Solución

ELO102 – S1 2014 – Control #14 – 28 de julio de 2014

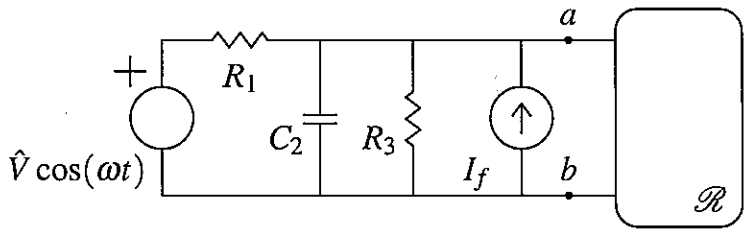
Problema 14.1 (10 puntos) *En la red de la figura,*

$\omega = 10[rad/s]$ $\quad R_1 = 600[\Omega]$

$\hat{V} = 200\sqrt{2}[V]$ $\quad C_2 = 0{,}25[\mu F]$

$I_f = 0{,}05[A]$ $\quad R_3 = 600[\Omega]$

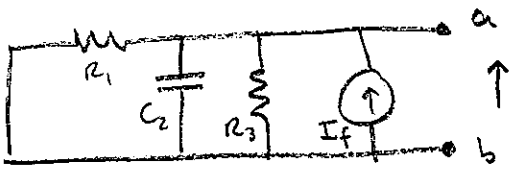
Determine el equivalente Thévenin en estado estacionario desde los terminales $a-b$.



Thévenin

a) Voltaje de circuito abierto: Existe una fuente constante y una sinusoidal, por tanto, aplicamos superposición:

Para frecuencia cero (se apaga fuente sinusoidal)



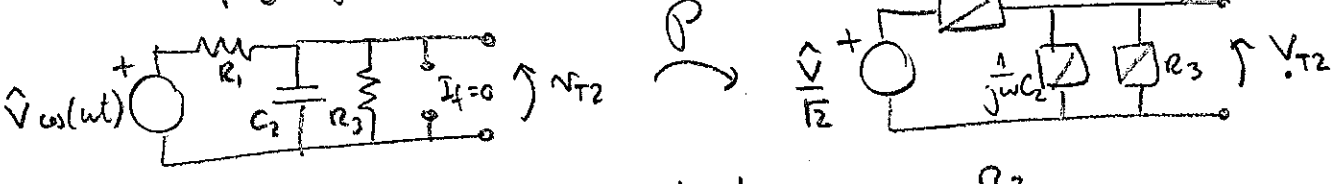
$\uparrow \quad v_{T1} = I_f (R_1 // R_3)$ pues en e.e. C_3 actúa como circuito abierto

$\Downarrow$

$v_{T1} = 0{,}05 \cdot \dfrac{(600)^2}{2\times 600}$

$= 15\,[V]$

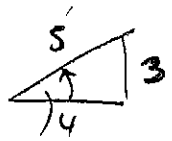
Para frecuencia ω:
(se apaga fuente constante)



$$\Rightarrow \quad V_{T2} = \frac{\hat{V}}{\sqrt{2}} \cdot \frac{R_3 // \frac{1}{j\omega C_2}}{R_1 + R_3 // \frac{1}{j\omega C_2}} = \frac{\frac{R_3}{1+j\omega C_2 R_3}}{R_1 + \frac{R_3}{1+j\omega C_2 R_3}} \cdot \frac{\hat{V}}{\sqrt{2}}$$

$$= \frac{\hat{V}}{\sqrt{2}} \cdot \frac{R_3}{(R_1+R_3) + j(\omega C_2 R_3 R_1)} = 200 \cdot \frac{600}{1200 + j\,900} = \frac{400}{4+j3}$$

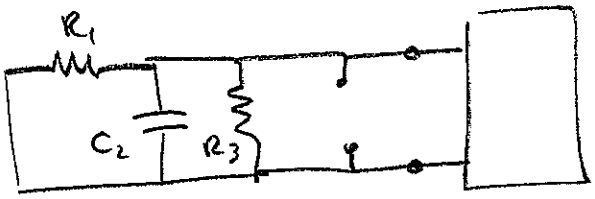
$$\Rightarrow v_{T2}(t) = \frac{400\sqrt{2}}{5}\cos(\omega t - 37°)$$



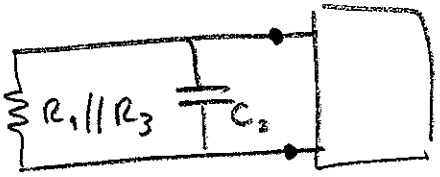
$\approx 37°$

$$\therefore v_T(t) = v_{T1} + v_{T2}(t)$$
$$= 15 + 80\sqrt{2}\cos(\omega t - 37°)$$

b) Red relajada: se apagan ambas fuentes y se simplifica el circuito, si es posible

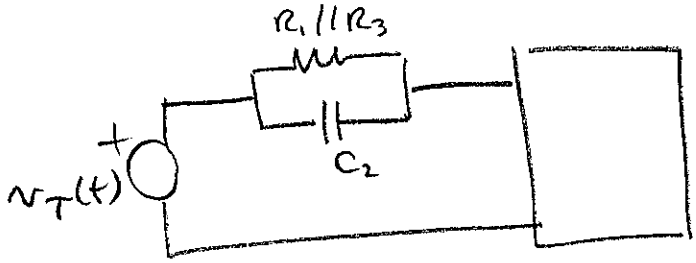


$\cong$



$$R_1 // R_3 = 300\ [\Omega]$$
$$C_2 = 0{,}25\ [mF]$$

$\therefore$ El equivalente Thévenin es



en que $R_1 // R_3 = 300\ [\Omega]$

$C_2 = 0{,}25\ [mF]$

$$v_T(t) = 15 + 80\sqrt{2}\cos(10t - 37°)$$