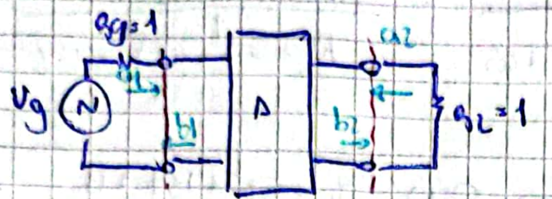
TP Semanal 13:



$b = S \cdot a$

$b_1 = a_1 \cdot S_{11} + a_2 \cdot S_{12}$

$b_2 = a_1 S_{21} + a_2 \cdot S_{22}$

Diseño Bessel

$$\text{Cotg}\,h(p) = \frac{1}{p} + \frac{1}{\frac{3}{p} + \frac{1}{5/p}} = \frac{1}{p} + \frac{1}{\frac{3}{p}+\frac{p}{5}} = \frac{1}{p} + \frac{5p}{15+p^2}$$

$$\text{Cotgh}(p) = \frac{15 + p^2 + 5p^2}{p(p^2+15)} = \frac{6p^2+15}{p(p^2+15)}$$

$$T(p) = \frac{k}{\text{senh}(p) + \cosh(p)} = \frac{15}{p^3+6p^2+15p+15}$$

1) La impedancia de entrada la calculo con el parámetro S_{11}

$$S_{11} = \frac{Z_{in} - R_{o1}}{Z_{in} + R_{o1}} \rightarrow Z_{in} = \frac{1+S_{11}}{1-S_{11}}$$

Red no disipativa $\rightarrow |S_{11}|^2 + |S_{12}|^2 = 1$

$$|S_{12}|^2 = T(p) \cdot T(-p) = \frac{15}{p^3+6p^2+15p+15} \cdot \frac{15}{-p^3+6p^2-15p+15}$$

$$|S_{12}|^2 = \frac{225}{-p^6 + p^5(6-6) + p^4(-15+36-15) + p^3(\cancel{-90+90}) + p^2(90-225+90) + p\,\cancel{(+225-225)} + 225}$$

$$|S_{12}|^2 = \frac{225}{-p^6 + p^4\, 6 - p^2 \cdot 45 + 225}$$

Obtengo $|S_{11}|^2$

$$|S_{11}|^2 = 1 - |S_{12}|^2 = 1 - \frac{225}{-p^6 + 6p^4 - 45p^2 + 225} = \frac{-p^6 + 6p^4 - 45p^2}{-p^6 + 6p^4 - 45p^2 + 225}$$

$$|S_{11}|^2 = S_{11}(p) \cdot S_{11}(-p) \rightarrow S_{11}(p) = \frac{P(p)}{Q(p)} \rightarrow Q(p) = p^3 + 6p^2 + 15p + 15$$

$$(a p^3 + b p^2 + c p + \cancel{d}) \cdot (-a p^3 + b p^2 - c p + \cancel{d}) = -p^6 + 6p^4 - 45p^2$$

$\boxed{p^0}$ $d = 0$

$\boxed{p^6}$ $-a^2 = -1 \rightarrow a = 1$

$\boxed{p^2}$ $-c^2 = -45 \rightarrow c = \sqrt{45}$

$\boxed{p^4}$ $-a \cdot c + b^2 - ac = 6$

$$-2ac + b^2 = 6$$

$$b^2 = 6 + 2 \cdot 1 \cdot \sqrt{45}$$

$$b = 4{,}406$$

$$S_{11} = \frac{p^3 + 4{,}406\, p^2 + \sqrt{45}\, p}{p^3 + 6p^2 + 15p + 15}$$

Encuentro Zin

$$Z_{in} = \frac{S_{11} + 1}{1 - S_{11}} = \frac{\frac{num}{den} + 1}{1 - \frac{num}{den}} = \frac{num + den}{den - num} = \frac{2p^3 + p^2\, 10{,}406 + p\, 21{,}7 + 15}{p^2 \cdot 1{,}59 + p \cdot 8{,}29 + 15}$$

Sintetizo red escalera por Cauer → pasabajo → remuevo en ∞

$$2p^3 + p^2 \cdot 10{,}406 + p\, 21{,}7 + 15 \;\big|\; p^2\, 1{,}594 + p \cdot 8{,}29 + 15$$

$$-\; 2p^3 + p^2 \cdot 10{,}401 + p \cdot 16{,}82 \qquad 1{,}254\, p$$

$$p \cdot 2{,}88 + 15 \qquad 0{,}554\, p$$

1,254

$$p^2\, 1{,}5947 + p\, 8{,}29 + 15$$

$$p^2\, 1{,}594 + p\, 8{,}29 + 0$$

$$15 \qquad 0{,}192\, p$$

$\frac{1}{1}$ 0,554

$$p \cdot 2{,}88 + 15$$

$$p \cdot 2{,}88 + 0$$

$$15 \;\big|\; 15$$

$$\frac{15}{0} \qquad 1$$

0,192

$\}$ 1

Síntesis Final