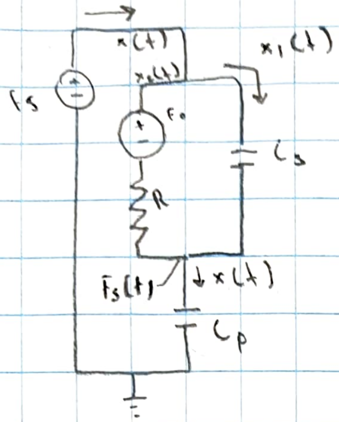
23-10-2025

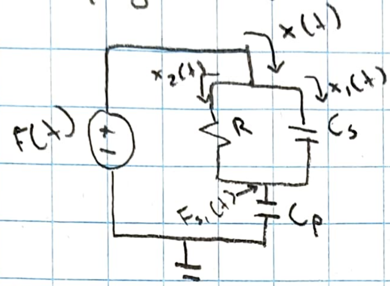
Circuito eléctrico

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



Función de transferencia

Apagando F_0



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

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

$$x_2 = \frac{F(t) - F_s(t)}{R}$$

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

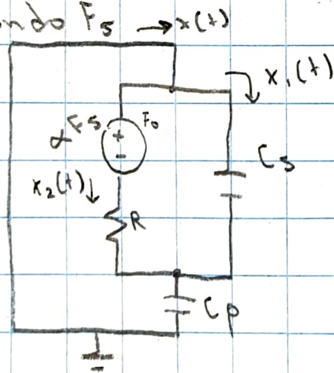
$$\frac{C_p\, dF_s(t)}{dt} = \frac{C_s\, d[F(t) - F_s(t)]}{dt} + \frac{F(t) - F_s(t)}{R}$$

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

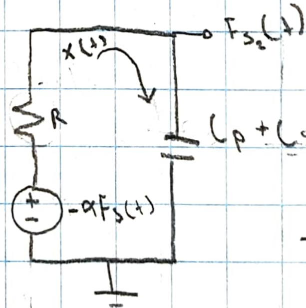
$$\left[C_p s + C_s s + \frac{1}{R}\right] F_s(s) = \left[C_s s + \frac{1}{R}\right] F(s)$$

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

Apagando F_s



$\Rightarrow$



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

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

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

$$F_s(s) = \frac{x(s)}{(C_s + C_p)s}$$

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

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

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

Función de transferencia

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

Error en estado estacionario

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

$$e(s) = \lim_{s \to 0} \cancel{s} \frac{1}{\cancel{s}} \left[1 - \frac{C_s R s + 1 - \alpha}{R(C_p + C_s)s + 1} \right] = 1 - \frac{1 - \alpha}{1} = \alpha = 0.25V$$

Estabilidad en lazo abierto

$$R(C_p + C_s)s + 1 = 0$$

$$\lambda = -\frac{1}{R(C_p + C_s)}$$ *La respuesta es estable

	control	caso
α	0.25	0.25
C_s	10 μ	10 μ
C_p	100 μ	100 μ
R	100 Ω	10 k