\longrightarrow$ ①

$$\boxed{m_1\frac{d^2y_1}{dt^2} = F(t) - k_{12}(y_1-y_2) - b\frac{dy_1}{dt} - K_1 y_1}$$

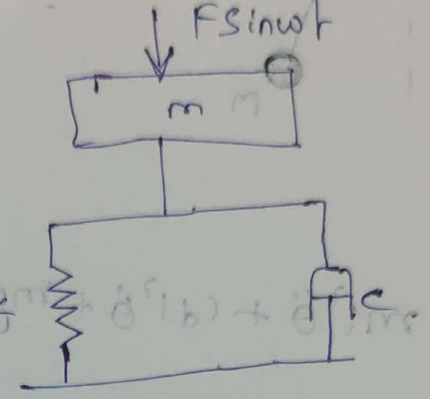
$\longrightarrow$ ②

$$\boxed{m_2\frac{d^2y_2}{dt^2} = -k_{12}(y_2-y_1)}$$

Assignment-7 Forced SMD System

$m = 1\,kg$; $K = 100\,N/m$; $C = 2\,N\text{-}s/m$; $x(0) = 2\,cm$;

$F\sin\omega t = 100\sin(20t)$



equation:-

$$m\frac{d^2x(t)}{dt^2} + c\frac{dx(t)}{dt} + kx(t) = F\sin\omega t$$

$$m\frac{d^2x(t)}{dt^2} + c\frac{dx(t)}{dt} = F\sin\omega t - kx(t)$$

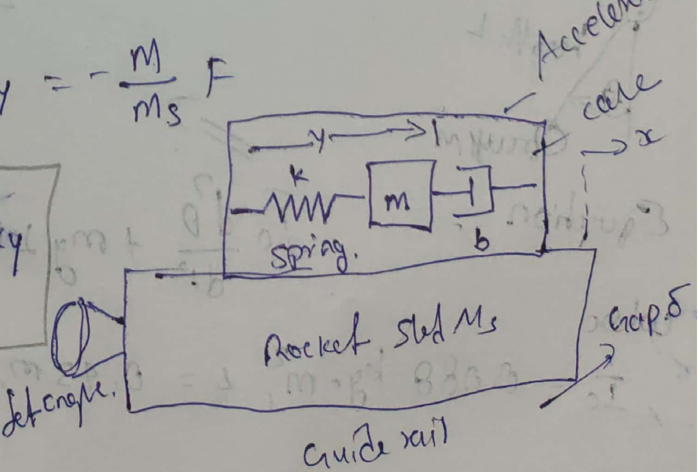
$$\boxed{m\frac{d^2x(t)}{dt^2} = F\sin\omega t - kx(t) - c\frac{dx(t)}{dt}}$$

Assignment-8 Mechanical Accelerometer.

$m = 10\,kg$, $k = 32\,N/m$, $b = 12\,N$. $m_s = 100\,kg$.

$$m\frac{d^2y}{dt^2} + b\frac{dy}{dt} + ky = -\frac{M}{M_s}F$$

$$\boxed{m\frac{d^2y}{dt^2} = -\frac{M}{M_s}F - b\frac{dy}{dt} - ky}$$



Assignment-9

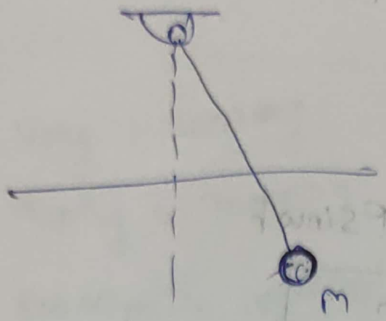
pendulum Viscous Damping where

$m = 10g$

$l = 5cm$

$c_d = 14 \, N \frac{sec}{cm}$

$g = 981 \, cm/sec^2$



$\theta(0) = 1.57, \; \dot{\theta}(0) = 0$

equation –

$$ml^2\ddot{\theta} + c_d l^2 \dot{\theta} + mgl\theta = 0$$

$\frac{3}{4}$

$$\boxed{ml^2\ddot{\theta} = -c_d l^2\dot{\theta} - mgl\theta}$$

Assignment-10

pendulum oscillator

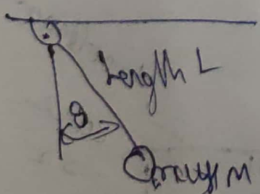
torque on the mass is $T = mgL\sin\theta$

where g is the gravitational constant. $\theta_0 = 0°$

~~mgLsinθ~~

~~sinθ*L*g~~

$-pi/4 < \theta < pi/4$.



$$I_0 \frac{d^2\theta}{dt^2} = -mgL\theta + T_{in}$$

$\Longrightarrow$

Equation –

$$I_0 \frac{d^2\theta}{dt^2} + mgL\theta = T_{in}$$

where

$I_0 = 0.088 \, kg\text{-}m^2, \; L = 0.43m, \; g = 9.81 \, m/s^2$