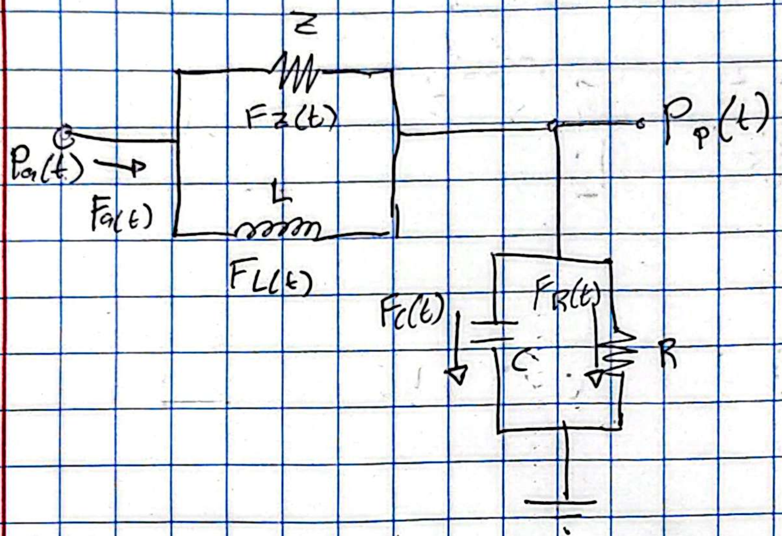


$$\frac{P_p(S)}{P_a(S)} = \frac{?}{?}$$

Formulas

$$F_Z(t) = F_Z(t) + F_L(t) = F_c(t) + F_R(t)$$

$$F_Z(t) = \frac{P_a(t) - P_p(t)}{Z} \qquad F_C(t) = C\left[\frac{d\,P_p(t)}{dt}\right]$$

$$F_L(t) = \frac{1}{C}\int (P_a(t) - P_p(t))\,dt$$

A

$$\frac{P_a(t)}{Z} - \frac{P_p(t)}{Z} + \int (P_a(t) - P_p(t))\,dt = C\left[\frac{d\,P_p(t)}{dt}\right] + \frac{P_p(t)}{R}$$

$$\frac{P_a(S)}{Z} - \frac{P_p(S)}{Z} + \frac{P_a(s) - P_p(s)}{LS} = CSP_p(S) + \frac{P_p(s)}{R}$$

$$\left(\frac{1}{Z} + \frac{1}{LS}\right)P_a(S) = \left(CS + \frac{1}{R} + \frac{1}{Z} + \frac{1}{LS}\right)P_p(S)$$

$$P_s(s) = \frac{\left(Cs + \frac{1}{R} + \frac{1}{Z} + \frac{1}{Ls}\right) P_p(s)}{\left(\frac{1}{Z} + \frac{1}{Ls}\right)}$$

$$P_s(s)\left(\frac{Z + Ls}{ZLs}\right) = \frac{CLs^2 + LZs + RLs + RZ}{RZLs}(P_p(s))$$

$$\frac{P_p(s)}{P_s(s)} = \frac{\left(\frac{Z + Ls}{ZLs}\right)}{\frac{CLs^2 + LZs + RLs + RZ}{RZLs}}$$

$$= \frac{(RZLs)(Z + Ls)}{(ZLs)(CLs^2 + (LZ + RL)s + RZ)}$$

$$= \frac{RZ^2Ls + RZL^2s^2}{(ZCL^2s^3 + (Z^2L^2 + RL^2)s^2 + Z^2LsR)}$$

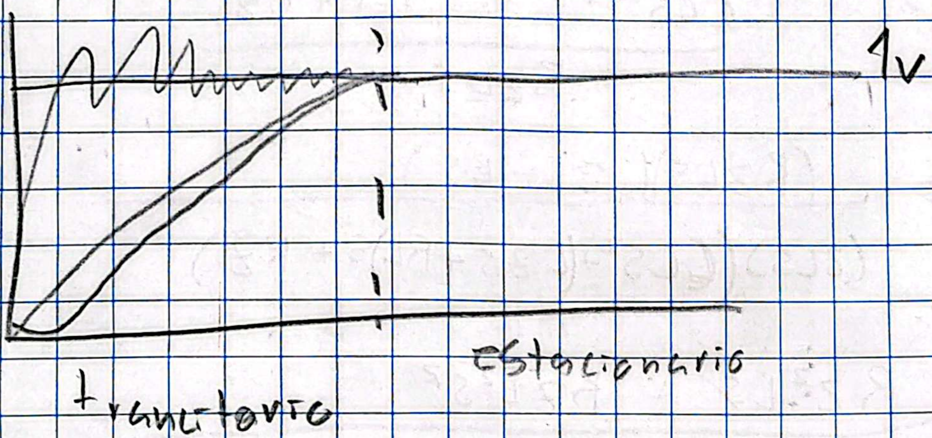
$$= \frac{(\cancel{LZs})(RZ + RLs)}{(\cancel{LZs})(CLs^2 + (LZ + RL)s + ZR)}$$

Error estado estacionario

$$e(S) = \lim_{s \to 0} s\, P_a(S) \left[1 - \frac{P_q(S)}{P_a(S)} \right]$$

$$= \lim_{s \to 0} \cancel{s} \cdot \frac{1}{\cancel{s}} \left[\frac{\cancel{RL\, s^0} + RZ}{\cancel{CLRZ\, s^0} + (LZ + RL)^2 + RZ} \right]$$

$$= 1 - \frac{RZ}{RZ} = 0\,V$$



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Estabilidad de lazo abierto

$$\lambda_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$a = CLRZ$

$b = (LZ + RL)$

$c = RZ$

$$\lambda_{1,2} = \frac{-(LZ + RL) \pm \sqrt{(LZ+RL)^2 - 4(CLRZ)(RZ)}}{2(CLRZ)}$$

el sistema tiene una respuesta estable

$$\lambda_{1,2} < 0$$

Modelo $\int \frac{d}{dt}$

$$P_P(t)\left(\frac{1}{R} + \frac{1}{Z}\right) = \frac{P_a(t)}{Z} + \frac{1}{L}\int [P_a(t) - P_P(t)]\,dt + C\frac{dP_P}{dt}$$

$$P_P(t) = \left(\frac{P_a(t)}{Z} + \frac{1}{L}\int [P_a(t) - P_P(t)]\,dt - C\frac{d\left[P_P(t)\right]}{dt}\right)\frac{ZR}{Z+R}$$