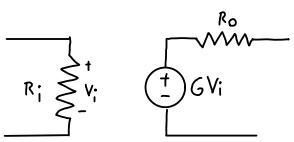
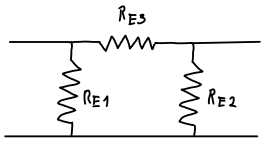
1) C 2) C 3) A 4) C 5) –

II a) Série – Série

Transadmitância $A_f = \frac{I_2}{V_1}$

b)





$Z_{11} = \left.\frac{V_1}{I_1}\right|_{I_2=0} = R_i \quad Z_{12} = \left.\frac{V_1}{I_2}\right|_{I_1=0} = 0$

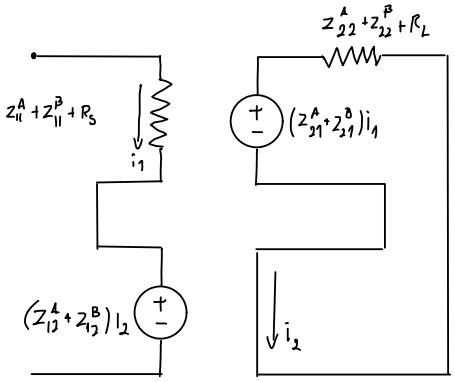
$Z_{21} = \left.\frac{V_2}{I_1}\right|_{I_2=0} = AR_i \quad Z_{22} = \left.\frac{V_2}{I_2}\right|_{I_1=0} = R_o$

$Z_{11} = \left.\frac{V_1}{I_1}\right|_{I_2=0} = R_{E1} /\!/ (R_{E2}+R_{E3}) \quad Z_{12} = \left.\frac{V_1}{I_2}\right|_{I_1=0} = \frac{R_{E1}\cdot R_{E2}}{(R_{E1}+R_{E2}+R_{E3})}$

$Z_{21} = \left.\frac{V_2}{I_1}\right|_{I_2=0} = \frac{R_{E1}\cdot R_{E2}}{(R_{E1}+R_{E2}+R_{E3})} \quad Z_{22} = \left.\frac{V_2}{I_2}\right|_{I_1=0} = R_{E2} /\!/ (R_{E1}+R_{E3})$

$$A = \begin{bmatrix} 2\,k & 0 \\ -1M & 200 \end{bmatrix} \Omega \qquad B = \begin{bmatrix} 1.714K & 285.7 \\ 285.7 & 1.714k \end{bmatrix}$$

c)



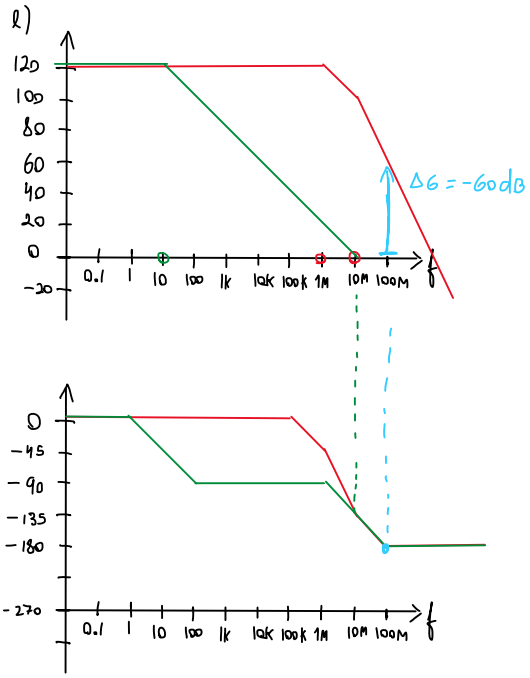
$A' = -\frac{Z_{21}^A + Z_{21}^B}{(Z_{11}^A + Z_{11}^B + R_S)(Z_{22}^A + Z_{22}^B + R_L)} = 22.6\,mS$

$B' = Z_{12}^A + Z_{12}^B = 286\,\Omega$

d) $A_f = \frac{A}{1 + AB} = 3\,mS$

$K_V = -A_f R_L = -30$

e)



III a) $A_p = 3dB \quad A_s = 24dB$

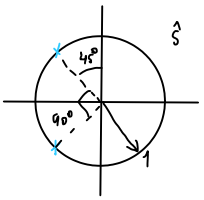
$\omega_p = 10\,kHz \quad \omega_s = 40\,kHz$

$\Omega_p = 1 \quad \Omega_s = 4$

$A(\Omega_p) = 3\,dB \iff 3 = 10\log(1+\varepsilon^2) \iff \varepsilon = 1$

$A(\Omega_s) = 24\,dB \iff 24 = 10\log(1+\Omega^{2m}) \iff m = 2 \quad (A(\Omega_s) = 24dB)$

$H(S) = S^2 + \sqrt{2}\,S + 1 \qquad T(s) = \left.\frac{1}{H(S)}\right|_{s=\frac{s}{\omega_p}} = \frac{\omega_p^2}{s^2 + \sqrt{2}\,\omega_p s + \omega_p^2} = \frac{3.95\times10^9}{s^2 + 88.86\times10^4 s + 3.95\times10^9}$



b) A transformação bilinear mantem a estabilidade, logo é estável

25kHz é muito atenuado, ganho menor, isto porque as frags não correspondem

c) Melhor LC duplamente terminados

Melhor RC ativos → Simulam RL duplamente terminados

d) Divisor resistivo cujo o paralelo é o valor da impedância substituída

IV

a) $$\frac{s\frac{K}{RC}}{s^2+\left(\frac{4}{CR}-\frac{K}{CR}\right)s+\frac{2}{R^2C^2}}$$

$\omega_p = \sqrt{\frac{2}{R^2C^2}} = 141,42\,k\text{rad/s} \Rightarrow 22,5\,k\text{Hz}$

$\frac{4}{CR} - \frac{K}{CR} = 0 \Leftrightarrow K = 4$

b) Sim filtrando e simplificando os seus harmónicos

c) A carga de C_B perde-se //