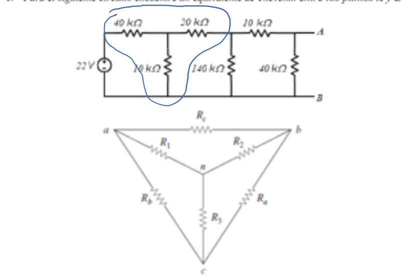
8 de octubre

viernes, 8 de octubre de 2021 1:24 p. m.

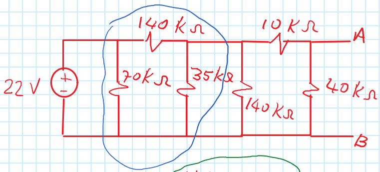
1. *Para el siguiente circuito encuentre un equivalente de Thévenin entre los puntos A y B*



$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1} \qquad R_1 = \frac{R_bR_c}{R_a + R_b + R_c}$$

$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2} \qquad R_2 = \frac{R_cR_a}{R_a + R_b + R_c}$$

$$R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3} \qquad R_3 = \frac{R_aR_b}{R_a + R_b + R_c}$$

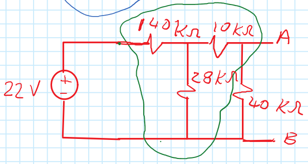


$$R_b = \frac{40 \cdot 10 + 40 \cdot 20 + 20 \cdot 10}{20}\ k\Omega = 70\ k\Omega$$

$$R_c = \frac{1400}{10}\ k\Omega = 140\ k\Omega$$

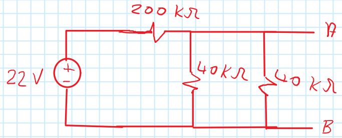
$$R_a = \frac{1400}{40}\ k\Omega = 35\ k\Omega$$

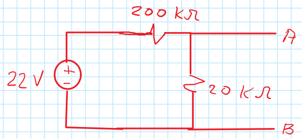
$35\ k\Omega \parallel 140\ k\Omega = 28\ k\Omega$

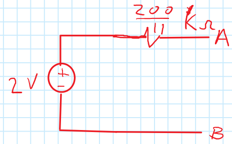


$$R_{c2} = \frac{140 \cdot 28 + 140 \cdot 10 + 10 \cdot 28}{28}\ k\Omega = 200\ k\Omega$$

$$R_{a2} = \frac{5600}{140}\ k\Omega = 40\ k\Omega$$



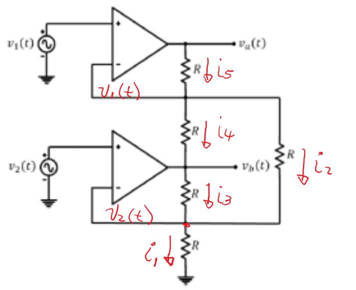




$$V_{AB\,oc} = 22\,V\ \frac{20}{220} = 2\ V$$

$$R_{TH} = 200\ k\Omega \parallel 20\ k\Omega = \frac{200}{11}\ k\Omega$$

2. *Para el circuito de la siguiente figura calcular los voltajes v_a, v_b en función de v_1 y v_2. Asuma Amplificadores operacionales ideales.*



$$i_1 = \frac{v_2(t)}{R} \qquad i_2 = \frac{v_1(t) - v_2(t)}{R}$$

$$i_2 + i_3 = i_1 \Rightarrow i_3 = i_1 - i_2 = \frac{v_2(t)}{R} - \frac{v_1(t) - v_2(t)}{R} = \frac{2v_2(t) - v_1(t)}{R}$$

$$i_3 = \frac{v_b(t) - v_2(t)}{R}$$

$$\frac{v_b(t) - v_2(t)}{R} = \frac{2v_2(t) - v_1(t)}{R} \Rightarrow v_b(t) = 3v_2(t) - v_1(t)$$

$$i_4 = \frac{v_1(t) - v_b(t)}{R} = \frac{v_1(t) - 3v_2(t) + v_1(t)}{R} = \frac{2v_1(t) - 3v_2(t)}{R}$$

$$i_5 = i_4 + i_2 = \frac{2v_1(t) - 3v_2(t)}{R} + \frac{v_1(t) - v_2(t)}{R} = \frac{3v_1(t) - 4v_2(t)}{R}$$

$$i_5 = \frac{v_a(t) - v_1(t)}{R}$$

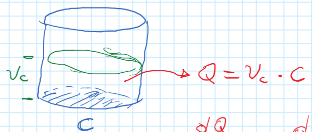
$$\frac{v_a(t) - v_1(t)}{R} = \frac{3v_1(t) - 4v_2(t)}{R}$$

$$v_a(t) = 4v_1(t) - 4v_2(t)$$

RESISTENCIA. $v_R = i_R \cdot R$

CONDENSADOR. $i_c = C \cdot \frac{dv_c}{dt}$

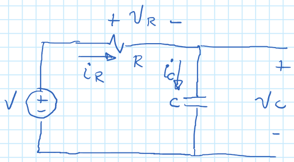
INDUCTANCIA $v_L = L\frac{di_L}{dt}$



$$Q = v_c \cdot C$$

$$\frac{dQ}{dt} = C \cdot \frac{dv_c}{dt}$$

$$i_c = C\frac{dv_c}{dt}$$



$$i_R = i_c$$

$$i_c = C\frac{dv_c}{dt}$$

$$v_R = RC\frac{dv_c}{dt}$$

$$V - v_R - v_c = 0$$

$$v_R + v_c = V$$

$$RC\frac{dv_c}{dt} + v_c = V$$

$$RC\frac{d^2v_c}{dt^2} + \frac{dv_c}{dt} = 0$$

$$\frac{d^2v_c}{dt^2} + \frac{1}{RC}\frac{dv_c}{dt} = 0$$

$$\frac{dv_c}{dt} = D\,v_c(t)$$

$$\frac{d^2v_c}{dt^2} = D^2\,v_c(t)$$

$$\left(D^2 + \frac{D}{RC}\right)v_c(t) = 0$$

$$\boxed{D\left(D + \frac{1}{RC}\right)v_c(t) = 0}$$

$\rightarrow v_c(t) = K_1$

$\rightarrow v_c(t) = K_2\,e^{-\frac{1}{RC}t}$

$$\boxed{v_c(t) = K_1 + K_2\,e^{-\frac{t}{RC}}}$$

$$\frac{d^2 v_c}{dt^2} + \frac{1}{RC}\frac{dv_c}{dt} = 0 \qquad \left(D^2 + \frac{D}{RC}\right) v_c(t) = 0 \qquad \longrightarrow v_c(t) = K_2\, e^{-\frac{t}{RC}}$$

$$f(t) = K \implies f'(t) = 0$$
$$D\, f(t) = 0$$

$$g(t) = K_1 t \implies D\, g(t) = K_1$$
$$D^2 g(t) = 0$$

$$h(t) = K_2\, e^{-\alpha t} \implies D\, h(t) = -\alpha K_2\, e^{-\alpha t}$$

$$D\, h(t) + \alpha h(t) = -\alpha K_2 e^{-\alpha t} + \alpha K_2 e^{-\alpha t} = 0$$

$$(D + \alpha)\, h(t) = 0$$

$$\boxed{v_c(t) = K_1 + K_2\, e^{-\frac{t}{RC}}}$$

$v_c(0) = v_{inicial} = v_i$

$v_c(\infty) = v_{final} = v_f$

$v_c(0) = K_1 + K_2 \implies K_2 = -K_1 + v_c(0) = v_i - K_1$

$$i_c(t) = C\frac{dv_c}{dt} = C\left[0 - \frac{1}{RC}K_2\, e^{-\frac{t}{RC}}\right] = -\frac{K_2}{R}\, e^{-\frac{t}{RC}}$$

$i_c(\infty) = 0$

$$\left.\begin{array}{l} i_c(\infty) = 0 \\ i_c(\infty) = i_R(\infty) = \dfrac{V - v_c(\infty)}{R} \end{array}\right\} \frac{V - v_c(\infty)}{R} = 0$$

$v_c(\infty) = V$

$v_f = V$

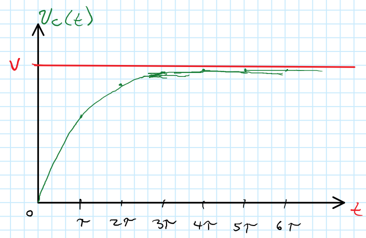
$v_c(\infty) = K_1 \implies v_f = K_1$

$$\boxed{v_c(t) = v_f + (v_i - v_f)\, e^{-\frac{t}{RC}}}$$

$RC = \tau \rightarrow$ constante de tiempo

$$i_c(t) = C\left[0 - \frac{1}{RC}(v_i - v_f)\, e^{-\frac{t}{RC}}\right]$$

$$i_c(t) = \frac{v_f - v_i}{R}\, e^{-\frac{t}{RC}}$$



Si $v_i = 0$ $\quad v_c(t) = v_f\left(1 - e^{-t/\tau}\right)$

$v_f = V$

$v_c(\tau) = V(1 - e^{-1}) = 0{,}6321\, V$

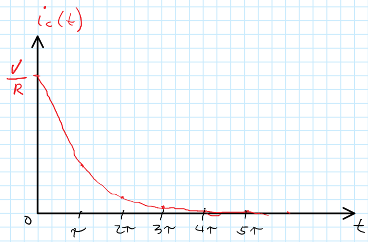
$v_c(2\tau) = V(1 - e^{-2}) = 0{,}8647\, V$

$v_c(3\tau) = V(1 - e^{-3}) = 0{,}9502\, V$

$v_c(4\tau) \cong V(1 - e^{-4}) = 0{,}9817\, V$

$v_c(5\tau) = V(1 - e^{-5}) = 0{,}9933\, V$

$v_c(6\tau) = V(1 - e^{-6}) = 0{,}9975\, V$



Si $v_i = 0$ $\quad V_f = V$

$i_c(\tau) = \frac{V}{R}e^{-1} = 0{,}3679\frac{V}{R}$

$v_c(2\tau) = \frac{V}{R}e^{-2} = 0{,}1353\frac{V}{R}$

$v_c(3\tau) = \frac{V}{R}e^{-3} = 0{,}0498\frac{V}{R}$

$v_c(4\tau) = \frac{V}{R}e^{-4} = 0{,}0183\frac{V}{R}$

$v_c(5\tau) = \frac{V}{R}e^{-5} = 0{,}0067\frac{V}{R}$