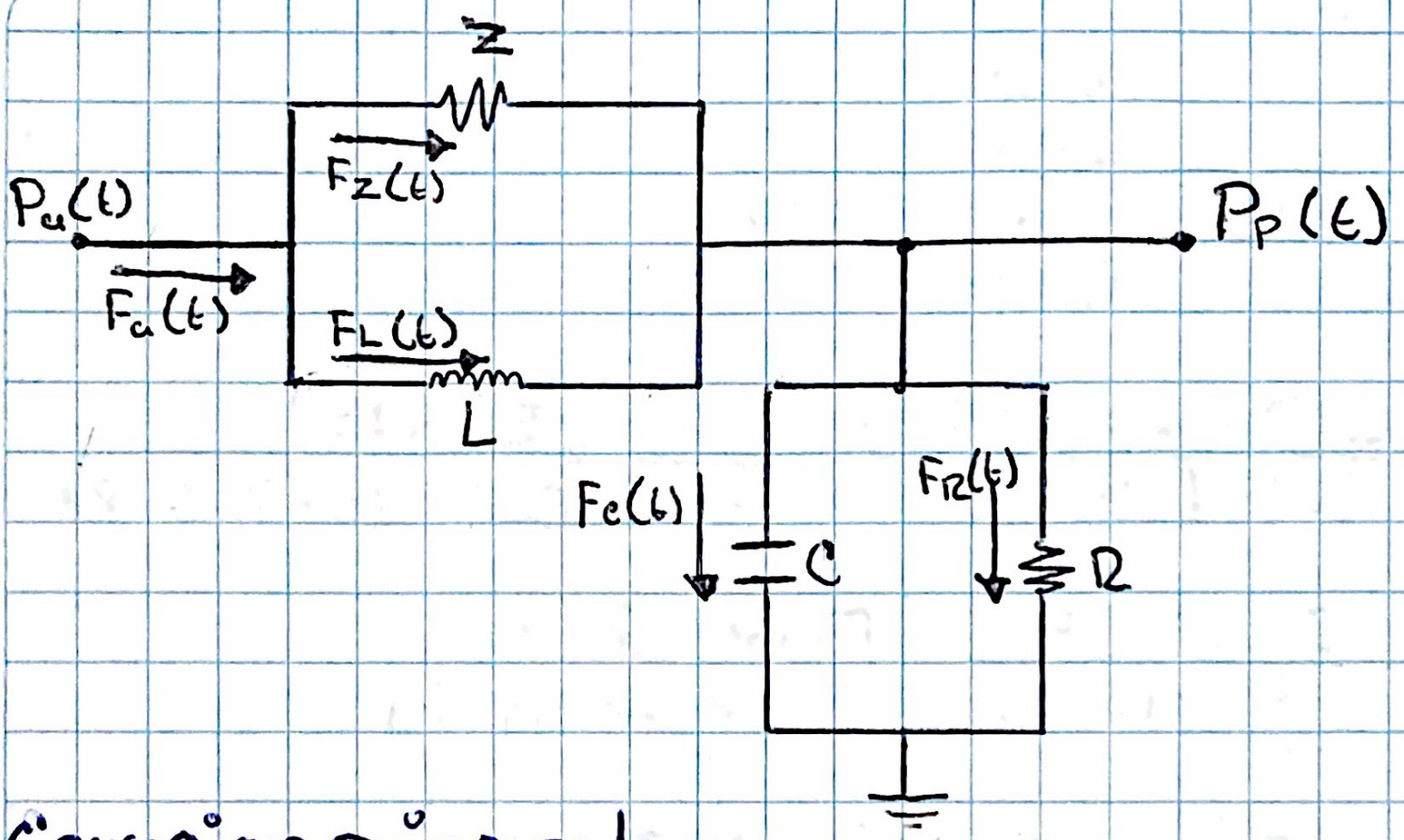
Práctica: Sistema Cardiovascular.



Ecuacion principal

$$F_a(t) = F_z(t) + F_L(t) = F_c(t) + F_R(t)$$

$$F_z(t) = \frac{P_a(t) - P_p(t)}{z} \qquad F_c(t) = C\frac{dP_p(t)}{dt}$$

$$F_L(t) = \frac{1}{L}\int [P_a(t) - P_p(t)]\,dt \qquad F_R = \frac{P_p(t)}{R}$$

Procedimiento algebraico

$$\frac{P_a(t)}{z} - \frac{P_p(t)}{z} + \frac{1}{L}\int\left[P_a(t) - P_p(t)\right]dt = C\frac{dP_p(t)}{dt} + \frac{P_R(t)}{R}$$

$$\frac{P_a(s)}{z} - \frac{P_p(s)}{z} + \frac{P_a(s) - P_p(t)}{L} = CS\,P_p(s) + \frac{P_p(s)}{R}$$

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

$$\frac{LS + z}{LzS}\,P_a(s) = \frac{CLRzS^2 + LzS + RLS + Rz}{RLzS}\,(P_p(s))$$

$$\frac{P_P(S)}{P_a(S)} = \frac{\frac{LS+Z}{LZS}}{\frac{CLRZS^2+(LZ+RL)S+RZ}{RLZS}}$$

$$= \frac{(RLZS)(LS+Z)}{(LZS)[CLRZS^2+(LS+RL)S+RZ]} = \frac{R(LS+Z)}{CLRZS^2+(LS+RL)S+RZ}$$

$$\frac{P_P(S)}{P_a(S)} = \frac{RLS+RZ}{CLS^2+(LS+RL)+RZ}$$

Función de Transferencia

Error en estado estacionario

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

$$= \lim_{S\to 0} S * \frac{1}{S}\left[1-\frac{RLS+RZ}{CLRZS^2+(LZ+RL)S+RZ}\right]$$

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