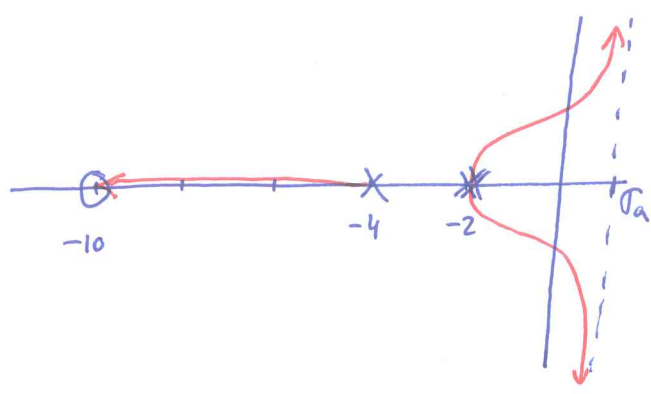


1) a) $G(s) = \frac{s+10}{(s+4)(s+2)^2}$

ceros: $s = -10$
 polos: $s = -2, -2,$
 grado rel. 2 \Rightarrow asíntota
 $\sigma_a = \frac{-4-2-2-(-10)}{2}$
 Punto de ruptura
 doble: $\sigma_r = -2$



b) $G_{BC} = \frac{1}{1+KG(s)} = \frac{K(s+10)}{(s+4)(s^2+4+4s)+Ks+40K} = \frac{K(s+10)}{s^3+4s^2+(4+K)s+40K}$
 $= \frac{K(s+10)}{s^3+8s^2+(20+K)s+(16+10K)s^0}$ Rango de estabilidad

s^3	1	$20+K$
s^2	8	$16+10K$
s^1	a_{11}	0
s^0	$16+10K$	0

$a_{11} = \frac{(20+K)8 - 16 - 10K}{8} = \frac{160 - 16 - 10K + 8K}{8} = \frac{144 - 2K}{8}$

Estabilidad: 1ª columna positiva

$\frac{144-2K}{8} > 0 \Rightarrow 72-K > 0 \Rightarrow K < 72$

$16+10K > 0 \Rightarrow K > \frac{-16}{10}$

Como $K > 0 \Rightarrow K \in (0, 72)$

c) $T_s = 4s \Rightarrow \frac{4}{\xi \omega_n} = 4 \Rightarrow \xi \omega_n = 1$ Cuando los polos conjugados estén en $-1 \pm j$. Para calcular la ω_n polo de la recta real. Cálculo su posición por la regla

$\sum p_i = -4-2-2 = -8$. luego $2 \cdot (-1) + p = -8 \Rightarrow p = -6 \Rightarrow$

$K = \frac{|D(s)|}{|N(s)|} = \frac{2 \cdot 4 \cdot 4}{4} = 8$

d) como $\frac{|-6|}{|-1|} \geq 5$, la ω_n

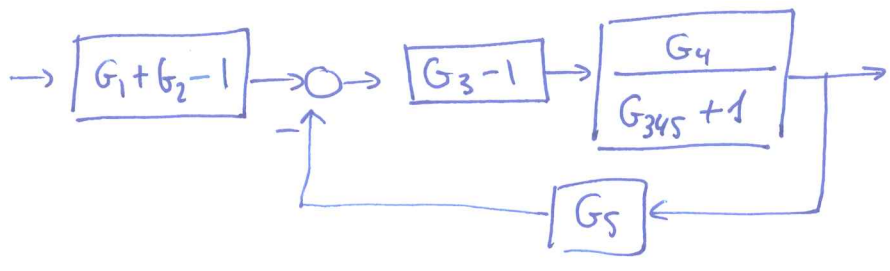
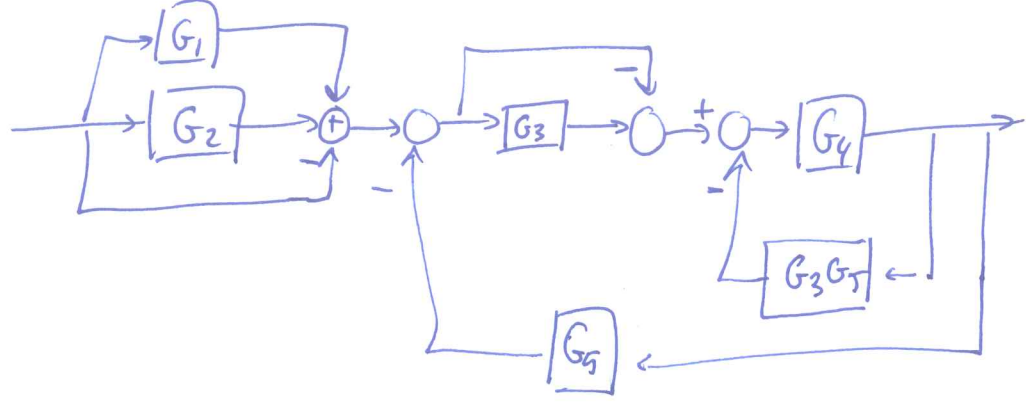
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$$\frac{(G_1 + G_2 - 1) (G_3 - 1) G_4}{G_4 G_5 (G_3 - 1) + G_3 G_5 + 1}$$

b)

$$\left(2 + \frac{1-s}{s} - 1\right) \frac{(5s-1)s}{2s(5s-1) + 10s^2 + 1} = \frac{1}{8} \frac{(5s-1)}{10s^2}$$

$$= \frac{5s-1}{20s^2-2s+1} \xrightarrow{\text{Reclin}} = \frac{1}{20s^2}$$

s^2	20	$1-k$
s^1	$5k-2$	\emptyset
s^0	$1-k$	\emptyset

$$\left. \begin{aligned} 1-k > 0 &\Rightarrow k < 1 \\ 5k-2 > 0 &\Rightarrow k > \frac{2}{5} \end{aligned} \right\} k$$

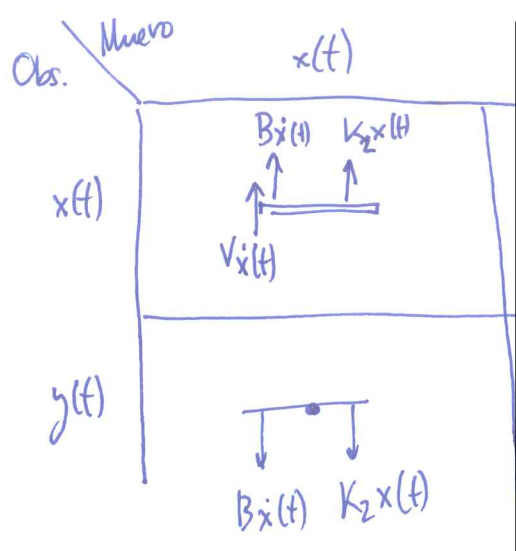
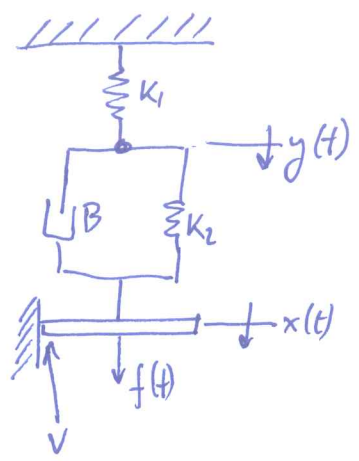
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2)

a)



$$(1) f(t) + B\dot{y}(t) + k_2 y(t) = (B+V)\dot{x}(t) + k_2 x(t)$$

$$(2) B\dot{x}(t) + k_2 x(t) = B\dot{y}(t) + (k_1 + k_2)y(t)$$

$$b) (1) F(s) + B_s Y(s) + k_2 Y(s) = (B+V)sX(s) + k_2 X(s)$$

$$(2) B_s X(s) + k_2 X(s) = B_s Y(s) + (k_1 + k_2)Y(s)$$

$$c) \text{ Sustituyo: } (1) F(s) + Y(s)(k+s) = X(s)(2s+k)$$

$$(2) X(s)(s+k) = Y(s)(s+2k)$$

$$\text{Despejo } Y(s) \text{ en (2): } Y(s) = X(s) \frac{k+s}{2k+s} \quad \text{Sustituyo en}$$

$$F(s) + X(s) \frac{(k+s)^2}{2k+s} = X(s)(2s+k) \Rightarrow F(s) = X(s) \left[(2s+k) - \frac{(k+s)^2}{2k+s} \right]$$

$$= X(s) \left[\frac{(2s+k)(2k+s) - k^2 - s^2 - 2ks}{2k+s} \right] = \left[\frac{4ks + 2s^2 + 2ks - k^2 - s^2 - 2ks}{2k+s} \right]$$

$$\Rightarrow \frac{X(s)}{F(s)} = \frac{2k+s}{k^2 + 3ks + s^2}$$

$$d) \mu = \frac{2k}{k^2} = \frac{2}{k} \quad f(t) = 10 \text{ kg} \cdot 9.8 = 98 \text{ N} \Rightarrow 98 \cdot \frac{2}{k} = 0'$$

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