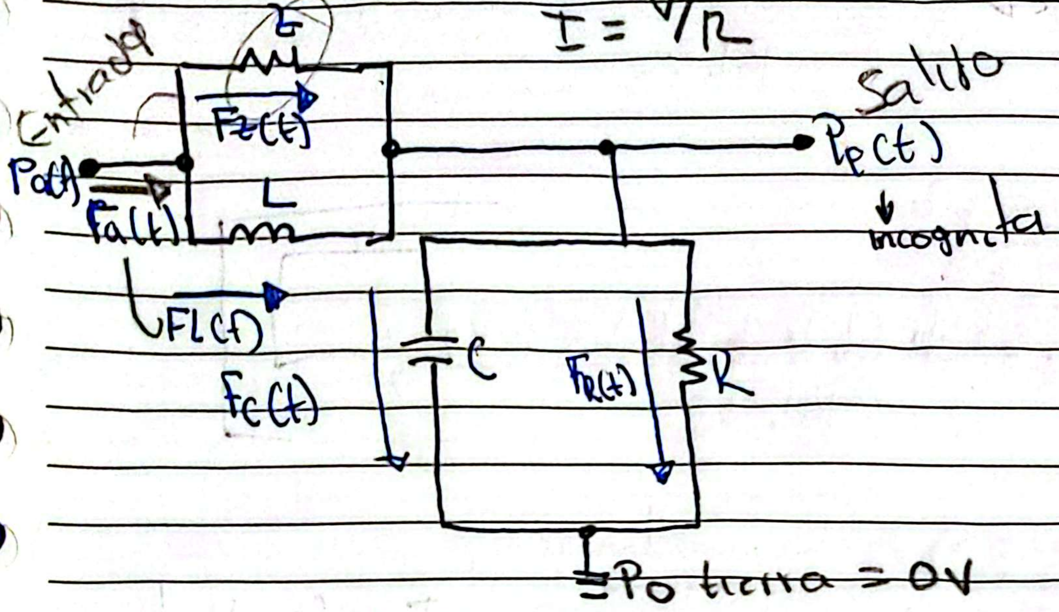
Practica 5.4 sistema cardiovascular

$I = V/R$



$Z = 120\,K$
$C = 100\,\mu F$
$R = 100\,K$
$L = 2.2\,mH$

Calculos:
Ecuación principal

$$F_a(t) = F_Z(t) + F_Z(t) = F_C(t) + F_R(t)$$

$$F_Z(t) = \frac{P_a(t) - P_p(t)}{Z}$$

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

$$F_C(t) = \frac{C\,dP_p(t)}{dt}$$

$$F_R(t) = \frac{P_p(t)}{R}$$

Procedimiento Algebraico

$$(I)\ \frac{P_a(t)}{Z} - \frac{P_p(t)}{Z} + \frac{1}{L}\int [P_a(t) - P_p(t)]\,dt$$

$$= \frac{C\,d\,P_p(t)}{dt} + \frac{P_p(t)}{R}$$ → de aqui buscar $P_p(t)$ = volt. Salida

$$(II)\ \frac{P_a(s)}{Z} - \frac{P_p(s)}{Z} + \frac{P_a(s) - P_p(s)}{Ls} = CsP_p(s) + \frac{P_p(s)}{R}$$

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

$$\frac{CsLz}{Lzs} Pa(s) = \frac{CLs^2 + Lzs + RLs + Rz}{RLzs} Pp(s)$$

$$\frac{Pp(t)}{Pa(s)} = \frac{\dfrac{Ls+z}{Lzs}}{\dfrac{CLs^2 + (Lz+RL)s + Rz}{RLzs}}$$

$$\boxed{\frac{Pp(t)}{Pa(s)} = \frac{(Ls+z)R}{CLs^2 + (Lz+RL)s + Rz}}$$ Función de transferencia

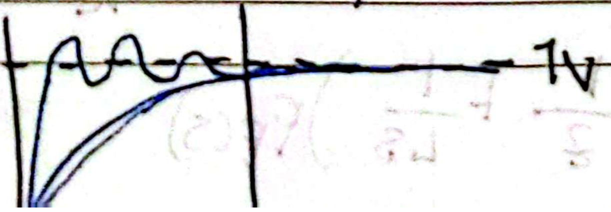
$$= \frac{(Ls+z)RLzs}{Lzs(CLs^2 + (Lz+RL)s + Rz)}$$

Error en estado estacionario

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

$$= \lim_{s \to 0} \cancel{s} * \frac{1}{\cancel{s}} \left[1 - \frac{RLs + Rz}{CLRz\, s^2 + (Lz+RL)s + Rz}\right]$$

$$= 1 - Rz/Rz = 0$$



FECHA: / /

Estabilidad en lazo abierto

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

$a = CLRZ$

$b = LZ + RL$

$c = RZ$

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

El sistema tiene una respuesta estable porque $Re\,\lambda_{1,2} < 0$

Modelo de ecuaciones Integro diferenciales.

De (I):

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

$$\therefore P_p(t) = \left(\frac{P_a(t)}{Z} + \frac{1}{L}\int (P_a(t) - P_p(t))\,dt - C\frac{dP_p(t)}{dt}\right)\cdot \frac{ZR}{Z+R}$$