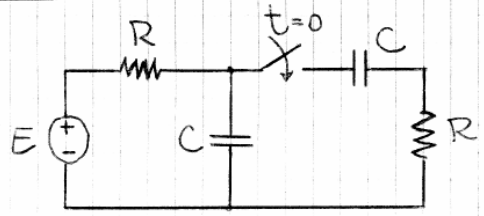
ES. 1

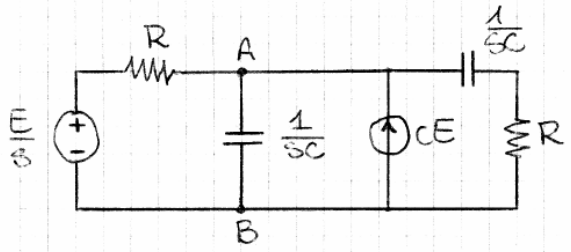
16/02/06




$R = 1\,\Omega$

$C = 1\,mF$

circuito trasformato:




$$V_{AB} = \frac{\frac{E}{sR} + cE}{\frac{1}{R} + cs + \frac{1}{R + 1/sC}} = \frac{1}{s} \frac{\frac{E}{R} + csE}{\frac{1+csR}{R} + cs(scR+1) + cs} =$$

$$= \frac{E}{sR} \cdot \frac{(1+RCs)\cdot(1+RCs)}{\frac{1}{R}(1+csR + c^2s^2R^2 + csR + csR)}$$

$$= \frac{E}{s} \frac{(1+csR)^2}{c^2s^2R^2 + 3csR + 1} = \frac{E}{sc^2R^2} \cdot \frac{(1+csR)^2}{s^2 + 3\frac{s}{cR} + \frac{1}{c^2R^2}}$$

$$s^2 + 3\frac{s}{cR} + \frac{1}{c^2R^2} = 0$$

$$s_{1,2} = -\underbrace{\frac{1}{cR}}_{1000} \cdot \left(\frac{3 \pm \sqrt{5}}{2}\right) \qquad V_{AB} = \frac{10^6 E}{s} \frac{(1+10^{-3}s)^2}{\left(s + 10^3 \cdot \frac{3+\sqrt{5}}{2}\right)\cdot\left(s + 10^3 \cdot \frac{3-\sqrt{5}}{2}\right)}$$

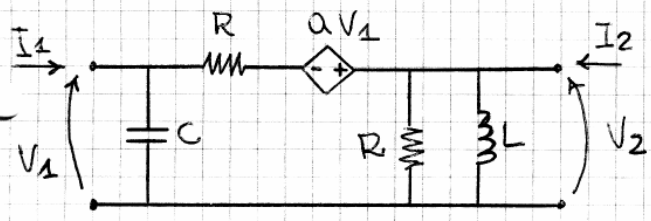
$$V_{AB} = 10^6 E \cdot \left[\frac{A}{s} + \frac{B}{s + 10^3 \frac{3+\sqrt{5}}{2}} + \frac{C}{s + 10^3 \cdot \frac{3-\sqrt{5}}{2}}\right]$$

$$A = \frac{1}{10^3 \frac{3+\sqrt{5}}{2} \cdot 10^3 \frac{3-\sqrt{5}}{2}} = 10^{-6} \frac{9-5}{4} = 10^{-6} \qquad B = \dots = \frac{10^{-6}}{\sqrt{5}} \quad ; \quad C = -\frac{10^{-6}}{\sqrt{5}}$$

$$v_{AB}(t) = E \cdot \left[1 + \frac{1}{\sqrt{5}} e^{-10^3 \frac{3+\sqrt{5}}{2} t} - \frac{1}{\sqrt{5}} e^{-10^3 \frac{3-\sqrt{5}}{2} t}\right]$$

16/02/06

## ES.2




$R = 0{,}5\,\Omega$ $\quad a = k+1$

$L = 0{,}5\,H$

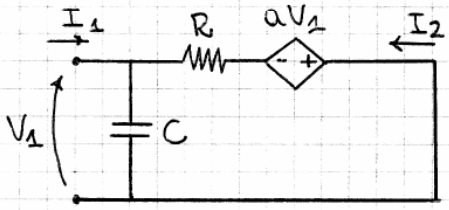
$C = 1\,mF$

$$\begin{cases} I_1 = Y_{11} V_1 + Y_{12} V_2 \\ I_2 = Y_{21} V_1 + Y_{22} V_2 \end{cases}$$

$$Y_{11} = \left.\frac{I_1}{V_1}\right|_{V_2=0} \qquad Y_{21} = \left.\frac{I_2}{V_1}\right|_{V_2=0}$$

$$Y_{12} = \left.\frac{I_1}{V_2}\right|_{V_1=0} \qquad Y_{22} = \left.\frac{I_2}{V_2}\right|_{V_1=0}$$

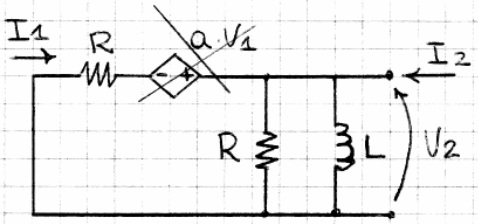
$Y_{11}$ e $Y_{21}$ si calcolano cortocircuitando la porta 2




$$I_1 = SCV_1 + \frac{aV_1 + V_1}{R} \qquad Y_{11} = SC + \frac{a+1}{R} = SC + \frac{K+2}{R}$$

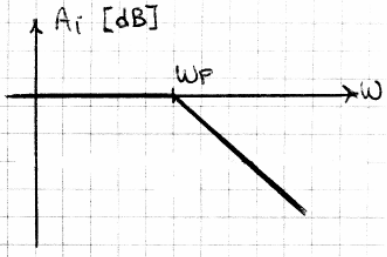
$$I_2 = \frac{-aV_1 - V_1}{R} \qquad Y_{21} = \frac{\frac{-aV_1 - V_1}{R}}{V_1} = \frac{-a-1}{R} = \frac{-K-2}{R}$$

$Y_{12}$ e $Y_{22}$ si calcolano cortocircuitando la porta 1




$$Y_{22} = \left.\frac{I_2}{V_2}\right|_{V_1=0} = \frac{1}{2R} + \frac{1}{SL}$$

$$I_1 = -\frac{V_2}{R} \qquad Y_{12} = \left.\frac{I_1}{V_2}\right|_{V_1=0} = -\frac{\frac{V_2}{R}}{V_2} = -\frac{1}{R}$$




$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} SC + \frac{K+2}{R} & -\frac{1}{R} \\ \frac{-K-2}{R} & \frac{1}{2R} + \frac{1}{SL} \end{bmatrix} \cdot \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$A_i = \left.\frac{I_2}{I_1}\right|_{V_2=0} = \frac{\frac{-aV_1 - V_1}{R}}{SCV_1 + \frac{aV_1 + V_1}{R}} = \frac{-(a+1)}{SCR + a + 1} = -\frac{a+1}{SCR + a + 1}$$

$$A_i = -\frac{1}{S\frac{CR}{a+1} + 1}$$