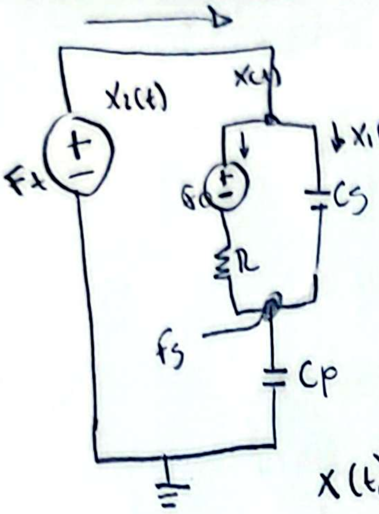
Circuito eléctrico

Modelado



mallas:

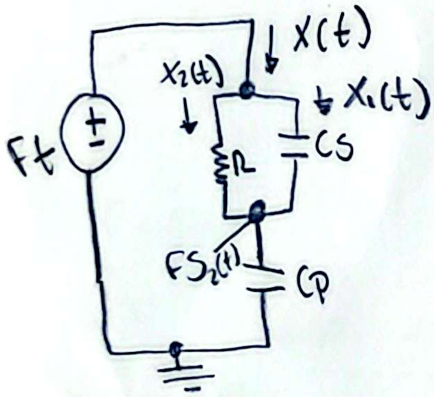
C → Integral

Nodos:

C → derivada

$$x(t) = x_1(t) + x_2(t)$$

Analisis apagado F_o (Por nodos)



$$x(t) = x_1(t) + x_2(t)$$

$$x(t) = C_p \frac{d[f_s(t)]}{dt}$$

$$x_1(t) = C_s \frac{d[f(t) - f_s(t)]}{dt}$$

$$x_2(t) = \frac{f(t) - f_s(t)}{R}$$

$$C_p \frac{d f_s(t)}{dt} = C_s \frac{d[f(t) - f_s(t)]}{dt} + \frac{f(t) - f_s(t)}{R}$$

Transformada de laplace:

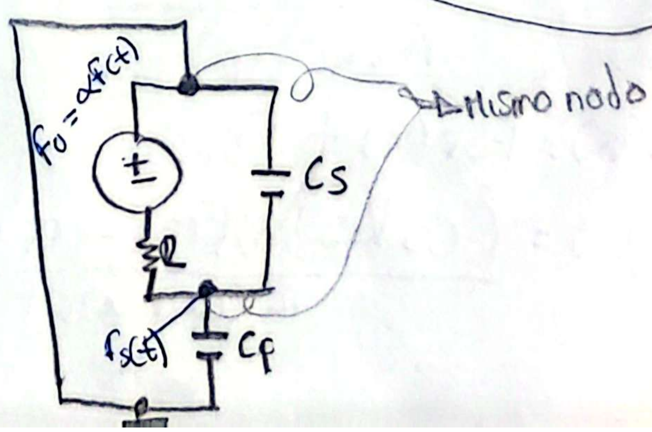
$$C_p S F_s(S) = C_s S[F(S) - F_s(S)] + \frac{F(S) - F_s(S)}{R}$$

Agrupar:

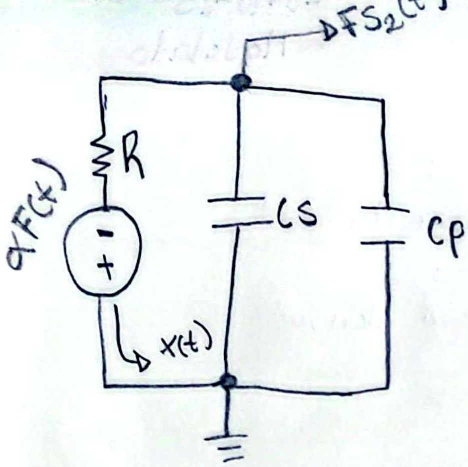
$$\left(C_p s + C_s s + \frac{1}{R}\right) F_s(S) = \left(C_s s + \frac{1}{R}\right) F(s)$$

$$\frac{F_s(s)}{F(s)} = \frac{C_s s + \frac{1}{R}}{C_p s + C_s s + \frac{1}{R}} = \longrightarrow \frac{F_s(s)}{F(s)} = \frac{C_s s R + 1}{C_p R s + C_s s R + 1}$$

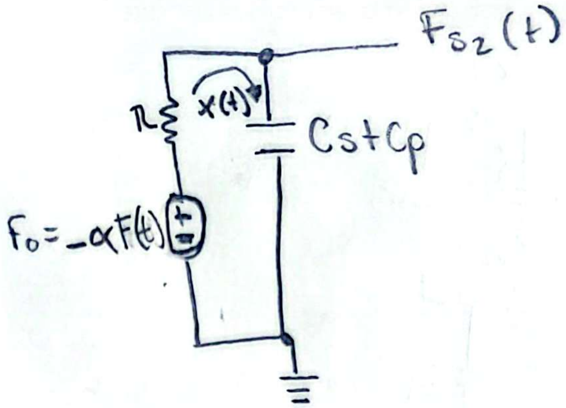
$$F_{s1}(s) = \frac{(C_s R + 1)\, F(s)}{R(C_s + C_p)s + 1}$$



Fuente alrevés:



Dar la vuelta a la fuente:



Ec. Principales:

$$-\alpha F(t) = R\,x(t) + \frac{1}{C_s+C_p}\int x(t)\,dt$$

$$F_s(t) = \frac{1}{C_s+C_p}\int x(t)\,dt$$

Transfomada de Laplace:

$$-\alpha F(s) = R\,X(s) + \frac{X(s)}{(C_s+C_p)s}$$

$$F_0(s) = \frac{X(s)}{(C_s+C_p)s}$$

$$F(s) = -\frac{R(C_s+C_p)s+1}{\alpha(C_s+C_p)s}X(s)$$

$$\frac{F_s(s)}{F(s)} = \frac{\dfrac{\cancel{X(s)}}{\cancel{(C_s+C_p)s}}}{\dfrac{R(C_s+C_p)s+1}{\alpha\cancel{(C_s+C_p)s}}\cancel{X(s)}}$$

$$= -\frac{\alpha}{R(C_s+C_p)s+1}$$

$$F_{S_2}(s) = -\frac{\alpha\, F(s)}{R(C_s+C_p)s+1}$$

$$F_s(s) = F_{S_1}(s) + F_{S_2}(s)$$

$$F_s(s) = \frac{(C_sRs+1)F(s) - \alpha F(s)}{R(C_p+C_s)s+1}$$

$$\frac{F_s(s)}{F(s)} = \frac{C_sRs+1-\alpha}{R(C_p+C_s)s+1}$$

- Estabilidad del sistema en lazo abierto:

Parametro	Control	Caso
F(t)	1v	1v
α	0.25	0.25
C_s	10 μF	10 μF
C_p	100 μF	100 μF
R	100 Ω	10 KΩ

$$\frac{F_s(s)}{F(s)} = \frac{RC_sS+1-\alpha}{[RC_p + RC_s]s+1}$$

$$[RC_p + RC_s]s + 1 = 0$$

▲ como es de 1er orden solo despejo "s":

$$S = -\frac{1}{RC_p + RC_s}$$

▷ Calculo de los polos:

A) control

$$S = -\frac{1}{(100)(100\times10^{-6}) + (100)(10\times10^{-6})}$$

$$\lambda_1 = -90.909$$

B) Caso

$$S = -\frac{1}{(10000)(100\times10^{-6}) + (10000)(10\times10^{-6})}$$

$$\lambda_2 = -0.909$$

El sistema tendra una respuesta estable.

- Error en estado estacionario

$$e(t) = \lim_{s\to 0} s\, R(s)\left[1 - \frac{F_s(s)}{F(s)}\right]$$

$$e(t) = \lim_{s\to 0} \cancel{s}\,\frac{1}{\cancel{s}}\left[1 - \frac{RC_sS+1-\alpha}{R[C_p + C_s]s+1}\right]$$

$$e(t) = \lim_{s\to 0} 1\left[1 - \frac{1-0.25}{1}\right]$$

$$e(t) = \lim_{s\to 0} 1\left[1 - 0.75\right] = \underbrace{0.25\,v}_{\alpha_{Error}} = \alpha$$