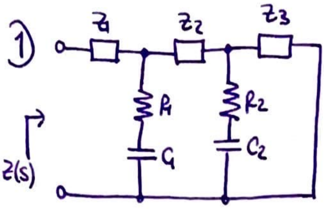
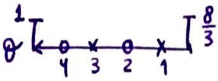
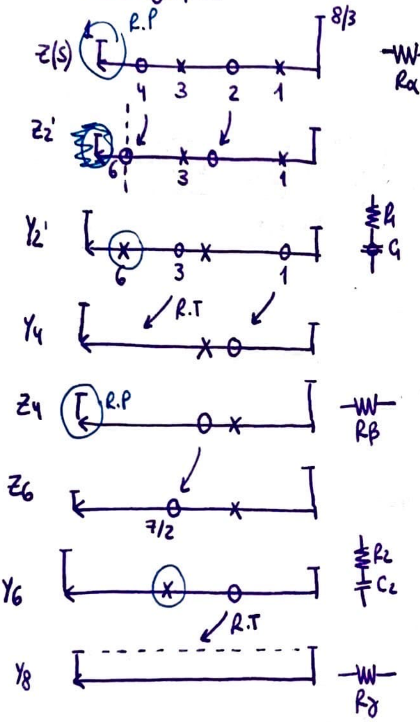
1)



$$Z(s)=\frac{(s^2+6s+8)}{(s^2+4s+3)} \quad R_1C_1=\frac{1}{6} \quad R_2C_2=\frac{2}{7} \quad Z(s)=\frac{(s+2)(s+4)}{(s+1)(s+3)}$$



Método gráfico



Álgebra

$$Z_2' = Z - Z_1 = Z - R\alpha$$

$$R\alpha = Z(s)\Big|_{s=-6} = \frac{(4)(-2)}{(-5)(-3)} = \frac{8}{15}$$

$$Z_2' = \frac{(s+2)(s+4) - 8/15(s+1)(s+3)}{(s+1)(s+3)}$$

$$= \frac{s^2(1-8/15)+s(6-32/15)+(8-8/5)}{(s+1)(s+3)} = \frac{\frac{7}{15}s^2+\frac{58}{15}s+\frac{32}{5}}{(s+1)(s+3)}$$

$$= \frac{7}{15}\frac{(s+16/7)(s+6)}{(s+1)(s+3)}$$

$$Y_2' = \frac{15}{7}\frac{(s+1)(s+3)}{(s+16/7)(s+6)}$$

$$Y_{R_1C_1} = \frac{s\cdot 1/R_1}{s+1/R_1C_1} = \frac{s/R_1}{s+6}$$

$$\lim_{s\to 6} Y_2' = \lim_{s\to 6} Y_{R_1C_1} \to \frac{1}{R_1} = \lim_{s\to 6} Y_2'\cdot\frac{(s+6)}{s}$$

$$\frac{1}{R_1} = \lim_{s\to 6}\frac{15}{7}\frac{(s+1)(s+3)}{s(s+16/7)} = \frac{15}{7}\frac{(-5)(-3)}{-6(-26/7)} = \frac{15^2}{6\cdot 26} = \frac{225}{156} = \frac{75}{52}$$

$$C_1 = \frac{1}{6R_1} = \frac{1}{6}\cdot\frac{75}{52} = \frac{25}{104}$$

$$Y_4 = Y_2' - Y_{R_1C_1} = \frac{15/7(s+1)(s+3)}{(s+16/7)(s+6)} - \frac{s\cdot 75/52}{s+6} = \frac{15/7(s+1)(s+3) - 75/52\, s(s+16/7)}{(s+16/7)(s+6)}$$

$$= \frac{\frac{15}{7}(s^2+4s+3) - \frac{75}{52}(s^2+\frac{16}{7}s)}{(s+16/7)(s+6)} = \frac{s^2\left(\frac{255}{364}\right)+s\left(\frac{60}{7}-\frac{300}{91}\right)+\frac{45}{7}}{(s+16/7)(s+6)} = \frac{\frac{255}{364}s^2+\frac{480}{91}s+\frac{45}{7}}{(s+16/7)(s+6)} = \frac{(s+\frac{26}{17})\cancel{(s+6)}\cdot\frac{255}{364}}{(s+16/7)\cancel{(s+6)}}$$

$$Z_4 = \frac{364}{255}\frac{(s+16/7)}{(s+26/17)} \quad Z_6 = Z_4 - R\beta \quad R\beta = Z_4(s)\Big|_{s=-7/2} =$$

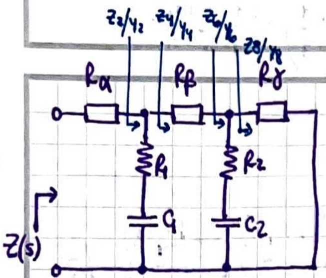
$$R\beta = \frac{(-7/2+16/7)}{(-7/2+26/17)}\cdot\frac{364}{255} = \frac{364}{255}\cdot\frac{34}{14}\cdot\frac{(-49+32)}{(-119+52)} = \frac{364}{255}\cdot\frac{34}{14}\cdot\frac{(-17)}{(-67)} = \frac{884}{1005}$$

$$Z_6 = Z_4 - R_\beta = \frac{364}{255}\frac{(s+16/7)}{(s+26/17)} - \frac{884}{1005} = \frac{\frac{364}{255}\left(s+\frac{16}{7}\right) - \frac{884}{1005}\left(s+\frac{26}{17}\right)}{s+26/17} = \frac{s\left(\frac{624}{1139}\right) + \left(\frac{832}{255} - \frac{1352}{1005}\right)}{s+26/17}$$

$$Y_6 = \frac{s+26/17}{s+1{,}9175}$$

$$\lim_{s\to -7/2} Y_6(s) = \lim_{s\to -7/2} Y_{R_2C_2} \rightarrow Y_{R_2C_2} = \frac{s\,1/R_2}{s+1/R_2C_2} = \frac{s\,1/R_2}{s+7/2}$$

$$\frac{1}{R_2} = \lim_{s\to -\frac{7}{2}} \frac{s+26/17}{s+1{,}9175}\cdot\frac{s+7/2}{s}$$? → Debería anularse $(s+7/2)$



$$Z(s)=\frac{(s+2)(s+4)}{(s+1)(s+3)}$$

$$Z_2=Z(s)-R_\alpha \qquad R_\alpha=Z(s)\Big|_{s=-6}=\frac{(-4)(-2)}{(-5)(-3)}=\frac{8}{15}$$

$$Z_2=\frac{(s+2)(s+4)-8/15\,(s+1)(s+3)}{(s+1)(s+3)}=\frac{s^2\cdot\frac{7}{15}+s\cdot\frac{58}{15}+\frac{32}{5}}{(s+1)(s+3)}$$

$$Z_2=\frac{7}{15}\,\frac{(s+16/7)(s+6)}{(s+1)(s+3)}$$

$$Y_2=\frac{15}{7}\,\frac{(s+1)(s+3)}{(s+16/7)(s+6)} \qquad Y_4=Y_2-Y_{R_1C_1} \qquad Y_{R_1C_1}=\frac{s\cdot 1/R_1}{s+1/R_1C_1}=\frac{s\cdot 1/R_1}{s+6}$$

$$\lim_{s\to-6}Y_{R_1C_1}=\lim_{s\to-6}Y_2\rightarrow\frac{1}{R_1}=\lim_{s\to-6}\frac{15}{7}\frac{(s+1)(s+3)}{(s+16/7)(s+6)}\cdot\frac{(s+6)}{s}=\frac{(-5)(-3)}{-6(-26/7)}\cdot\frac{15}{7}=\frac{75}{52}\rightarrow R_1=\frac{52}{75}$$

$$C_1=\frac{1}{6R_1}=\frac{1}{6}\cdot\frac{75}{52}=\frac{25}{104}$$

$$Y_4=\frac{\frac{15}{7}(s+1)(s+3)-\frac{1}{R_1}\cdot s\cdot(s+16/7)}{(s+16/7)(s+6)}=\frac{s^2\cdot\frac{255}{364}+s\cdot\frac{480}{91}+\frac{45}{7}}{(s+16/7)(s+6)}=\frac{255}{364}\,\frac{(s+26/17)\cancel{(s+6)}}{(s+16/7)\cancel{(s+6)}}$$

$$Y_4=\frac{255}{364}\,\frac{(s+26/17)}{(s+16/7)}$$

$$Z_4=\frac{364}{255}\,\frac{(s+16/7)}{(s+26/17)} \qquad Z_6=Z_4-R_\beta \qquad R_\beta=Z_4(s)\Big|_{s=-7/2}=\frac{884}{1005}$$

$$Z_6=\frac{364}{255}\,\frac{(s+16/7)}{(s+26/17)}-\frac{884}{1005}=\frac{\frac{364}{255}(s+16/7)-\frac{884}{1005}(s+26/17)}{s+26/17}=\frac{\frac{624}{1139}\cdot s+\frac{624}{1139}\cdot\frac{7}{2}}{s+26/17}=\frac{624}{1139}\,\frac{s+7/2}{s+26/17}$$

$$Y_6=\frac{1139}{624}\,\frac{(s+26/17)}{(s+7/2)} \qquad Y_{R_2C_2}=\frac{s\cdot 1/R_2}{s+7/2} \qquad \lim_{s\to-7/2}Y_{R_2C_2}=\lim_{s\to-7/2}Y_6$$

$$\frac{1}{R_2}=\lim_{s\to-7/2}\frac{1139}{624}\,\frac{(s+26/17)}{(s+7/2)}\cdot\frac{(s+7/2)}{s}=\frac{1139}{624}\cdot\frac{(-7/2+26/17)}{-7/2}=\frac{4489}{4368}$$

$$C_2=\frac{2}{7}\cdot\frac{4489}{4368}=\frac{4489}{15288}$$

$$Y_8 = \frac{1}{R_8} = Y_6 - Y_{R_2C_2} = \frac{1139}{624}\frac{(s+26/17)}{s+7/2} - \frac{4489}{4368}\cdot\frac{s}{s+7/2} = \frac{1}{s+7/2}\left(\frac{67}{84}s + \frac{67}{24}\right) = \frac{67}{84}\frac{(s+7/2)}{(s+7/2)}$$

$$\to \frac{1}{R_8} = \frac{67}{84}$$

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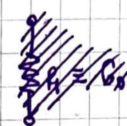
2)

$$Z(s) = \frac{(s^2+s+1)}{(s^2+2s+5)(s+1)} = \frac{\left(s+\frac{1-j\sqrt{3}}{2}\right)\left(s+\frac{1+j\sqrt{3}}{2}\right)}{(s+1)(s+1-j2)(s+1+j2)} \quad (?)$$

$$Y(s) = \frac{(s^2+2s+5)(s+1)}{(s^2+s+1)}$$

 $C_1 \equiv s\cdot k_\infty$



$$\lim_{s\to\infty} Y(s) = \lim_{s\to\infty} s\, C_1 \to C_1 = \lim_{s\to\infty}\frac{Y(s)}{s} = 1$$

$$Y_2 = Y - sC_1 = Y - s\cdot 1 = \frac{(s^2+2s+5)(s+1)}{(s^2+s+1)} - \frac{s(s^2+s+1)}{(s^2+s+1)} = \frac{s^3+s^2(1+2)+s(2+5)+5-s^3(1)-s^2(1)-s}{(s^2+s+1)}$$

$$= \frac{2s^2+6s+5}{s^2+s+1} = \frac{2\left(s^2+3s+5/2\right)}{s^2+s+1}$$

$$Y_3 = Y_2 - G_{R_1} = \frac{2s^2+6s+5-\frac{1}{R_1}s^2-\frac{1}{R_1}s-\frac{1}{R_1}}{s^2+s+1} = \frac{1}{s^2+s+1}\cdot\left(s^2\left(2-\frac{1}{R_1}\right)+s\left(6-\frac{1}{R_1}\right)+\left(5-\frac{1}{R_1}\right)\right)$$

$$Z_3 = \frac{s^2+s+1}{\left(2-\frac{1}{R_1}\right)s^2+\left(6-\frac{1}{R_1}\right)s+\left(5-\frac{1}{R_1}\right)}$$

No hay término cuadrát. en el den.

$Z_3 = ?$ ↳ forma?

$$sL_1 + R_2 + \frac{1}{sC_2+\frac{1}{R_3}} = sL_1 + R_2 + \frac{R_3}{sC_2R_3+1} = \frac{(sL_1+R_2)(sC_2R_3+1)+R_3}{sC_2R_3+1} = \frac{s^2L_1C_2R_3 + s(L_1+C_2R_2R_3)+(R_2+R_3)}{sC_2R_3+1}$$

$$\Rightarrow 2-\frac{1}{R_1} = 0 \Rightarrow R_1 = \frac{1}{2} \Rightarrow Z_3 = \frac{s^2+s+1}{4s+3}$$

$$L \equiv k_\infty\cdot s \Rightarrow \lim_{s\to 0} Z_3 = \lim_{s\to 0} L_1\cdot s \to L_1 = \lim_{s\to 0}\frac{(s^2+s+1)}{(4s+3)\cdot s} = \frac{1}{4}$$

$$\Rightarrow Z_4 = Z_3 - sL = \frac{s^2+s+1-\frac{1}{4}(4s+3)s}{4s+3} = \frac{\frac{1}{4}s+1}{4s+3} = \frac{1}{16}\frac{(s+4)}{(s+3/4)}$$

$$Z_5 = Z_4 - R_2 = \frac{\frac{1}{4}s+1-4sR_2-3R_2}{4s+3} \qquad Z_5 = \frac{1}{sC_2+1/R_3} = \frac{R_3}{sC_2R_3+1}$$ → Sin término s en el num.

$$= \frac{s\left(\frac{1}{4}-4R_2\right)+(1-3R_2)}{4s+3} \to \frac{1}{4} = 4R_2 \to R_2 = \frac{1}{16}$$

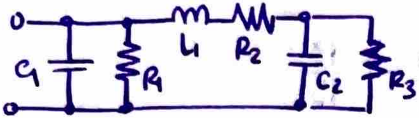
$$Z_5 = \frac{1/4\,S + 1}{4S+3} - \frac{1}{16} = \frac{1}{4S+3}\left(S\left(\frac{1}{4} - 4\cdot\frac{1}{16}\right) + \left(1 - 3\cdot\frac{1}{16}\right)\right) = \frac{13/16}{4S+3}$$

$$Y_5 = \frac{4S+3}{13/16} = \frac{16}{13}\cdot 4\left(S+3/4\right) = \frac{64}{13}\left(S+3/4\right) = \frac{64}{13}S + \frac{48}{13}$$

$$\frac{1}{C_2} \equiv S\cdot k_\infty \rightarrow C_2 = \lim_{S\to\infty} \frac{64/13\,S + 48/13}{S} = \frac{64}{13}$$

$$\rightarrow \frac{1}{R_3} = Y_5 - SC_2 = \frac{64}{13}S + \frac{48}{13} - \frac{64}{13}S = \frac{48}{13}$$

Comprobación



$$Y_5 = SC_2 + \frac{1}{R_3} = S \cdot \frac{64}{13} + \frac{48}{13} = \frac{16}{13}(4S+3)$$

$$Z_5 = \frac{13}{16} \cdot \frac{1}{4S+3}$$

$$Z_3 = SL_1 + R_2 + Z_5 = S \cdot \frac{1}{4} + \frac{1}{16} + \frac{13}{16} \cdot \frac{1}{4S+3} = \frac{1}{16}\left(4S+1+\frac{13}{4S+3}\right)$$

$$= \frac{1}{16}\left(\frac{(4S+1)(4S+3)+13}{4S+3}\right) = \frac{1}{16}\left(\frac{16S^2+16S+16}{4S+3}\right) = \frac{S^2+S+1}{4S+3}$$

$$Y_3 = \frac{4S+3}{S^2+S+1}$$

$$Y = SC_1 + \frac{1}{R_1} + Y_3 = S+2+\frac{4S+3}{S^2+S+1} = \frac{(S+2)(S^2+S+1)+4S+3}{S^2+S+1}$$

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

$$(S^2+2S+5)(S+1) = S^3+S^2(1+2)+S(2+5)+5 = S^3+3S^2+7S+5$$

↳ Se comprueba.