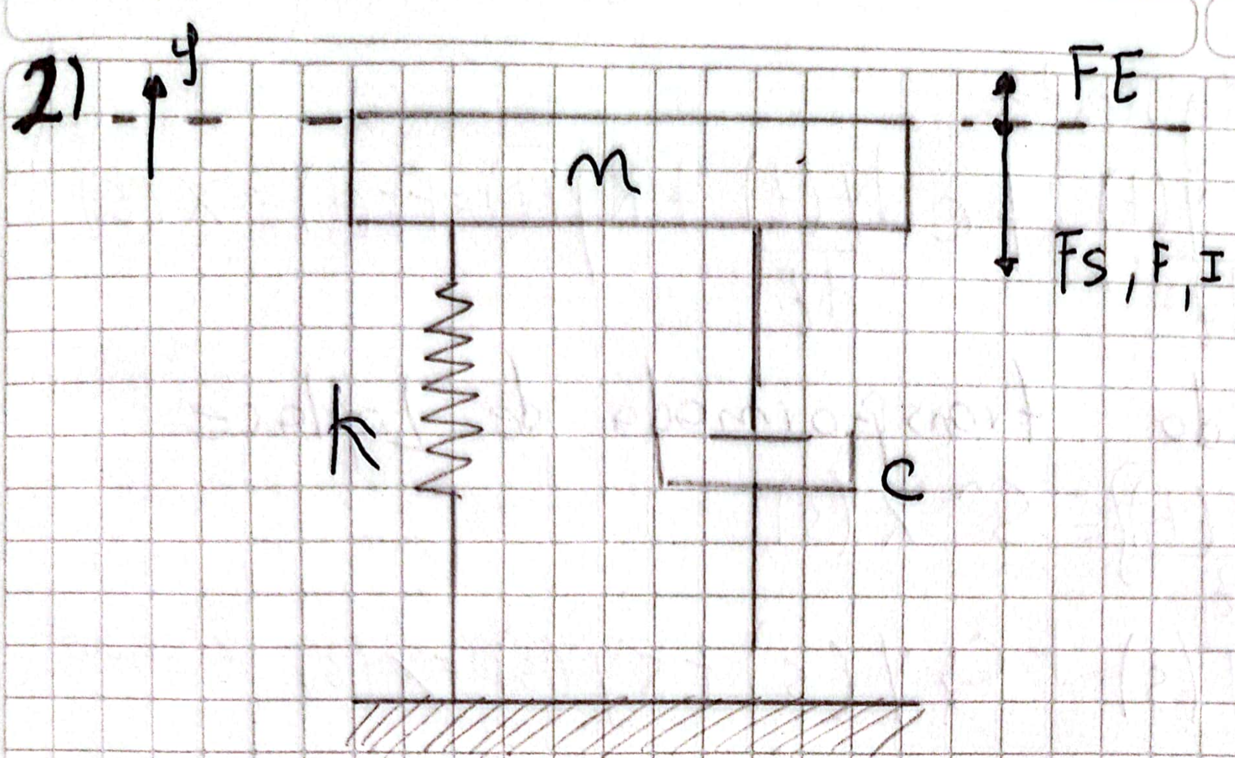
2)




• El sistema masa-resorte y amartiguador se puede modelar apartir de la conservación de fuerzas:

$$F_S(t) + F_F(t) + F_I(t) = F_E(t)$$

Donde:

• $F_S(t)$ (Fuerza del resorte)

$$F_S(t) = K y(t)$$

$K$ = Constante del resorte

$y(t)$ = desplazamiento de la masa

• $F_F(t)$ (Fuerza del amartiguador)

$$F_F(t) = c\ dy(t)/dt$$

• Fuerza incereial (masa)

$$F_I(t) = m \frac{d^2 y(t)}{dt^2}$$

Por consiguiente

$$m\frac{d^2 y(t)}{dt^2} + c\frac{dy(t)}{dt} + Ky(t) = F_E(t) = x(t)$$

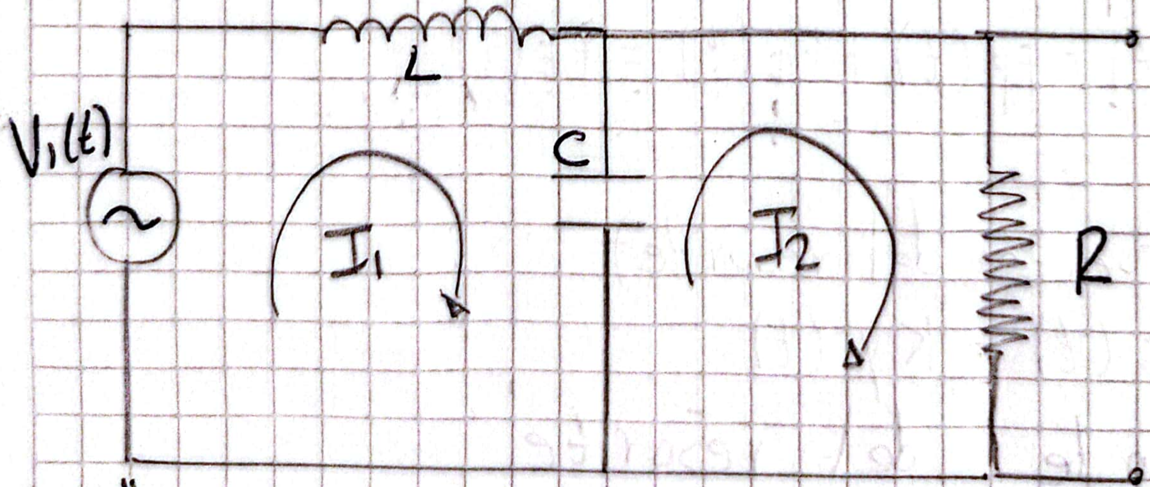
Aplicando transformada de Laplace

$$\mathcal{L}\left\{\frac{d^n x(t)}{dt}\right\} = S^n X(s)$$

$$m\,s^2 Y(s) + cs\,Y(s) + K\,Y(s) = X(s)$$

$$H(s) = \frac{Y(s)}{X(s)} = \frac{1}{ms^2 + cs + K}$$

Para el circuito




Malla 1

$$V_1(t) = L\frac{di_1(t)}{dt} + \frac{1}{C}\int i_1(t) - i(t)\,dt$$

Pasando a Laplace

$$Vi(s) = L\,s\,\bar{I}_1(s) + \frac{1}{Cs}\left(\bar{I}_1(s) - I_2(s)\right)$$

Malla 2

$$\phi = \frac{1}{C}\int\left(\bar{I}_2(t) - \bar{I}_1(t)\right)dt + R \cdot I_2(t)$$

Pasando a Laplace

$$V\bar{I}_2(t) = \frac{1}{Cs}\left(I_2(s) - \bar{I}_1(s)\right) + R \cdot I(s)$$

Despejando $I_1(t)$

$$I_1(s) = I_2(s)(1 + CRs)$$

Se reemplaza en la entrada:

$$V_1(t) = Ls\,I_2(s)(1 + CRs) + \left(I_2(s)(1 + CRs) - I(s)\right)\frac{1}{Cs}$$

$$Vi(t) = Ls\,I_2(s) + CRs^2\,I_2(s) + I_2(s)\frac{1}{Cs} + I_2(s)R - I_2(s)\frac{1}{Cs}$$

$$Vi(s) = I_2(s)(CRLs^2 + Ls + R)$$

$$\frac{I_2(s)}{Vi(s)} = \frac{1}{CRLs^2 + Ls + R}$$

$$R\,I_2(s) = Vo(s) = \frac{R}{CRLs^2 + Ls + R}$$

$$= H(s) = \frac{Vo(s)}{Vi(s)} = \frac{1}{CLs^2 + \frac{L}{R}s + 1}$$