# Tarea Semanal 10

## Síntesis de funciones No disipativas

(1)

$$Z(s) = \frac{(s^2+3)(s^2+1)}{s(s^2+2)}$$

(a) Síntesis FOSTER

$$F(s) = s k_\infty + \frac{k_0}{s} + \sum_{n=1}^{N} \frac{2k_n s}{s^2+\omega_n^2}$$

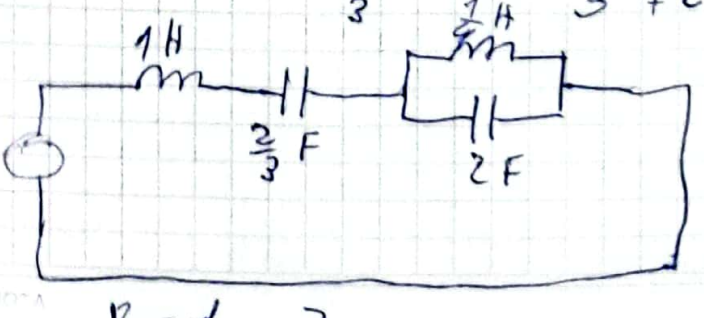
N Tanques / polos

$$k_\infty = \lim_{s\to\infty} \frac{F(s)}{s} = \frac{(s^2+3)(s^2+1)}{s^2(s^2+2)} = 1$$

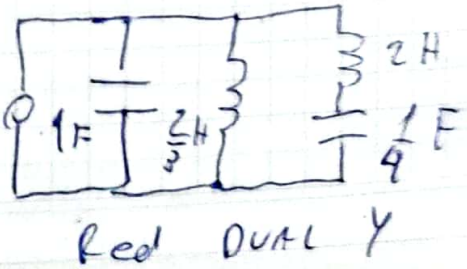
$$k_0 = \lim_{s\to 0} F(s)\,s = \frac{(s^2+3)(s^2+1)}{s(s^2+2)} = 3/2$$

$$2k_1 = \lim_{s^2\to -2} \frac{(s^2+3)(s^2+1)(s^2+2)}{(s^2+2)s^2} = 1/2$$

$$Z(s) = s + \frac{1}{\frac{2}{3}s} + \frac{1/2\, s}{s^2+2} = s + \frac{1}{\frac{2}{3}s} + \frac{1}{2s+\frac{4}{5}}$$




Red Z



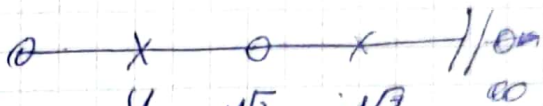

Red DUAL Y

# Síntesis de Y

$$Y(s) = \frac{s(s^2+2)}{(s^2+3)(s^2+1)}$$

$$K_\infty = \lim_{s\to\infty} \frac{s^2+2}{(s^2+3)(s^2+1)} = 0$$

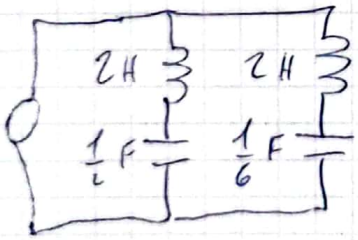
$$K_0 = \lim_{s\to 0} \frac{s^2(s^2+2)}{(s^2+3)(s^2+1)} = 0$$



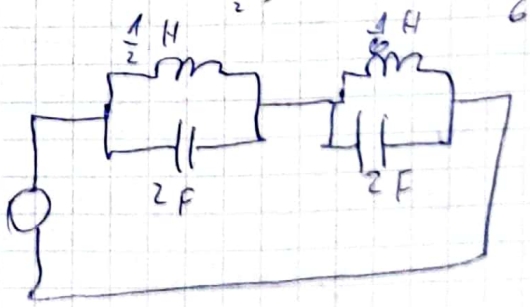

$$2K_1 = \lim_{s^2\to -1} \frac{s^2+2}{s^2+3} = 1/2$$

$$2K_2 = \lim_{s^2\to -3} \frac{s^2+2}{s^2+1} = 1/2$$

$$Y(s) = \frac{\frac{1}{2}s}{s^2+1} + \frac{\frac{1}{2}s}{s^2+3} = \frac{1}{2s+\frac{1}{\frac{1}{2}s}} + \frac{1}{2s+\frac{1}{\frac{1}{6}s}}$$




Red Y




Red Dual Z

(6) Síntesis por CAUER 1 (Remoción en ∞)

$$Z(s) = \frac{s^4 + 4s^2 + 3}{s^3 + 2s}$$

$s^4 + 4s^2 + 3 \;\big|\; s^3 + 2s$

$s^4 + 2s^2$ — $s$ → $1\,H$

$s^3 + 2s \;\big|\; 2s^2 + 3$

$s^3 + \frac{3}{2}s$ — $\frac{1}{2}s$ → $\frac{1}{F}$ → $\frac{1}{2}\,F$

$2s^2 + 3 \;\big|\; \frac{1}{2}s$

$2s^2$ — $4s$ → $4H$

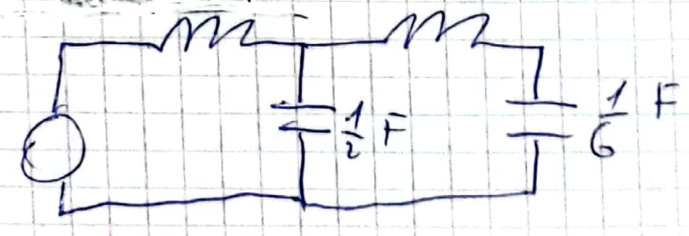
$3 \;\big|\; \frac{1}{2}s$

$\frac{1}{2}s$ — $6$ → $\frac{1}{F}$ → $\frac{1}{6}\,F$

$0$

Síntesis en Cauer: 1H, 4H, $\frac{1}{2}F$, $\frac{1}{6}F$

Red 2.




Red DUAL

Síntesis CAUER 2 (Reacción en 0)

$3 + 4s^2 + s^4 \;|\; 2s + s^3$

$3 + \frac{3}{2}s^2$ — $\frac{3}{2}s$ — $\frac{2}{3}$ F

$2s + s^3 \;|\; \frac{5}{2}s^2 + s^4$

$2s + \frac{4}{5}s^3$ — $\frac{4}{5}s$ — $\frac{5}{4}$ H

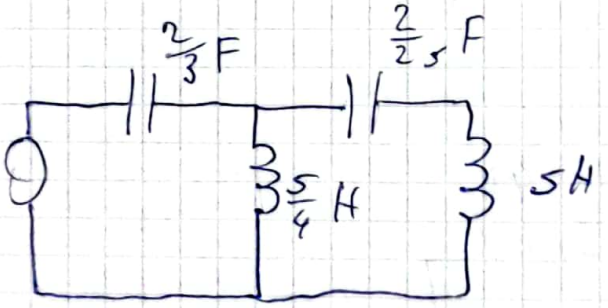
$\frac{5}{2}s^2 + s^4 \;|\; \frac{1}{5}s^3$

$\frac{5}{2}s^2 + s^4$ — $\frac{25}{2}s$ — $\frac{2}{25}$ F

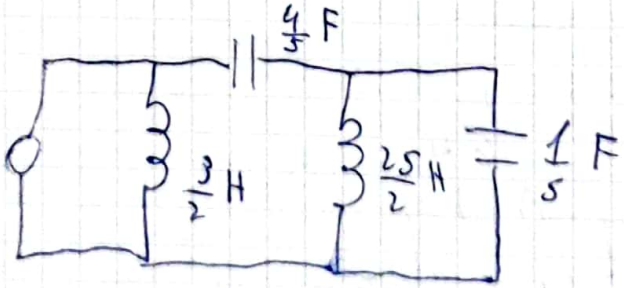
$\frac{1}{5}s^3 \;|\; s^4$

$\frac{1}{5}s^3$ — $\frac{1}{5}s^{-1}$ — 5 H

0

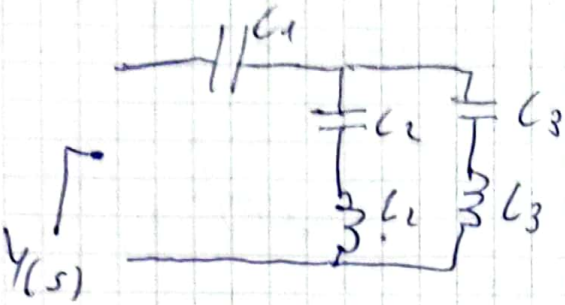



Red 2




Red DUAL Y

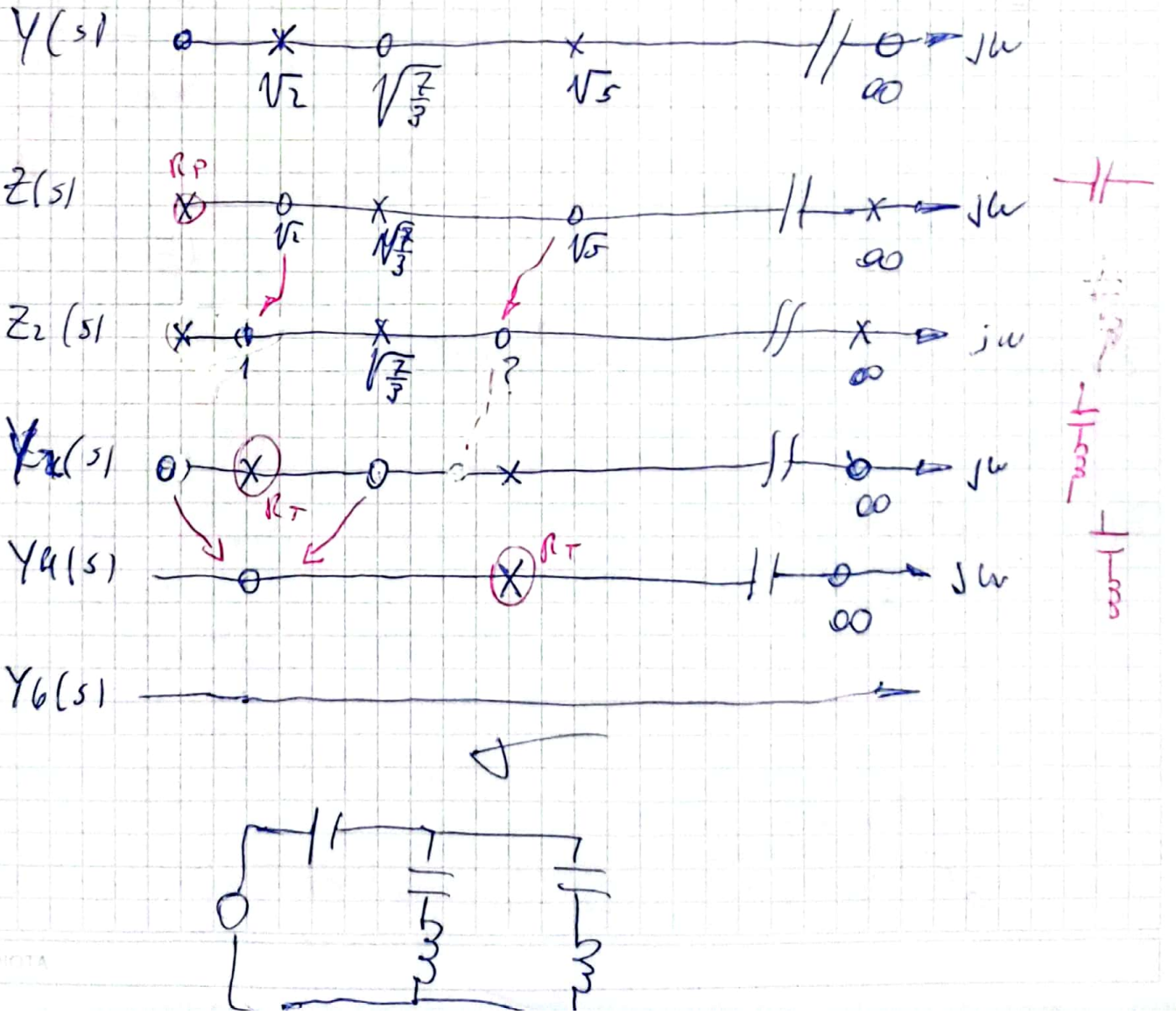
② Remoción por polos




$L_2$ y $C_2$ resonan a $\frac{1}{\sqrt{L_2 C_2}} = 1 \frac{rad}{s}$

## Método gráfico

$$Y(s) = \frac{3s(s^2 + \frac{7}{3})}{(s^2+2)(s^2+5)}$$



## Calculo de Componentes

$$Y(s) = \frac{3s\left(s^2+\frac{7}{3}\right)}{(s^2+2)(s^2+5)} = \frac{3s^3+7s}{s^4+7s^2+10}$$

$$Z_2(s) = Z(s) - Z_1(s) = \frac{s^4+7s^2+10}{3s^3+7s} - Z_1(s)$$

Remoción Parcial en 0

$$Z_2(s)\Big|_{s=j1} = \left[Z - \frac{k_0}{s}\right]_{s=j1} = 0$$

$$\left[\frac{s^4+7s^2+10}{3s^3+7s} - \frac{k_0}{s}\right]_{s=j1} = 0$$

$$\frac{1-7+10}{-3j+7j} = \frac{k_0}{j} \Rightarrow \frac{4}{4j} = \frac{k_0}{j} \Rightarrow \boxed{k_0 = 1}$$

$$Z_2(s) = \frac{s^4+7s^2+10}{3s^3+7s} - \frac{1}{s} \rightarrow \text{FP} + \text{IF}$$

$$Z_2(s) = \frac{(s^4+7s^2+10)s - (3s^3+7s)}{(3s^3+7s)s}$$

$$Z_2(s) = \frac{3s^5+4s^3+3s}{3s^4+7s^2}$$

Remoción Total en 1

$$Y_2 = \frac{3s^4+7s^2}{s^5+4s^3+3s} \rightarrow \text{Apreciado el polo en 1}$$

NOTA

$$Y_4 = Y_2 - \frac{2k_1 s}{s^2+w^2}$$

$$2k_1 = \lim_{s^2 \to -1} \frac{(3s^4+7s^2)(s^2+1)}{(s^5+4s^3+3s)s}$$

$$2k_1 = \lim_{s^2 \to -1} \frac{(3s^4+7s^2)(s^2+1)}{(s^2+1)(s^2+3)s^2} = \frac{3-7}{-(3-1)} = 2$$

$$Y_4 = \frac{3s^4+7s^2}{s^5+4s^3+3s} - \frac{2s}{s^2+1} \rightarrow \frac{\frac{1}{3}H}{1F}$$

$$Y_4 = \frac{(3s^4+7s^2)(s^2+1) - 2s(s^2+1)(s^2+3)s}{(s^2+1)(s^5+4s^3+3s)}$$

$$Y_4 = \frac{3s^4+7s^2-2s^4-6s^2}{s^5+4s^3+3s}$$

$$Y_4 = \frac{s^4+s^2}{s^5+4s^3+3s} = \frac{s^2(s^2+1)}{s(s^4+4s^2+3)}$$

$$Y_4 = \frac{s^2(s^2+1)}{(s^2+1)(s^2+3)s} = \frac{s}{s^2+3} \rightarrow \frac{\frac{1}{3}H}{1F}$$