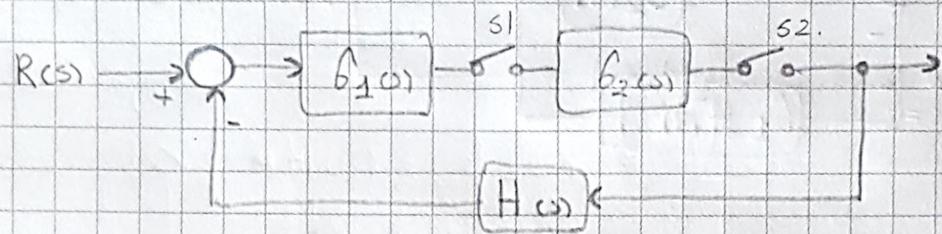
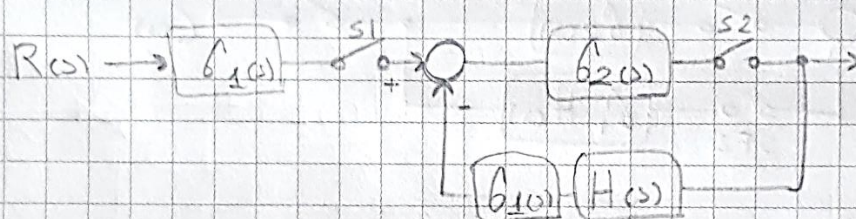
3.9 Determinar.

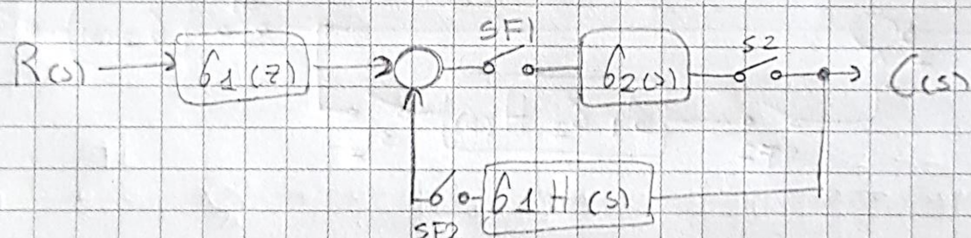
a) La Función de transferencia de pulso o la relación entre la entrada y la salida para cada uno de los sistemas que se muestran

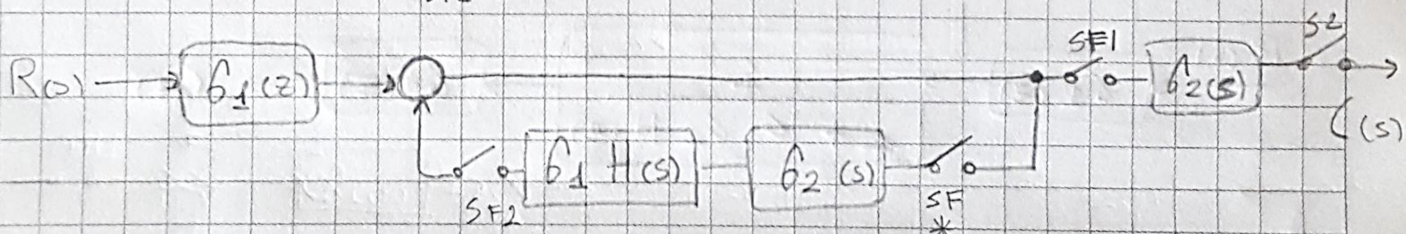
b) Aplicar el resultado obtenido en (a) when:

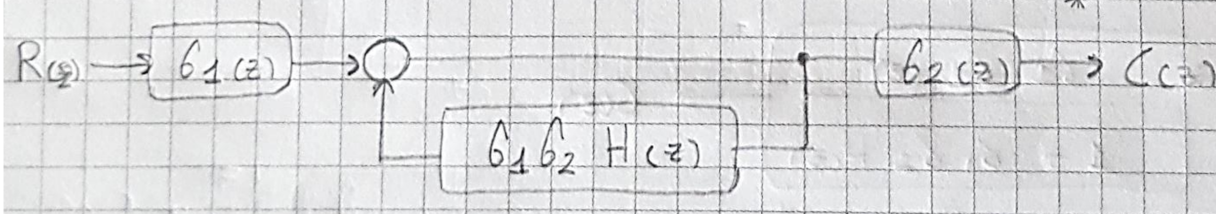
- $G_1(s) = \frac{0,5}{5s+1}$ • $G_2(s) = \frac{1}{s}$ • $H(s) = H_1(s) = H_2(s) = 1.$

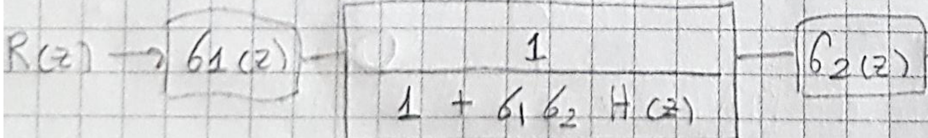


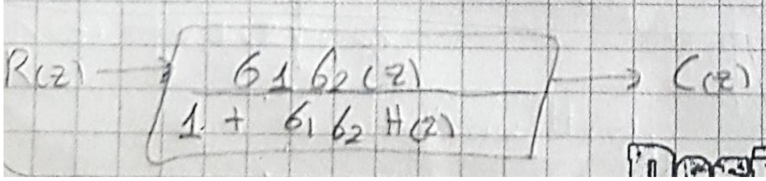


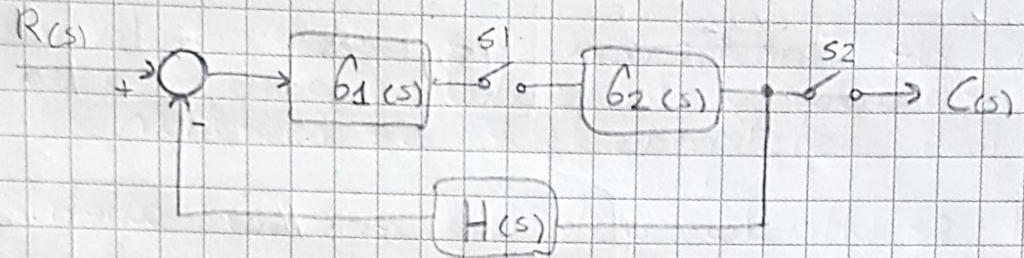


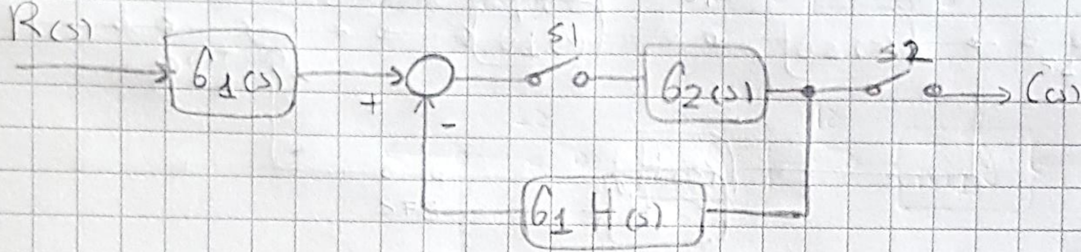


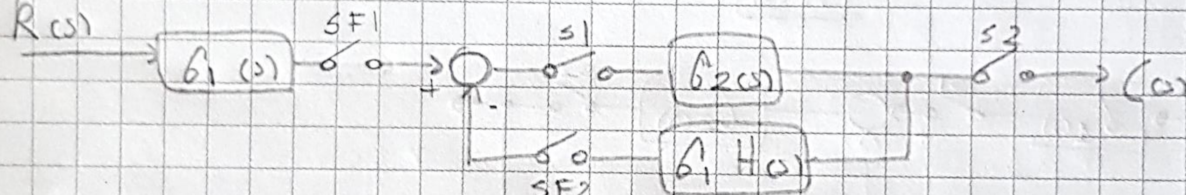


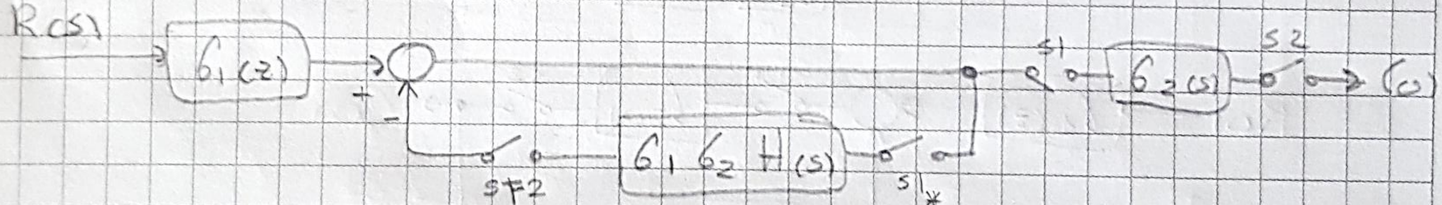


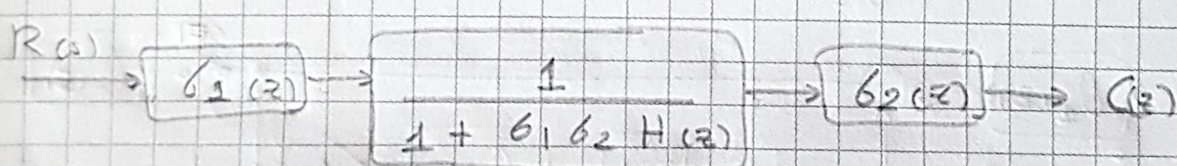


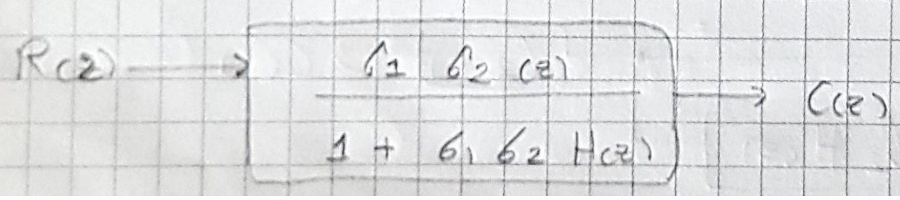

R(s)
+
-
G1(s)
S1
G2(s)
S2
C(s)
H(s)

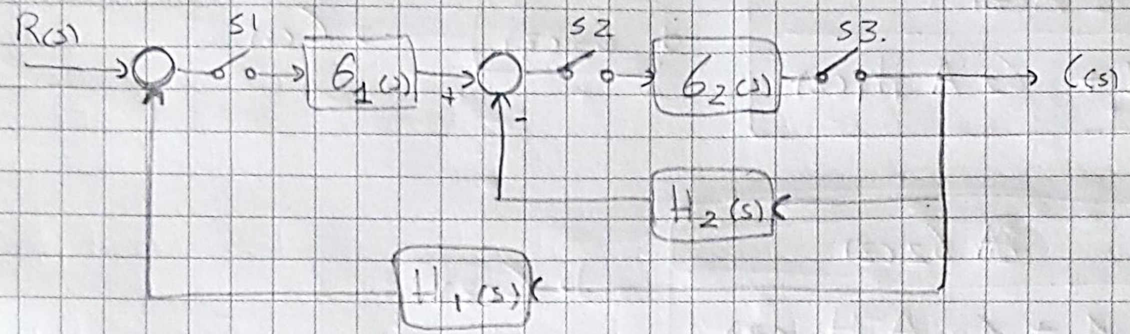

R(s)
G1(s)
+
-
S1
G2(s)
S2
C(s)
G1 H(s)

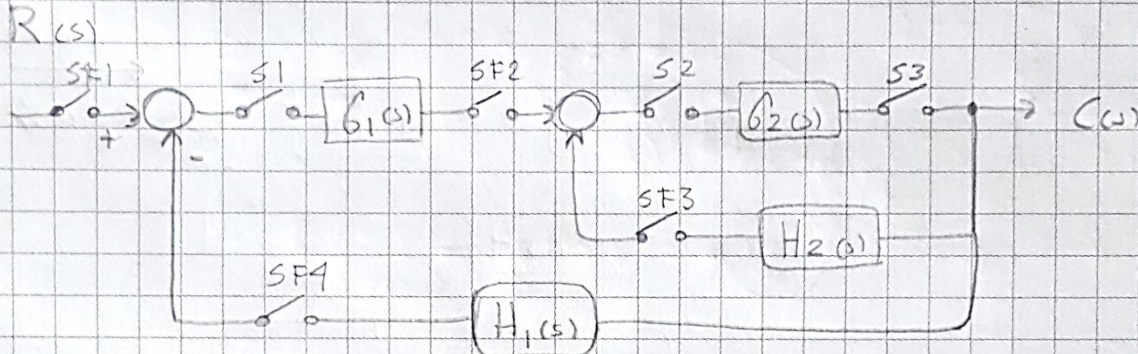

R(s)
G1 (s)
SF1
+
-
S1
G2(s)
S2
C(s)
G1 H(s)
SF2

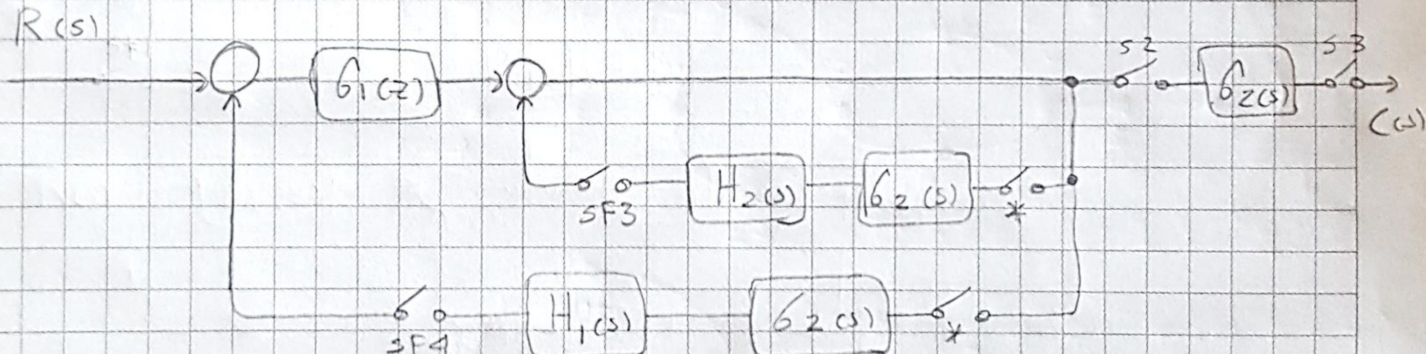

R(s)
G1(z)
+
-
S1
G2(s)
S2
C(s)
G1 G2 H(s)
SF2
S1*

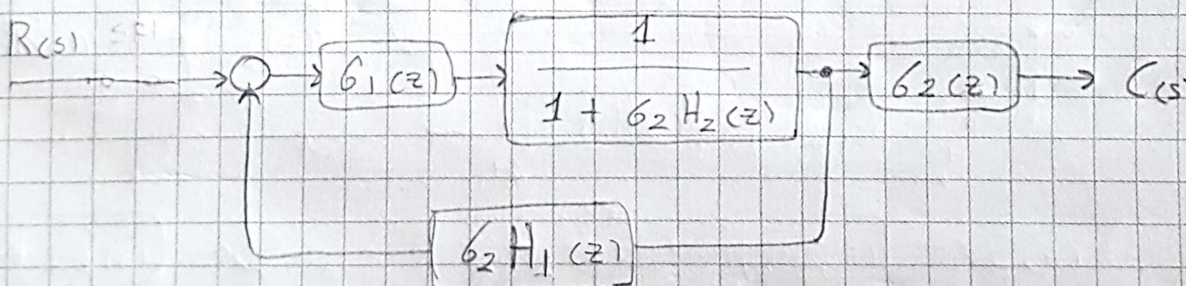

R(s)
G1(z)
1
1 + G1 G2 H(z)
G2(z)
C(z)

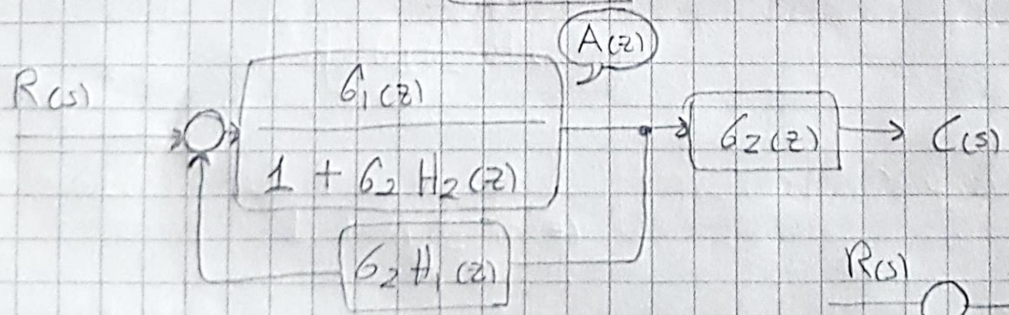

R(z)
G1 G2 (z)
1 + G1 G2 H(z)
C(z)

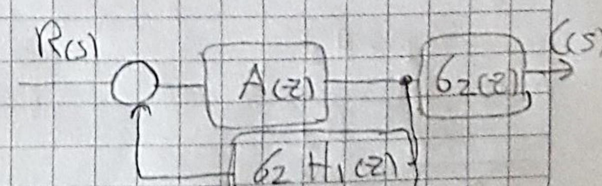

R(s)
S1
S2
S3.
G1(s)
G2(s)
H2(s)
H1(s)
+
-
C(s)

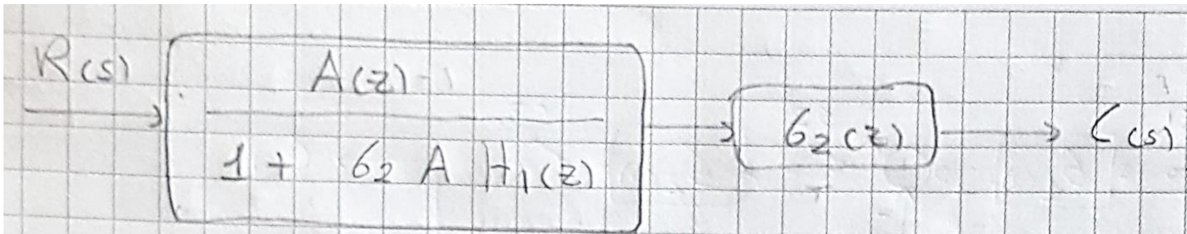

R(s)
SF1
S1
SF2
S2
S3
G1(s)
G2(s)
SF3
H2(s)
SF4
H1(s)
+
-
C(s)

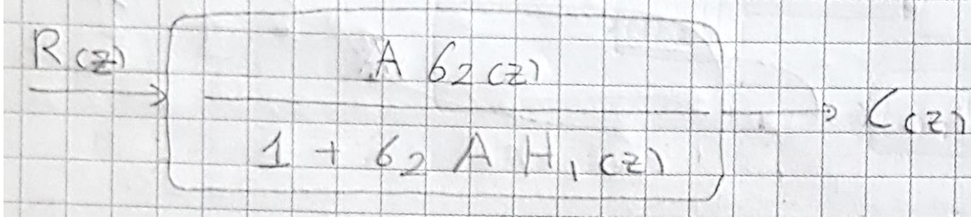

R(s)
G1(z)
S2
S3
G2(s)
C(s)
H2(s)
G2(s)
SF3
H1(s)
G2(s)
SF4


R(s)
G1(z)
1
1 + G2 H2(z)
G2(z)
C(s)
G2 H1(z)

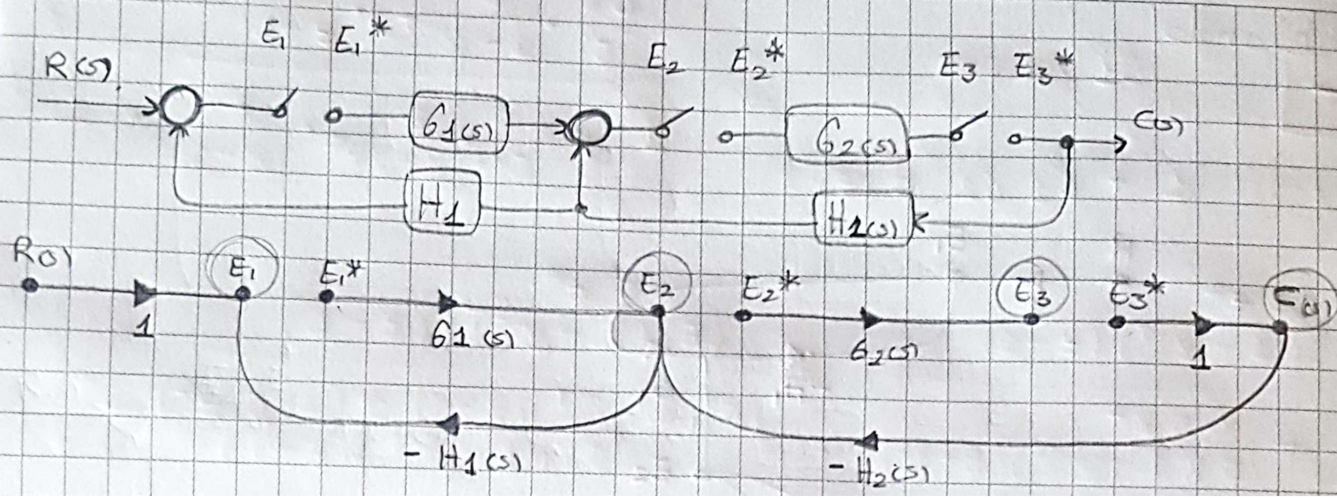

A(z)
R(s)
G1(z)
1 + G2 H2(z)
G2(z)
C(s)
G2 H1(z)


R(s)
A(z)
G2(z)
C(s)
G2 H1(z)





29



-Primero Señales

$E_1 = 1 \cdot R(s) - H_1(s)\ \cancel{E_2}\ G_1(s)\ E_1^*$

$E_2 = G_1(s)\ E_1^* - H_2(s)\ \cancel{C(s)}\ 1\ E_3^*$

$E_3 = G_2(s)\ E_2^*$

$C(s) = 1\ E_3^*$

-Anular señales

$E_1 = R(s) - H_1\, G_1\, E_1^*(s)$

$E_2 = G_1\, E_1^*(s) - H_2\, E_3^*(s)$

$E_3 = G_2(s)\, E_2^*$

$C(s) = E_3^*$

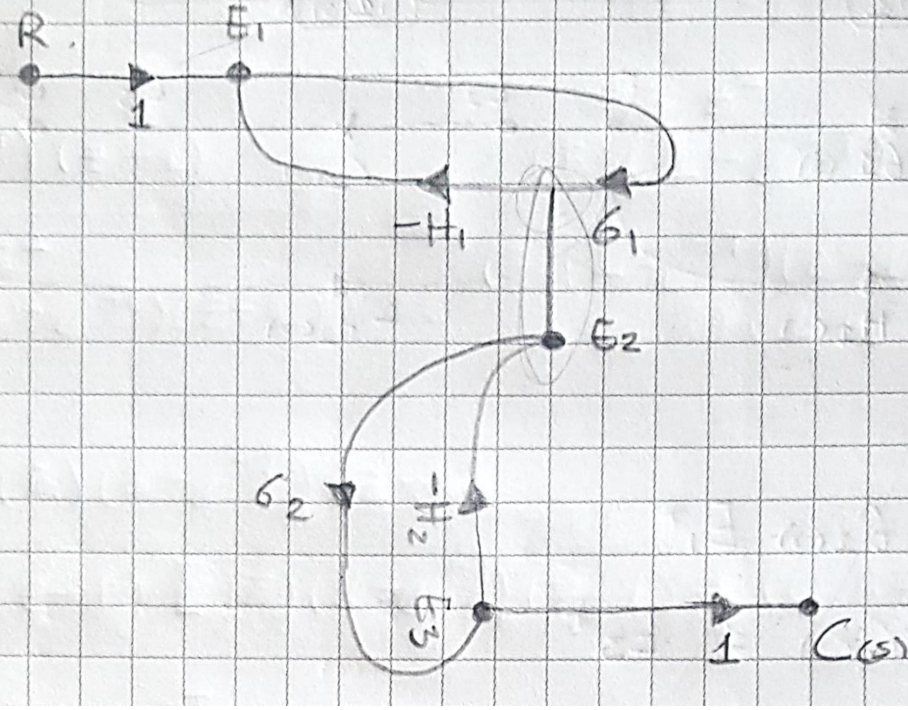
- Poner Asteisk

$E_1^* = R^*_{(s)} - H_1^* G_1^* E_{1(s)}^*$

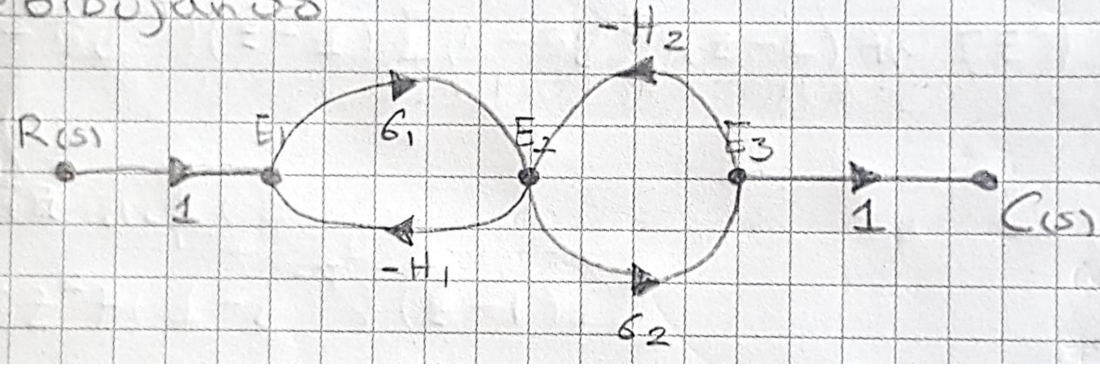
$E_2 = G_{1(s)}^* E_{1(s)}^* - H_2^* E_{3(s)}^*$

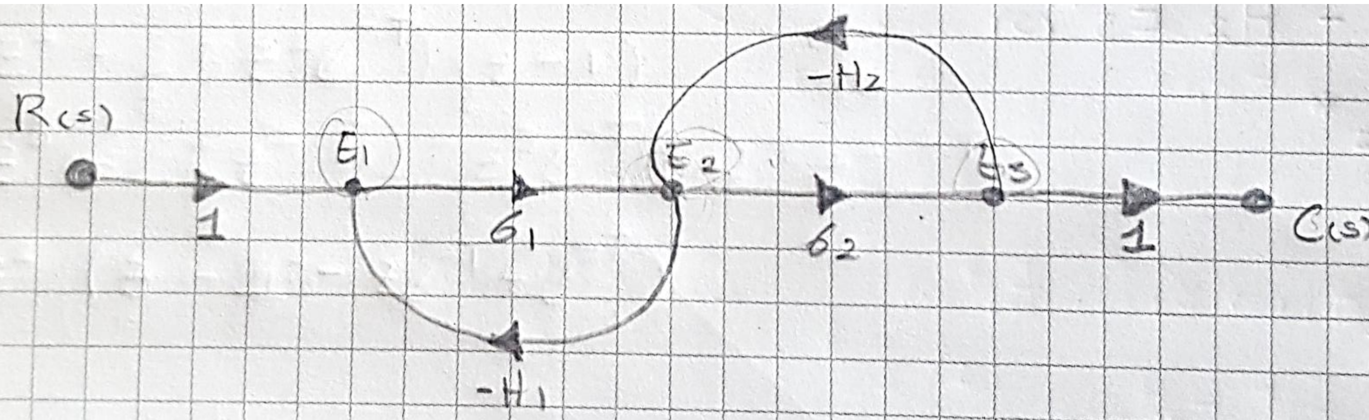
$E_3 = G_{2(s)}^* E_2^*$

$C_{(s)} = E_3^*$.



Redibujando





1. Ganancia de Trayectoria directa.

$G_1 \cdot G_2$

2. Ganancia de Malla

$G_1 \cdot H_1$

$G_2 \cdot H_2$

3. Mallas que no se tocan, dobles.
4. De las que no se tocan si hay, tres, mallas triples

5. formar Δ

$\Delta = 1 - [(G_1 \cdot H_1) + (G_2 \cdot H_2)]$

6. $K = 1$

$T_1 = G_1 \cdot G_2$

7. $\Delta K = 1$

8. Sustituir en Mason

$$G(s) = \frac{T_1 \quad \Delta k}{\Delta}$$

$$G(s) = \frac{(G_1 \cdot G_2)(1)}{1 - [G_1 \cdot H_1 + G_2 H_2]}$$

$$\boxed{G(s) = \frac{G_1 \quad G_2}{1 - (G_1 H_1 + G_2 H_2)}}$$

Reemplazar Valores.

$-$ $G_1 = \frac{0,5}{s(s+1)}$ $G_2 = \frac{1}{s}$ $H = 1$

$G_1 \to 6$, $G_2 \to 2$, $H \to 1$

$\frac{0,5}{5} \cdot \frac{1}{s+1}$ $\frac{z}{z-1}$ 1

$\downarrow$

$\frac{0,5}{5} \cdot \frac{z}{z - e^{-T}}$

$\boxed{-}$

$$\frac{G_1 \, G_2 \, (z)}{1 + G_1 \, G_2 \, H(z)} \Rightarrow \frac{\frac{0,5}{5} \cdot \frac{z}{1 - e^{-T}} \cdot \frac{z}{z-1}}{1 + \frac{0,5}{5} \cdot \frac{z}{1 - e^{-T}} \cdot \frac{z}{z-1} \cdot 1}$$

$$\frac{\frac{0,5 \, z^2}{(5)(1 - e^{-T})(z-1)}}{\frac{1}{1} + \frac{0,5 \, z^2}{(5)(1 - e^{-T})(z-1)}} \Rightarrow \frac{\frac{0,5 \, z^2}{(5)(1 - e^{-T})(z-1)}}{\frac{(5)(1 - e^{-T})(z-1) + (0,5 \, z^2)}{(5)(1 - e^{-T})(z-1)}}$$

$$\frac{(0,5 \, z^2)(5)(1 - e^{-T})(z-1)}{(5)(1 - e^{-T})(z-1)[(5)(1 - e^{-T})(z-1) + (0,5 \, z^2)]}$$

$$\frac{G_1 G_2(z)}{1 + G_1 G_2 H(z)}$$

* Es exactamente igual al ⊖, por tanto mismo resultado *

$$\frac{0,5\, z^2}{(5)(1 - e^{-T})(z-1) + (0,5 z^2)}$$

$$\frac{A\, G_2(z)}{1 + G_2\, A\, H_1(z)} \qquad A = \frac{G_1(z)}{1 + G_2 H_2(z)}$$

entonces.

$$\frac{\frac{G_1(z)}{1 + G_2 H_2(z)} \cdot G_2(z)}{1 + G_2 \cdot \frac{G_1(z)}{1 + G_2 H_2(z)} \cdot H_1(z)} \Rightarrow \frac{\frac{G_1 G_2(z)}{1 + G_2 H_2(z)}}{\frac{1}{1} + \frac{G_2 G_1 H_1(z)}{1 + G_2 H_2(z)}}$$

$$\frac{\frac{G_1 G_2(z)}{\cancel{1 + G_2 H_2(z)}}}{\frac{1 + G_2 H_2(z) + G_2 G_1 H_1(z)}{\cancel{1 + G_2 H_2(z)}}} \Longrightarrow \frac{G_1 G_2(z)}{1 + G_2 H_2(z) + G_2 G_1 H_1(z)}$$

$$\frac{\frac{0,5}{5} \cdot \frac{z}{z - e^{-T}} \cdot \frac{z}{z-1}}{\frac{1}{1} + \frac{z}{z-1} + \frac{z}{z-1} \cdot \frac{0,5}{5} \cdot \frac{z}{z - e^{-T}}} \qquad \frac{0,5}{5} = \frac{\frac{1}{2}}{\frac{5}{1}} = \frac{1}{10}$$

$$\frac{\frac{z^2}{(10)(z - e^{-T})(z-1)}}{\frac{1}{1} + \frac{z}{z-1} + \frac{z^2}{(10)(z - e^{-T})(z-1)}}$$

$$\frac{\frac{z^2}{(10)(z - e^{-T})(z-1)}}{\frac{1}{1} + \frac{(z)(10)(z - e^{-T})(z-1) + (z^2)(z-1)}{(z-1)(10)(z - e^{-T})(z-1)}}$$

$$\frac{\dfrac{z^2}{\cancel{(10)}\,(z-e^{-T})\,\cancel{(z-1)}}}{\dfrac{(z-1)(10)(z-e^{-T})(z-1)+(z)(10)(z-e^{-T})(z-1)+(z^2)(z-1)}{\cancel{(z-1)}\,\cancel{(10)}\,\cancel{(z-e^{-T})}\,(z-1)}}$$

$$\frac{\dfrac{z^2}{1}}{\dfrac{(z-1)(10)(z-e^{-T})(z-1)+(z)(10)(z-e^{-T})(z-1)+(z^2)(z-1)}{(z-1)}}$$

$$\frac{z^2(z-1)}{(z-1)(10)(z-e^{-T})(z-1)+(z)(10)(z-e^{-T})(z-1)+(z^2)(z-1)}$$

$$\frac{z^3-z^2}{(z-1)^2(10)(z-e^{-T})+(10z)(z-1)(z-e^{-T})+z^3-z^2}$$

四

$$\frac{G_1\,G_2}{1-(G_1H_1+G_2H_2)}$$

$$\frac{\dfrac{1}{10}\cdot\dfrac{z}{z-e^{-T}}\cdot\dfrac{z}{z-1}}{\dfrac{1}{1}-\left(\dfrac{1}{10}\cdot\dfrac{z}{z-e^{-T}}+\dfrac{z}{z-1}\right)}$$

$$\frac{\dfrac{z^2}{(10)(z-e^{-T})(z-1)}}{\dfrac{1}{1}-\left(\dfrac{(z-1)(z)+(z)(10)(z-e^{-T})}{(10)(z-e^{-T})(z-1)}\right.}$$

$$\frac{\dfrac{z^2}{\cancel{(10)(z-e^{-T})(z-1)}}}{\dfrac{(10)(z-e^{-T})(z-1)-(z-1)(z)+(z)(10)(z-e^{-T})}{\cancel{(10)(z-e^{-T})(z-1)}}}$$

$$\frac{(10)(z-e^{-T})(z-1)-(z-1)(z)+(z)(10)(z-e^{-T})}{z^2}$$

$$\frac{(10z-10)(z-e^{-T})-z^2-z+10z^2-10ze^{-T}}{z^2}$$

$$\frac{\cancel{10z^2}\cancel{-10ze^{-T}}\cancel{-10z}\cancel{+10e^{-T}}\cancel{-z^2}\cancel{-z}\cancel{+10z^2}\cancel{-10ze^{-T}}}{z^2}$$

$$\frac{10z^2-z^2+10z^2-10ze^{-T}-10ze^{-T}-10z-z+10e^{-T}}{z^2}$$

$$\frac{19z^2-20ze^{-T}-11z+10e^{-T}}{z^2}$$