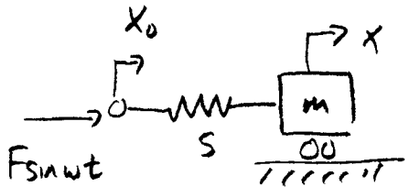
HW #2 Solutions - Handwritten Part

1.12.1



Let $F\cdot\cos\omega t = F(t)$

↑ without loss in generality, change $\sin\omega t \to \cos\omega t$

EOM's are $F(t) - s(x_0 - x) = 0$

$$-s(x - x_0) = m\ddot{x}$$

EOM for driven end is (eliminate x)

$$F(t) - sx_0 = -sx \qquad x = -\frac{1}{s}F(t) + x_0$$

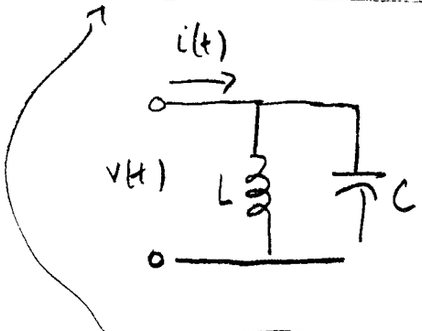
$$\ddot{x} = -\frac{1}{s}\ddot{F}(t) + \ddot{x}_0$$

So

$$-s\left(-\frac{1}{s}F(t) + x_0 - x_0\right) = -\frac{m}{s}\ddot{F}(t) + m\ddot{x}_0$$

$$\boxed{F(t) + \frac{m}{s}\ddot{F}(t) = m\ddot{x}_0 = m\dot{v}_0}$$

$v_0 = \dot{x}$ = speed of driven end



$$i(t) = \frac{1}{L}\int v\,dt + C\frac{dv}{dt}$$

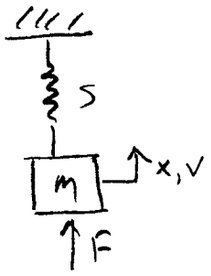
$$\frac{di}{dt} = \frac{1}{L}v + C\frac{d^2v}{dt^2}$$

$$\boxed{L\frac{di}{dt} = v + LC\frac{d^2v}{dt^2}}$$

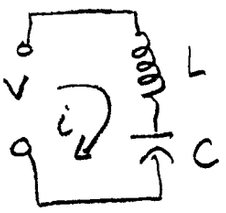
Those two are identical

1.12.2 HW #2 Solutions

a

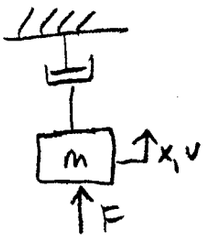


$$F = m\ddot{x} + sx = m\dot{v} + s\int v\,dt$$

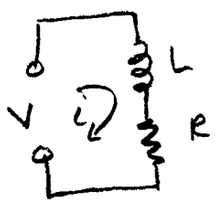


$$V = L\frac{di}{dt} + \frac{1}{C}\int i\,dt$$

b.

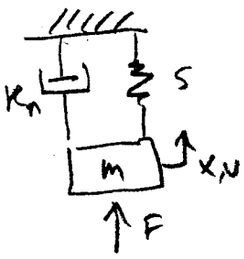


$$F = m\ddot{x} + R_m\dot{x} = m\dot{v} + R_m v$$

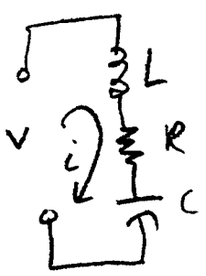


$$V = L\frac{di}{dt} + Ri$$

c.



$$F = m\ddot{x} + R_m\dot{x} + sx = m\dot{v} + R_m v + s\int v\,dt$$



$$V = L\frac{di}{dt} + Ri + \frac{1}{C}\int i\,dt$$