

Lucrare 2

Circuitul Circuit RC trece-vii

Beluciu Vlad

Memorul lucrării

Temă de istrare sinusoidal

BA $R = 12 \text{ k}\Omega$
 $C = 470 \text{ pF}$

a) $f_1 = 4 \cdot 10^5 \text{ Hz}$
Osciloscop (simulare)

$$\begin{aligned} T &= 5 \text{ div} \cdot 0,5 \mu = 2,5 \mu\text{s} \\ V_{in} &= 2,5 \text{ div} \cdot 2 \text{ V} = 5 \text{ V} \\ V_{out} &= 2,5 \text{ div} \cdot 2 \text{ V} = 5 \text{ V} \end{aligned} \quad \Rightarrow A = \frac{V_{out}}{V_{in}} = 1$$

$\Delta t = 0,5 \text{ div} \cdot 0,5 \mu\text{s} = 0,025 \mu\text{s}$

$$\phi = \frac{360}{T} = \frac{0,025 \cdot 360}{2,5} = 3,6^\circ$$

Teoretic

$$\omega = 2\pi f = 2\pi \cdot 4 \cdot 10^5 \text{ Hz} = 8\pi \cdot 10^5 \text{ Hz}$$

$$\begin{aligned} A &= \frac{1}{\sqrt{1 + (\omega RC)^2}} = \frac{1}{\sqrt{1 + 8\pi \cdot 10^5 \cdot 12 \cdot 10^3 \cdot 470 \cdot 10^{-12}}} \\ &= \frac{1}{\sqrt{1 + \frac{1}{(45120\pi \cdot 10^{-4})^2}}} = \frac{1}{\sqrt{1 + \frac{1}{290}}} \\ &= \frac{1}{\sqrt{1,005}} \approx 1 \end{aligned}$$

$$\phi = \arctan\left(\frac{1}{\omega RC}\right) = \arctan\left(\frac{1}{14,12251}\right) = \arctan(0,07) \approx 4^\circ$$

b) $f_2 = 4 \cdot 10^4 \text{ Hz}$

Oscilloscope (simulare)

$$T = 5 \text{ div} \cdot 5 \mu\text{s} = 25 \mu\text{s}$$

$$U_{iw} = 2,5 \text{ div} \cdot 2 \text{ V} = 5 \text{ V}$$

$$U_{ew} = 2 \text{ div} \cdot 2 \text{ V} = 4 \text{ V}$$

$$\rightarrow A = \frac{U_e}{U_i} = \frac{4}{5} = 0,8$$

$$t = 0,6 \text{ div} \cdot 5 \mu\text{s} = 3 \mu\text{s}$$

$$\phi = \frac{t \cdot 360}{T} = \frac{3 \cdot 360}{25} = 43,2^\circ$$

Theoretic

$$\omega = 2\pi f = 8\pi \cdot 10^4 \text{ Hz}$$

$$A = \frac{1}{\sqrt{1 + \frac{1}{(\omega RC)^2}}} = \frac{1}{\sqrt{1 + \frac{1}{(45120\pi \cdot 10^{-5})^2}}}$$

$$= \frac{1}{\sqrt{1 + \frac{1}{2024}}} = \frac{1}{\sqrt{1,5}} = \frac{1}{1,224} = 0,817$$

$$\phi = \arctan\left(\frac{1}{\omega RC}\right) = \arctan\left(\frac{1}{1,412}\right) = \arctan(0,708) \approx 35,3^\circ$$

$$c) f_3 = 4 \cdot 10^3 \text{ Hz}$$

Oscilloscope (simulare)

$$T = 5 \text{ div} \cdot 0,05 \text{ ms} = 0,25 \text{ ms} = 250 \mu\text{s}$$

$$U_{iw} = 2,5 \text{ div} \cdot 2V = 5V$$

$$U_{ew} = 0,6 \text{ div} \cdot 2V = 1,2V$$

$$\Rightarrow A = \frac{U_e}{U_i} = \frac{1,2}{5} = 0,24$$

$$t = 1,1 \text{ div} \cdot 0,05 \text{ ms} = 0,055 \text{ ms} = 55 \mu\text{s}$$

$$\varphi = \frac{t \cdot 360}{T} = \frac{55 \cdot 360}{250 \mu\text{s}} = 79,2^\circ$$

Theoretic

$$\omega = 2\pi f = 8\pi \cdot 10^3 \text{ Hz}$$

$$A = \frac{1}{\sqrt{1 + \frac{1}{(\omega RC)^2}}} = \frac{1}{\sqrt{1 + \frac{1}{(45120\pi \cdot 10^{-6})^2}}}$$

$$= \frac{1}{\sqrt{1 + \frac{1}{0,02}}} = \frac{1}{\sqrt{51}} = \frac{1}{7,141} =$$

$$= 0,14$$

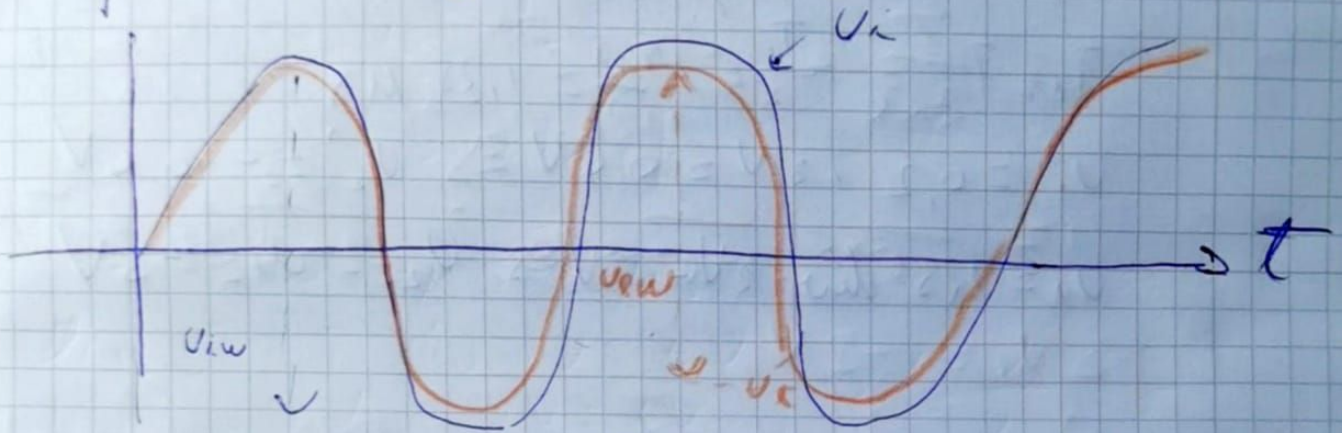
$$\varphi = \arctg\left(\frac{1}{\omega RC}\right) = \arctg\left(\frac{1}{0,141}\right) = \arctg(7,052)$$

$$= 81,97^\circ$$

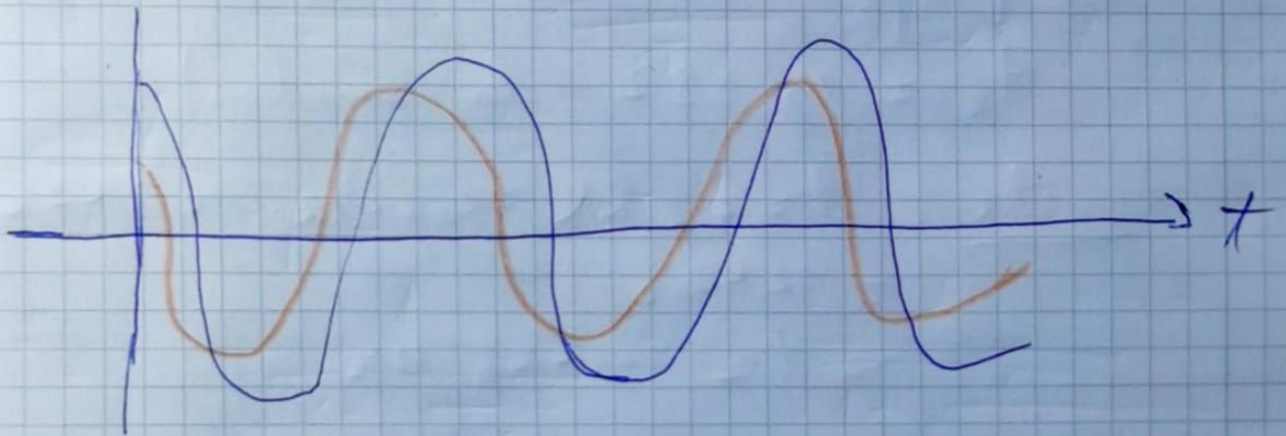
Solace Steel

a) Oscilograma temperatur de intrare V_i si de iesire V_e

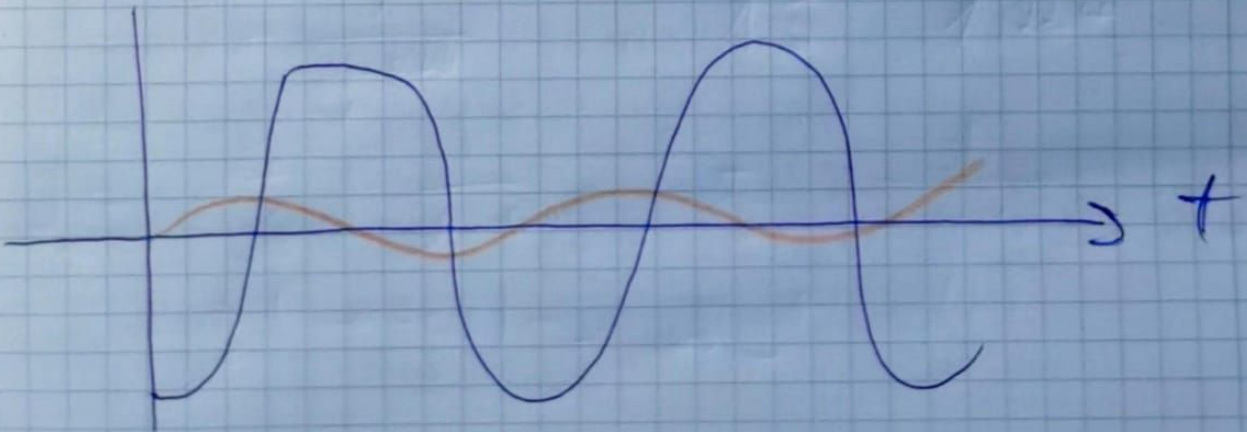
1. $f_1 = 4 \cdot 10^5 \text{ Hz}$



2. $f_2 = 4 \cdot 10^4 \text{ Hz}$



3. $f_3 = 4 \cdot 10^3 \text{ Hz}$



Signal de intrare rectangular

Bolcu Vlad

$$a) f_1 = 4 \cdot 10^5 \text{ Hz}$$

$$T = 5 \text{ div} \cdot 0,5 \mu\text{s} = 2,5 \mu\text{s}$$

$$T_1 = T_2 = \frac{T}{2} = \frac{2,5}{2} = 1,25 \mu\text{s}$$

$$X = \frac{T}{2RC} = \frac{2,5 \cdot 10^{-6}}{2 \cdot 12 \cdot 10^3 \cdot 470 \cdot 10^{-12}} = \frac{2,5}{1128} \cdot 10^2 \approx 0,22$$

$$U_1 = \frac{U}{1 - e^{-X}} = \frac{5}{1 - e^{-0,22}} = \frac{5}{1 - 0,8} = \frac{5}{0,2} = 25 \text{ V}$$

$$\Rightarrow U_2 = -U_1 \Rightarrow U_2 = -25 \text{ V}$$

$$U_1' = \frac{U}{1 + e^{-X}} = \frac{5}{1 + e^{-0,22}} = \frac{5}{1 + 0,8} = \frac{5}{1,8} = 2,78 \text{ V}$$

$$\Rightarrow U_2' = -U_1' \Rightarrow U_2' = -2,78 \text{ V}$$

$$b) f_2 = 4 \cdot 10^4 \text{ Hz} \quad T = 5 \text{ div} \cdot 5 \mu\text{s} = 25 \mu\text{s}$$

$$T_1 = T_2 = \frac{T}{2} = \frac{25 \mu\text{s}}{2} = 12,5 \mu\text{s}$$

$$X = \frac{T}{2RC} = \frac{25 \cdot 10^{-6}}{1128 \cdot 10^{-8}} = \frac{25}{1128} \cdot 10^2 \approx 2,2$$

$$U_1 = \frac{U}{1 - e^{-X}} = \frac{5}{1 - e^{-2,2}} = \frac{5}{1 - 0,11} = \frac{5}{0,89} = 5,62 \text{ V}$$

$$\Rightarrow U_2 = -5,62 \text{ V}$$

$$U_1' = \frac{U}{1 + e^{-X}} = \frac{5}{1 + e^{-2,2}} = \frac{5}{1 + 0,9} = \frac{5}{1,9} = 0,5 \text{ V}$$

$$\Rightarrow U_2' = -0,5 \text{ V}$$

$$c) f_3 = 4 \cdot 10^3 \text{ Hz}$$

$$T = 5 \text{ div} \cdot 50 \mu\text{s} = 250 \mu\text{s}$$

$$T_1 = T_2 = \frac{T}{2} = \frac{250}{2} = 125 \mu\text{s}$$

$$x = \frac{T}{2RC} = \frac{250 \cdot 10^{-6}}{1128 \cdot 10^{-8}} = \frac{25000}{1128} \approx 22,16$$

$$U_1 = \frac{U}{1 - e^{-x}} = \frac{U}{1 - e^{-22,16}} = \frac{5}{1 - 2,38 \cdot 10^{-10}} \approx 5 \text{ V}$$

$$\Rightarrow U_2 = -5 \text{ V}$$

$$U_1' = \frac{U}{1 + e^x} = \frac{5}{1 + e^{22,16}} \approx 0 \text{ V} \quad U_2' = 0 \text{ V}$$

$$b) f = f_3 = 4 \cdot 10^3 \text{ Hz} \quad \text{tiimpul de recuperare}$$

$$t_c = 13,392 \text{ (din simulare)}$$

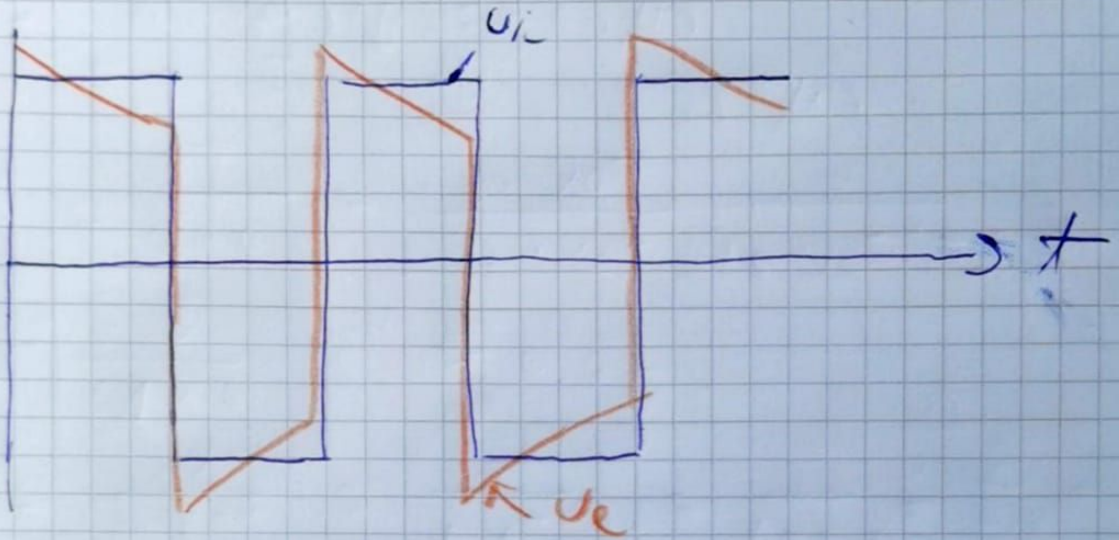
$$\text{Teoretic: } t = 2,2 RC = 2,2 \cdot 12 \cdot 10^3 \cdot 470 \cdot 10^{-12} = 1240,8$$

$$\Rightarrow t = 12,408 \mu\text{s}$$

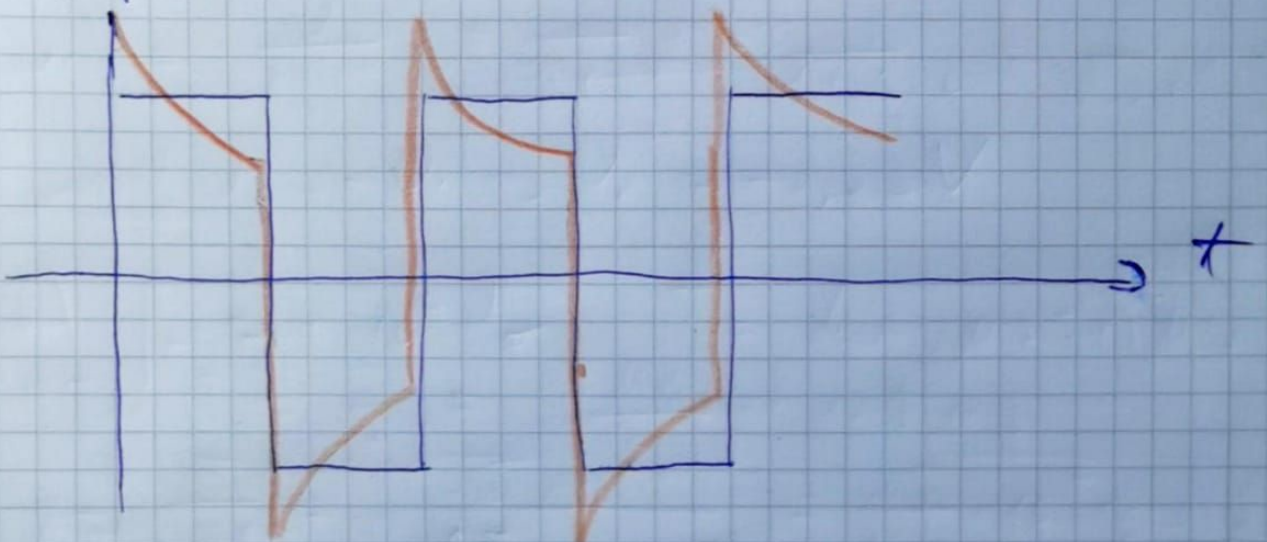
Beldan Vlad

Criolografarea semnalelor de intrare și ieșire

a) $f_1 = 4 \cdot 10^5 \text{ Hz}$



b) $f_2 = 4 \cdot 10^4 \text{ Hz}$



c) $f_3 = 4 \cdot 10^3 \text{ Hz}$

