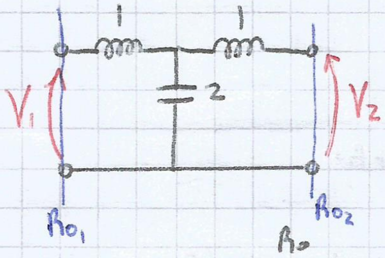
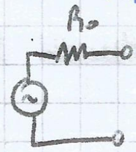
TS 14

1) Calcular parámetros S de siguiente Red:



- Para excitar uso v_g  en el puerto que corresponda según el parámetro.
- Como carga uso R_o.
- Elijo $R_{o_1} = R_{o_2} = R_o$.

- $S_{11} = \dfrac{Z_1 - R_o}{Z_1 + R_o}$ donde $Z_1 = s + \dfrac{1}{\dfrac{1}{s+R_o} + 2s} = s + \dfrac{1}{\dfrac{1+2s^2+2sR_o}{s+R_o}}$

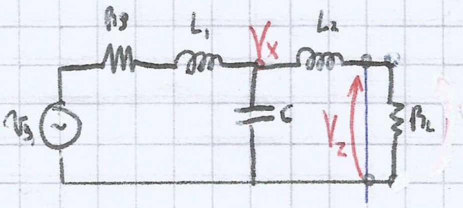
$$Z_1 = \frac{2s^3 + 2s^2R_o + s + s + R_o}{2s^2 + 2sR_o + 1}$$

$$Z_1 = \frac{s^3 + R_o s^2 + s + \frac{R_o}{2}}{s^2 + R_o s + \frac{1}{2}}$$

$$S_{11} = \frac{\dfrac{s^3 + \cancel{R_o s^2} + s + \cancel{R_o/2} - \cancel{s^2 R_o} - R_o^2 s - \cancel{R_o/2}}{\cancel{s^2 + R_o s + 1/2}}}{\dfrac{s^3 + R_o s^2 + s + R_o/2 + s^2 R_o + R_o^2 s + R_o/2}{\cancel{s^2 + R_o s + 1/2}}}$$

$$\boxed{S_{11} = \frac{s^3 + s(1-R_o^2)}{s^3 + s^2 2R_o + s(1+R_o^2) + R_o}} = S_{22} \text{ por ser red simétrica}$$

- $S_{21} = \left.\dfrac{b_2}{a_1}\right|_{a_2=0} = \dfrac{V_2}{\frac{v_{g_1}}{2}}$



$$V_2 = V_x \cdot \frac{R_L}{R_L + sL_2}$$

$$V_x = v_{g_1} \cdot \frac{1}{sC + \frac{1}{R_L + sL_2}} \cdot \frac{1}{\dfrac{1}{sC + \frac{1}{R_L+sL_2}} + R_g + sL_1} = v_{g_1} \frac{R_L + sL_2}{\cancel{sCR_L + s^2L_2C + 1}} \cdot \frac{\cancel{sCR_L + s^2L_2C + 1}}{R_L + sL_2 + (R_g + sL_1)(sCR_L + s^2L_2C + 1)}$$

$$V_x = v_{g_1} \cdot \frac{R_0 + sL_2}{R_0 + sL_2 + sCR_0^2 + s^2L_2CR_0 + R_0 + s^2L_1CR_0 + s^3L_1L_2C + sL_1}$$

$$V_x = v_{g_1} \cdot \frac{s + R_0}{2s^3 + 4R_0 s^2 + (2+2R_0^2)s + 2R_0}$$

$$V_2 = V_x \cdot \frac{R_0}{R_0+s} = \frac{v_{g_1}}{2} \frac{R_0}{s^3 + 2R_0 s^2 + (1+R_0^2)s + R_0}$$

$$\boxed{S_{21} = \frac{V_2}{\frac{v_{g_1}}{2}} = \frac{R_0}{s^3 + 2R_0 s^2 + (1+R_0^2)s + R_0}} = S_{12} \quad \text{por red pasiva (recíproca)}$$

b) • $S_{11}(j\omega) = S_{11}(s)\Big|_{s=j\omega} = \dfrac{-j\omega^3}{-j\omega^3 - 2\omega^2 + 2j\omega + 1}$ (con $R_0 = 1$)

$$|S_{11}(j\omega)| = \frac{\omega^3}{\sqrt{(1-2\omega^2)^2 + (2\omega - \omega^3)^2}}$$

$\rightarrow |S_{11}(0)| = 0$

$\rightarrow |S_{11}(1)| = \frac{1}{\sqrt{2}}$

$\rightarrow |S_{11}(\infty)| = 1$

• $S_{21}(j\omega) = S_{21}(s)\Big|_{s=j\omega} = \dfrac{1}{-j\omega^3 - 2\omega^2 + 2j\omega + 1}$

$$|S_{21}(j\omega)| = \frac{1}{\sqrt{(1-2\omega^2)^2 + (2\omega - \omega^3)^2}}$$

$\rightarrow |S_{21}(0)| = 1$

$\rightarrow |S_{21}(1)| = \frac{1}{\sqrt{2}}$

$\rightarrow |S_{21}(\infty)| = 0$

NOTA