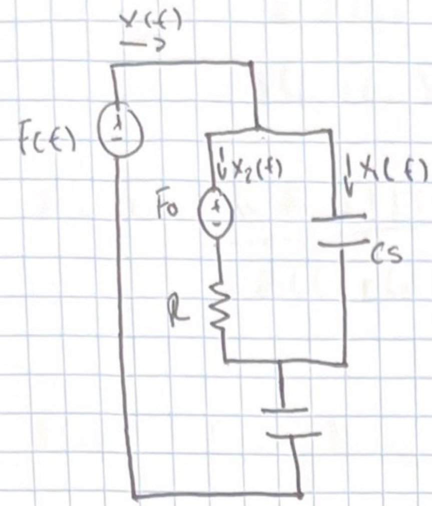
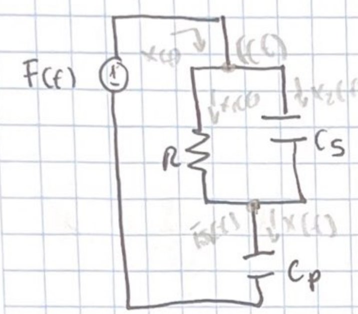


Superposición



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

$$x_1(t) = \frac{F(t) - F_{s1}(t)}{R} \qquad x_2(t) = C_s \frac{d[F(t) - F_{s1}(t)]}{dt}$$

$$x(t) = C_p \frac{d[F_{s1}(t)]}{dt}$$

$$C_p \frac{d[F_{s1}(t)]}{dt} = \frac{F(t) - F_{s1}(t)}{R} + C_s \frac{d[F(t) - F_{s1}(t)]}{dt}$$

Laplace

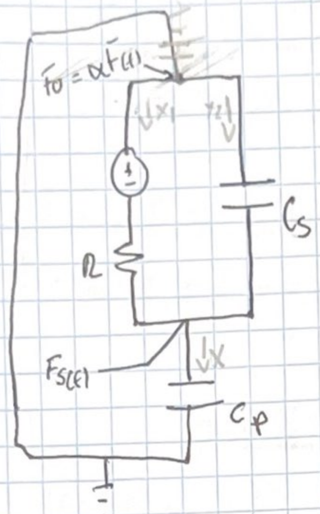
$$S C_p F_s(s) = \frac{F(s) - F_s(s)}{R} + S C_s [F(s) - F_{s1}(s)]$$

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

$$\frac{F_{s1}(s)}{F(s)} = \frac{\frac{RSC_s + 1}{R}}{\frac{RC_pS - RC_sS + 1}{R}} = \frac{RSC_s + 1}{R} \cdot \frac{R}{RC_pS - RC_sS + 1} = \frac{RSC_s + 1}{RC_pS - RC_sS + 1}$$

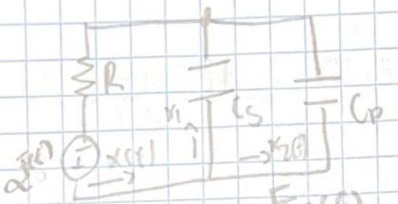
$$= \frac{(RC_s)S + 1}{R(C_p - C_s)S + 1}$$

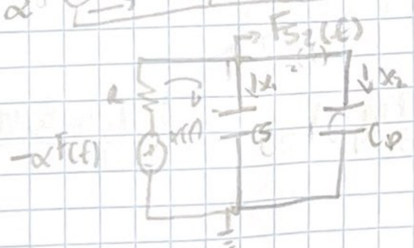
$F_0 = \alpha F(t)$



$X = X_1 + X_2$

F_0





$x(t) = \dfrac{-\alpha F(t) - F_{s2}(t)}{R}$

$x_1(t) = \dfrac{C_s\, d[F_{s2}(t)]}{dt}$

$x_2(t) = \dfrac{C_p\, d[F_{s2}(t)]}{dt}$

$$\frac{-\alpha F(t) - F_{s2}(t)}{R} = \frac{(C_s + C_p)\,(d[F_{s2}(t)])}{dt}$$

Laplace

$$\frac{-\alpha F(s) - F_{s2}(s)}{R} = (C_s + C_p)\, S F_{s2}(t)$$

$$\frac{-\alpha}{R} F(s) = \left((S(C_s + C_p)) + \frac{1}{R}\right) F_{s2}(s)$$

$$\frac{F_{s2}(s)}{F(s)} = \frac{\frac{-\alpha}{R}}{\frac{RSC_s + RSC_p + R}{R}} = \frac{-\alpha R}{R(SC_s + RC_p + 1)} = \frac{-\alpha}{RS(C_s + C_p) + 1}$$

$$F_{s_2}(s) = \frac{-\alpha F(s)}{RS(C_s + C_p) + 1}$$

Error es estado estacionario
Estabilidad en lazo abierto

$$F_{s_1}(s) = \frac{(C_s R S + 1) F_{(s)}}{R((C_s + C_p)S + 1}$$

$$Fs(s) = F_{s_1(s)} + F_{s_2(s)}$$

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

Funcion de trans Ferencia

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

Error en estado estacionario

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

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

$$e(s) = \frac{1 - +1 - \alpha}{1} = \alpha$$

$$e(t) = \alpha V$$

Estabilidad en lazo abierto

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

$$\lambda = \frac{1}{R(C_p + C_s)}$$

$$R < \lambda < 0$$