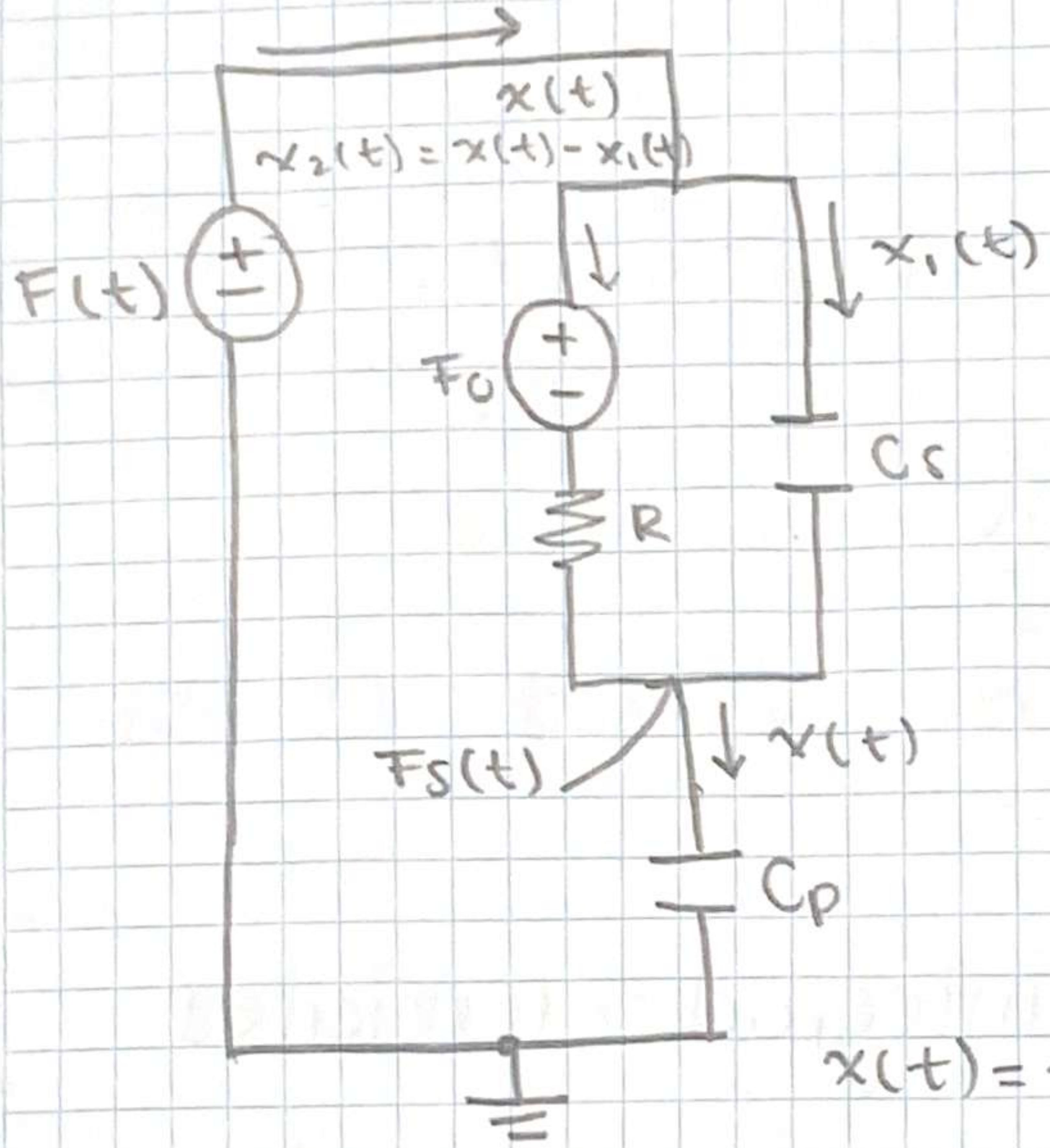
Circuito eléctrico

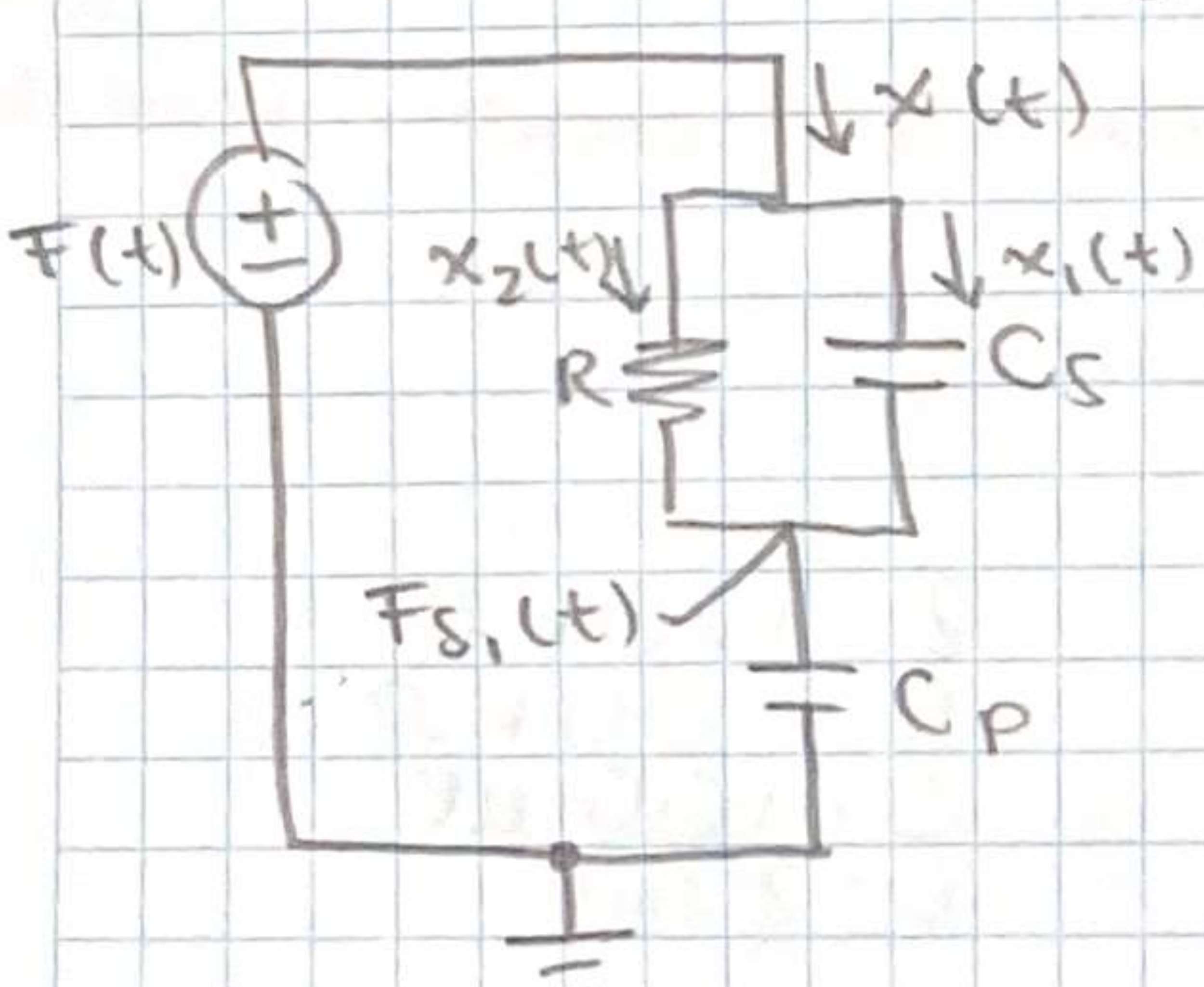
23-oct 25



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

Función de transferencia

→ Análisis apagando F_0



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

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

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

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

$$C_p \frac{dF_S(t)}{dt} = C_S \frac{d[F(t) - F_S(t)]}{dt} + \frac{F(t) - F_S(t)}{R}$$

$$C_p S F_S(s) = C_S S [F(s) - F_S(s)] + \frac{F(s) - F_S(s)}{R}$$

$$\frac{RCsS+1}{\frac{R}{R(Cp+Cs)S+1}} = \frac{R^2CsS+R}{R^2(Cp+Cs)S+R}$$

$$\left(C_pS+C_sS+\frac{1}{R}\right)F_s(S)=\left(C_sS+\frac{1}{R}\right)F(S)$$

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

$$\frac{F_s(S)}{F(S)}=\frac{C_sRS+1}{C_pRS+C_sRS+1}=\boxed{\frac{C_sRS+1}{(C_pR+C_sR)S+1}}$$

$$\boxed{F_{s1}(S)=\frac{(C_sRS+1)F(S)}{R(C_s+C_p)S+1}}$$

$F(t)=1V - 7V$

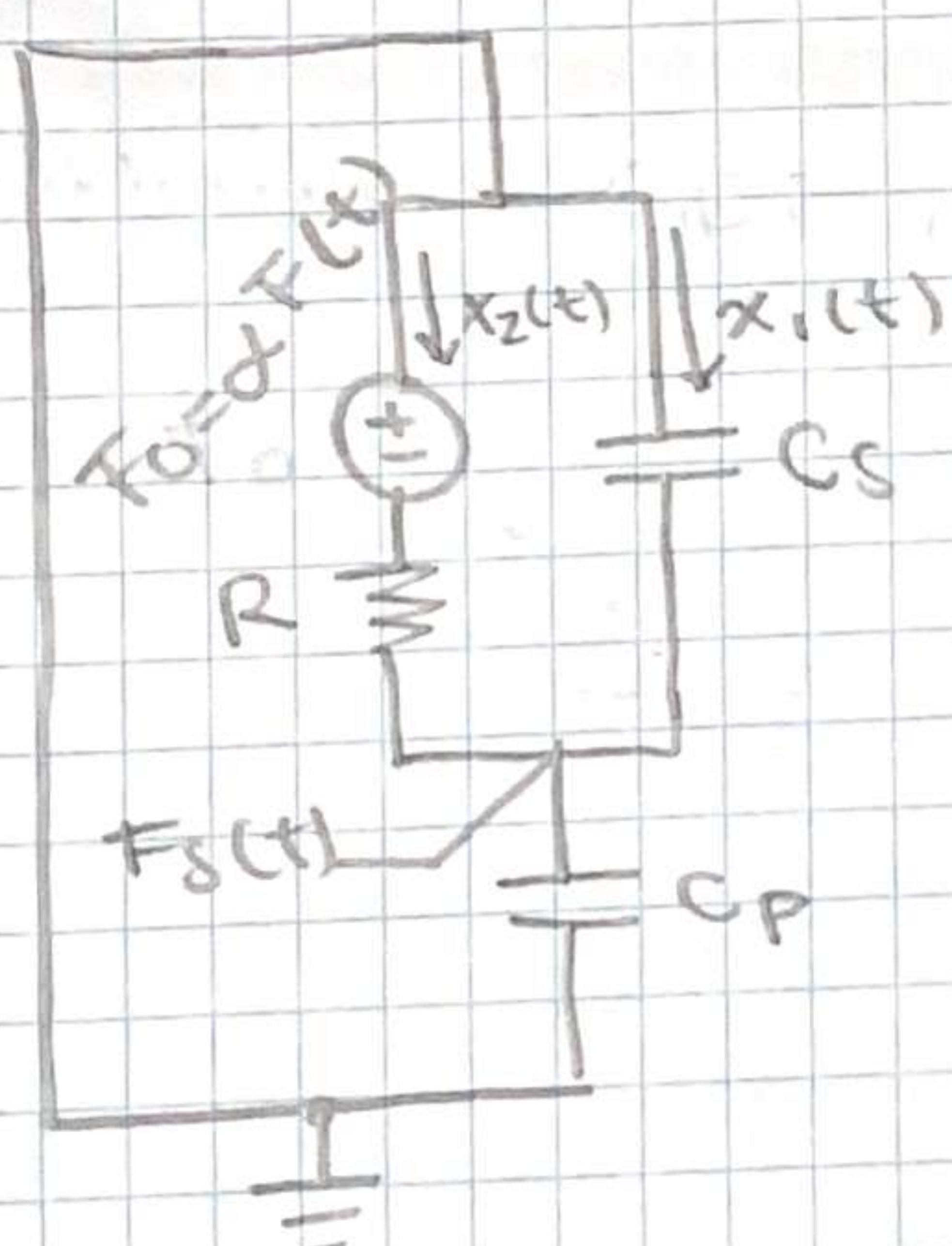
$\alpha=0.25-0.25$

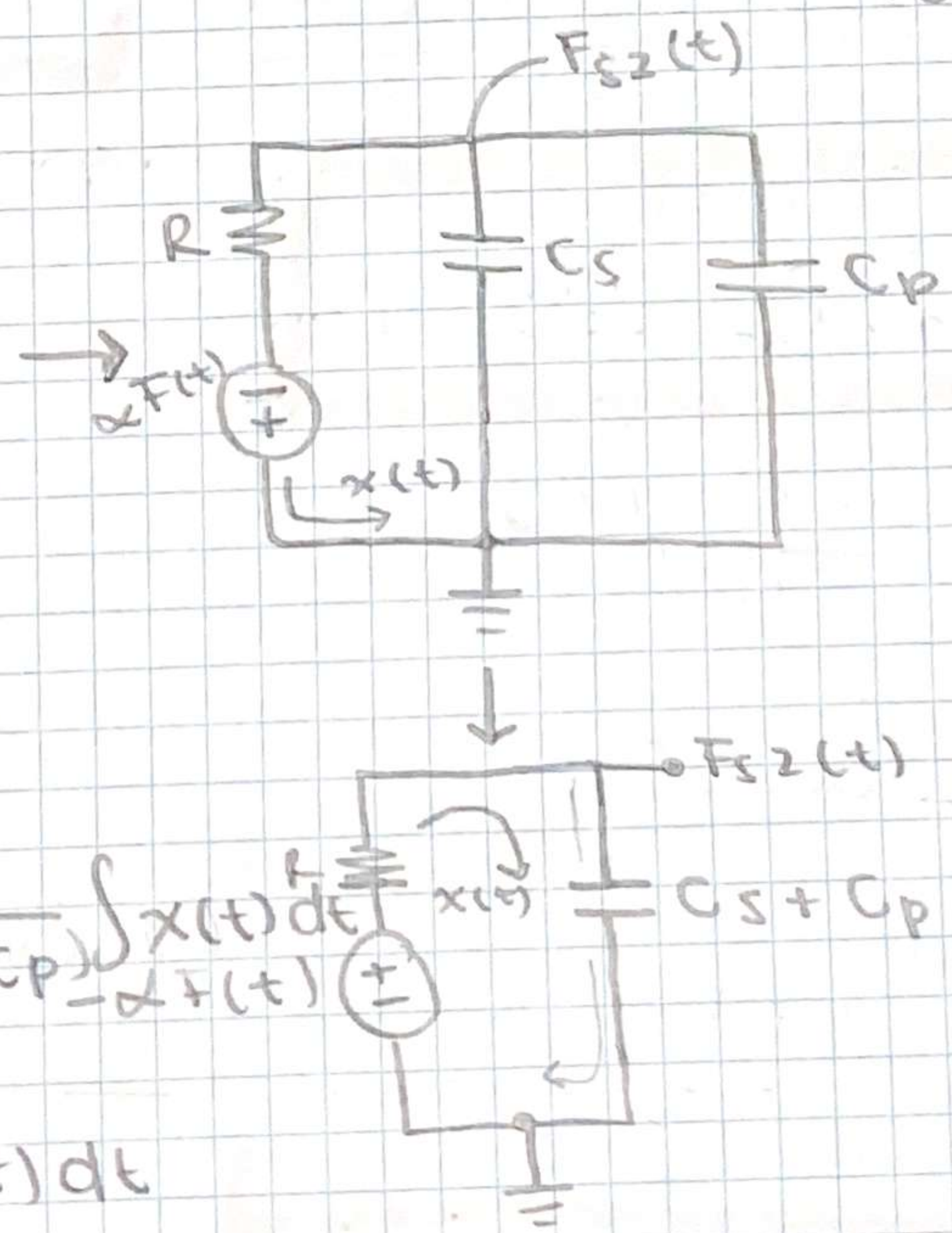
$C_s=10\mu F$

$C_p=100\mu F$

$R=100-10K$

→ Análisis apagando $F(t)$





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

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

Error de estado estacionario y lazo abierto

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

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

$$F_s = \frac{Rx(s)(\cancel{\alpha}((C_s+C_p)s) + \cancel{\alpha}x(s))}{-\alpha^{\cancel{2}}((C_s+C_p)s}$$

$$= \frac{x(s)\left[R((C_s+C_p)s+1\right]}{-\alpha((C_s+C_p)s}$$

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

$$\boxed{F_{s2}(s) = \frac{-\alpha F_s}{R((C_s+C_p)s+1}}$$

$$F_s(s) = F_{s1}(s) + F_{s2}(s)$$

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

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

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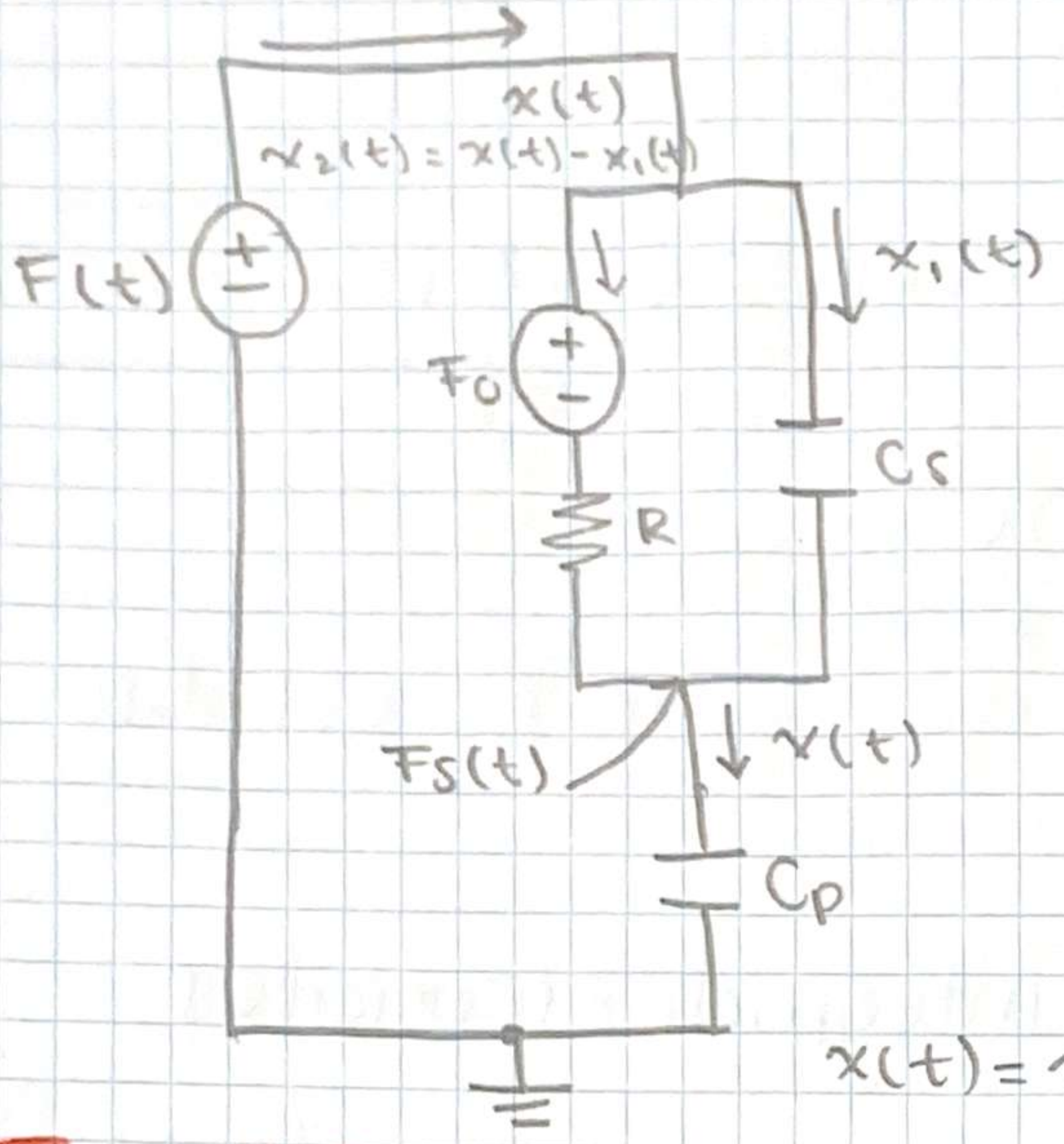
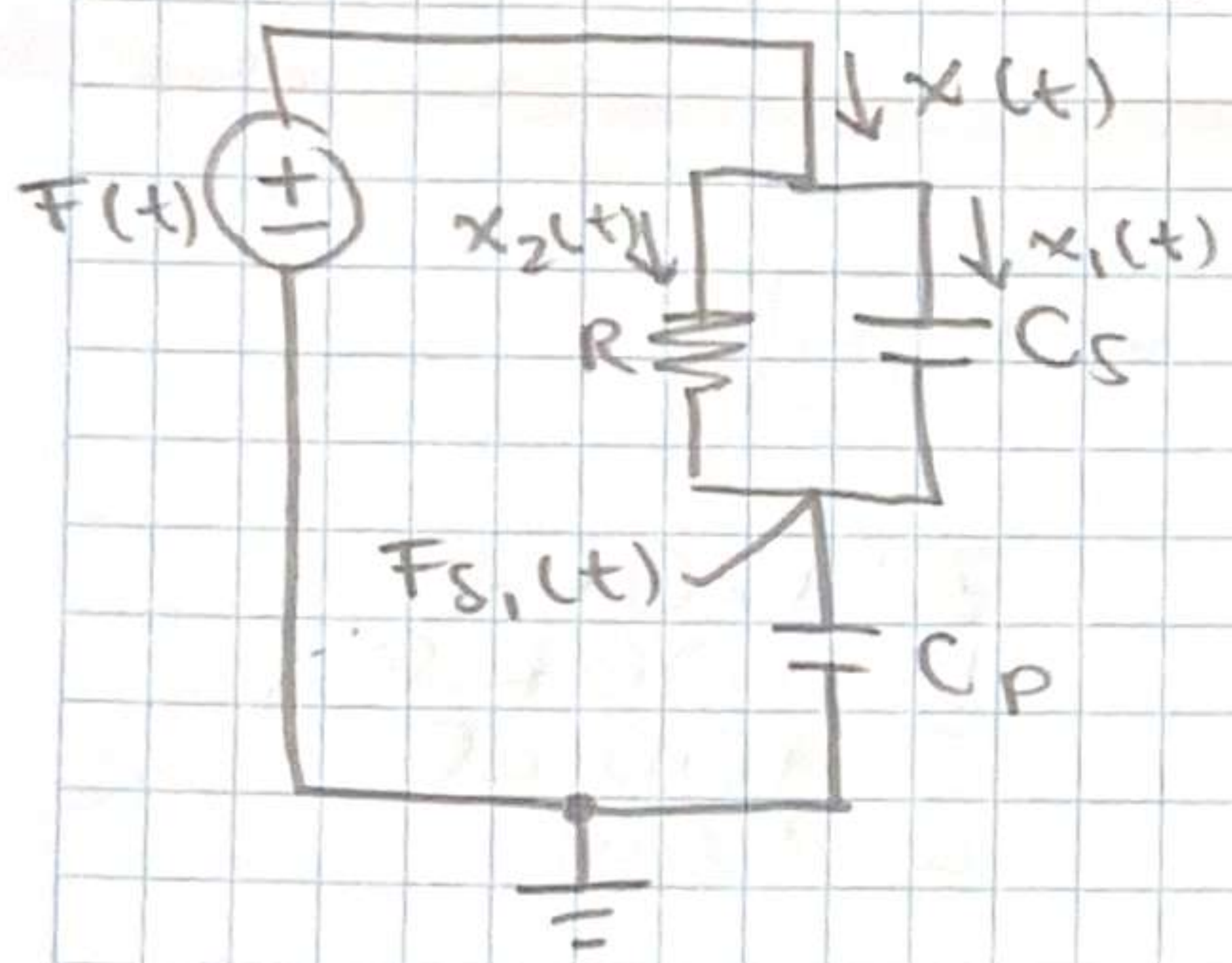


$$x(t) = x_1(t) + x_2(t)$$

Función de transferencia

→ Análisis apagando F_0



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

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

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

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

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

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

$$\frac{\dfrac{RC_sS+1}{R}}{\dfrac{R}{R((C_p+C_s)S+1}} = \frac{R^2C_sS+R}{R^2((C_p+C_s)S+R}$$

$$\left(C_pS+{}^{R}C_sS+\frac{1}{R}\right)F_s(S)=\left(C_sS+\frac{1}{R}\right)F(S)$$

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

$$\frac{F_s(S)}{F(S)}=\frac{C_sRS+1}{C_pRS+C_sRS+1}=\frac{C_sRS+1}{(C_pR+C_sR)S+1}$$

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

$F(t)=1V - 7V$

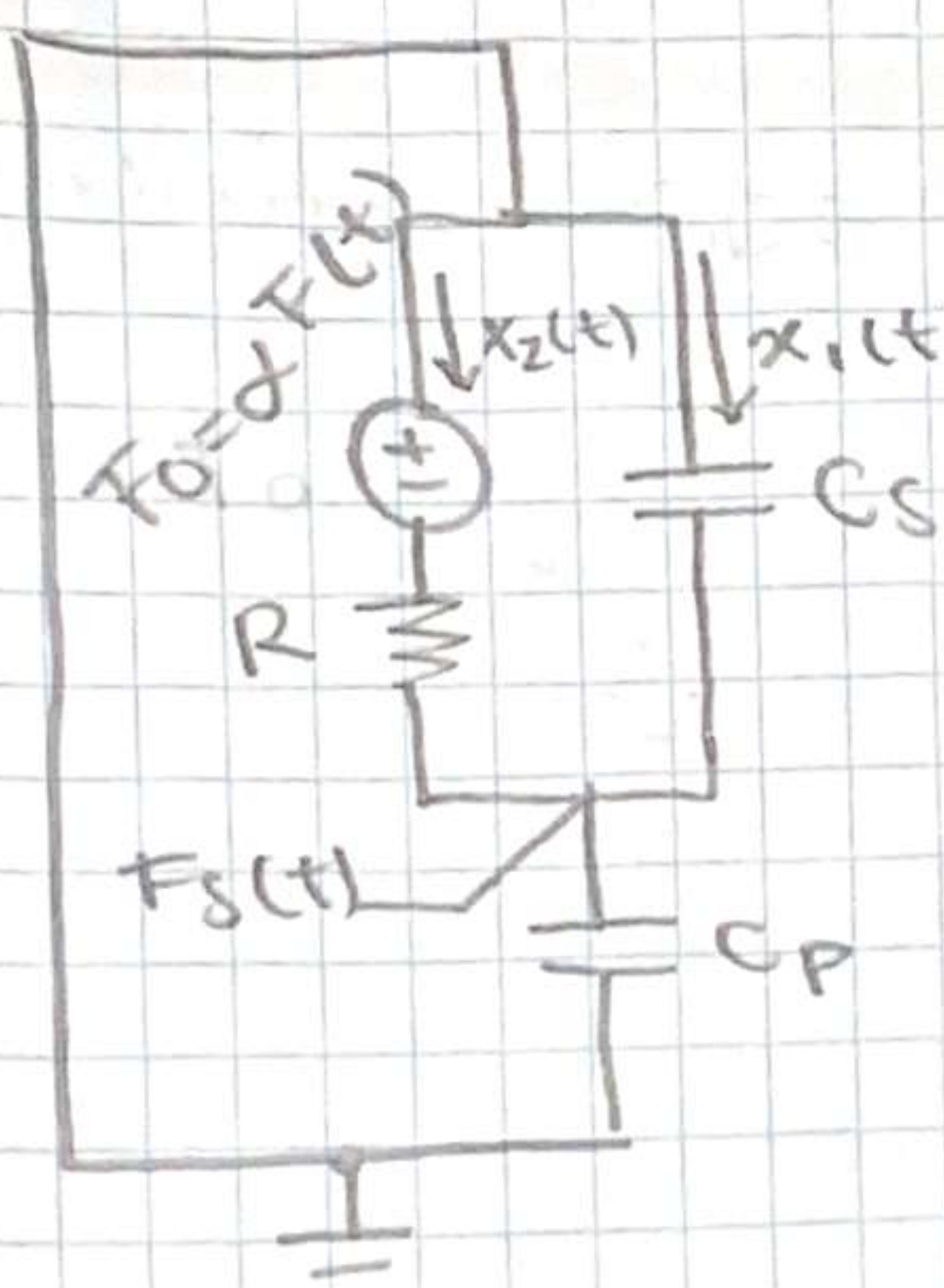
$\alpha=0.25-0.25$

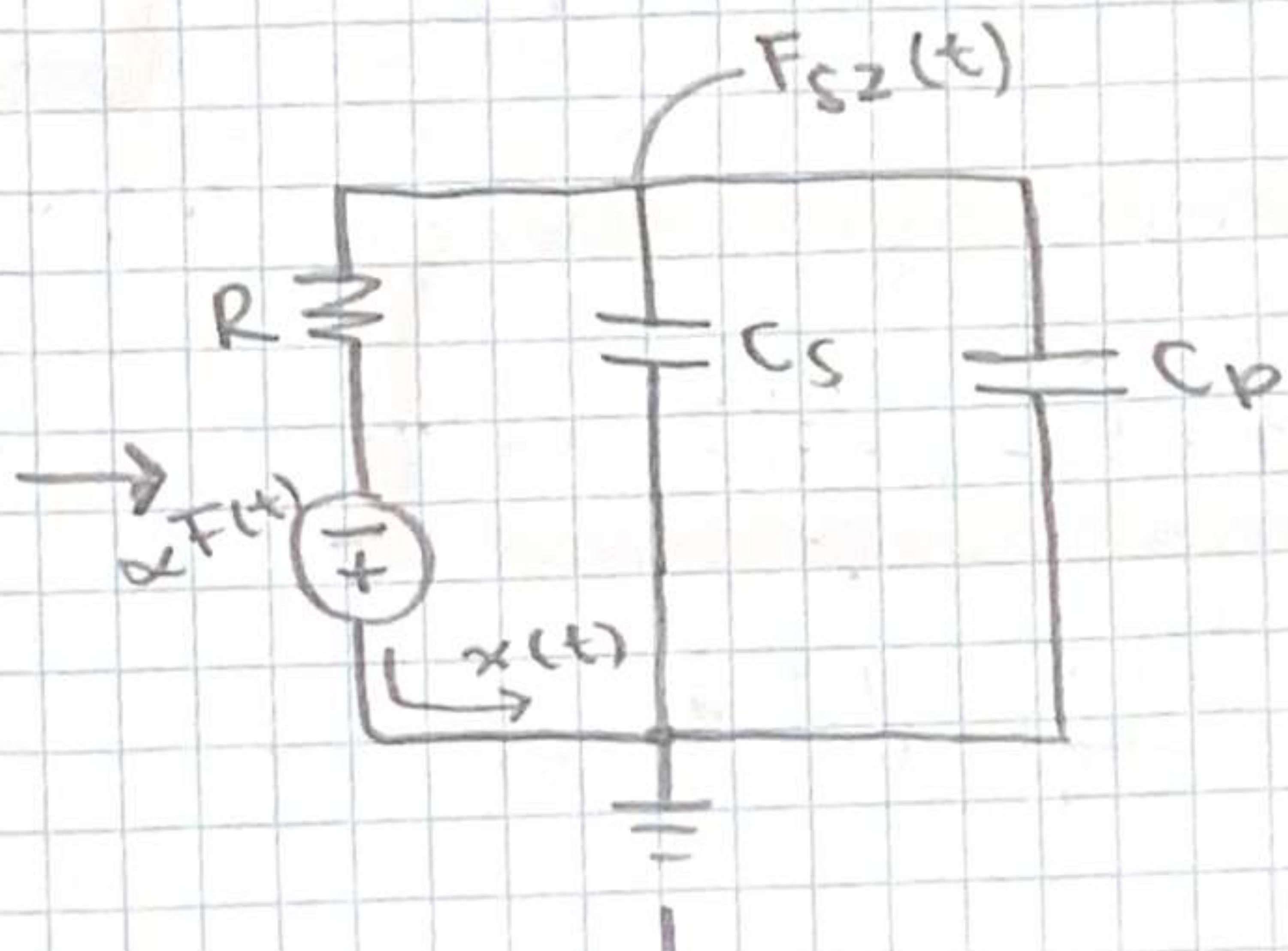
$C_s=10\,\mu F$

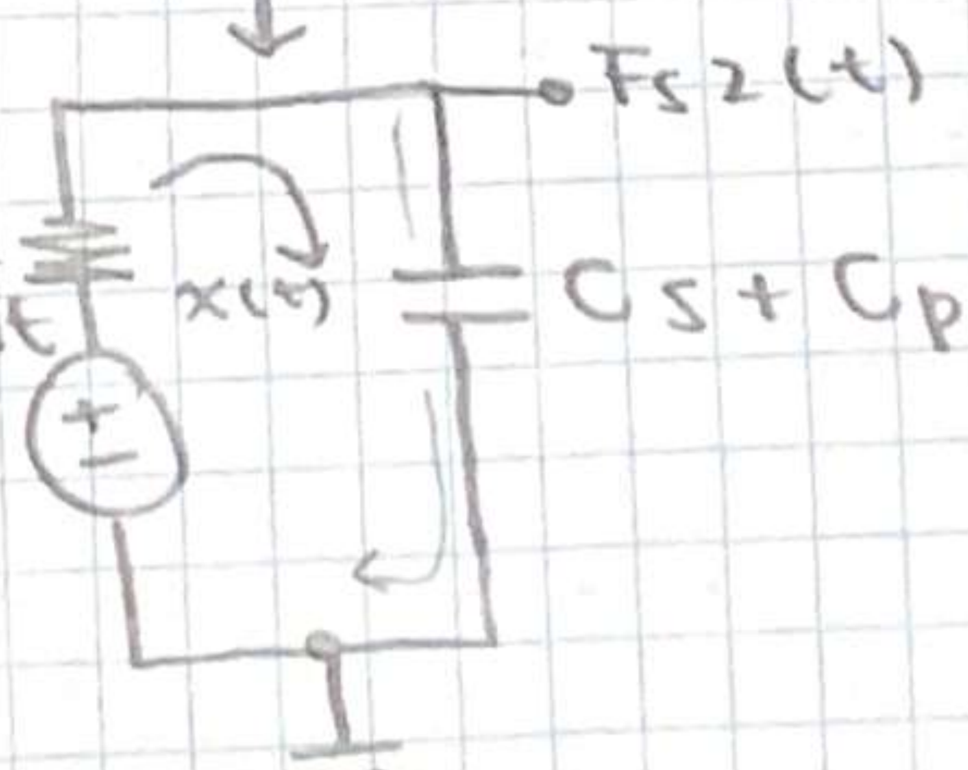
$C_p=100\,\mu F$

$R=100-10k$

→ Análisis apagando $F(t)$







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

$-\alpha F(t)$

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

Error de estado estacionario y lazo abierto

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

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

$$F_s = \frac{Rx(s)(\cancel{\alpha}((C_s+C_p)s) + \cancel{\alpha}x(s)}{-\alpha^2((C_s+C_p)s}$$

$$= \frac{x(s)\left[R((C_s+C_p)s+1\right]}{-\alpha((C_s+C_p)s}$$

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

$$\boxed{F_{s_2}(s) = \frac{-\alpha F_s}{R((C_s+C_p)s+1}}$$

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

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

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

Error de estado estacionario

$$e(s) = \lim_{s\to 0} s \cdot F(s)\left[1 - \frac{Fs(s)}{F(s)_0}\right]$$

$$= \lim_{s\to 0} \left(\cancel{s} \cdot \frac{1}{\cancel{s}} \cdot \left(1 - \frac{CsRs + 1 - \alpha}{R(Cp+Cs)s+1}\right)\right) = 1 - 1 + \alpha$$

$$\boxed{e(s) = +\alpha} = \alpha V = 0.25V$$

Estabilidad en lazo abierto

$$R(Cp + Cs)s + 1 = 0$$

$$R(Cp+Cs)s = -1$$

$$s = -\frac{1}{R(Cp+Cs)}$$

$$\boxed{\lambda = -\frac{1}{R(Cp+Cs)}}$$

→ La respuesta es estable.

→ Es asintóticamente estable.