Berejnec Adrian-David

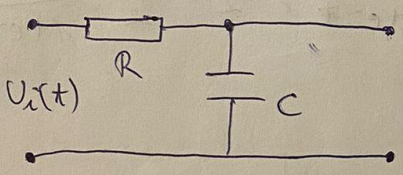
Conspect Lucrare 1 CD

Scopul lucrării este studierea semnalelor de diferite tipuri prin circuitele RC trece-jos.

Considerații teoretice

Fenomenul de transformare liniară a semnalelor se manifestă diferit pentru tipuri de semnale diferite.

Pentru un semnal sinusoidal, răspunsul va fi tot de formă sinusoidală, în timp ce pentru o aplicare de semnal nesinusoidal, răspunsul va avea distorsiuni.

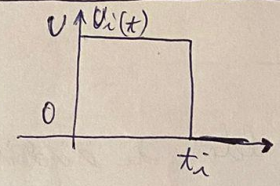


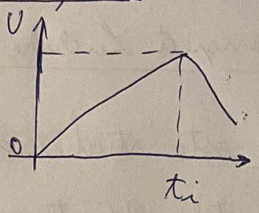
Circuit RC trece-jos

Relații: $A(\omega) = \frac{1}{\sqrt{1+(\omega RC)^2}}$; $A = \frac{U_e}{U_i}$

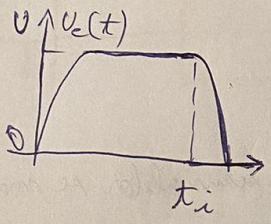
$\varphi(\omega) = -\operatorname{arctg}(\omega RC)$; $\varphi = \frac{t \cdot 360^\circ}{T}$, $\omega = 2\pi f$

Semnalul de intrare impuls





pentru $RC < t_i$



$RC \ll t_i$

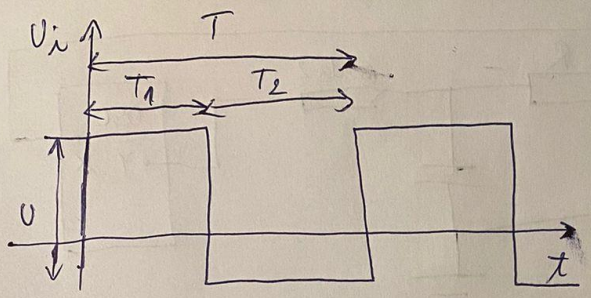
Dacă timpul de ridicare t_r este mic în comparație cu T_1, T_2, răspunsul său va reproduce forma semnalului de intrare.

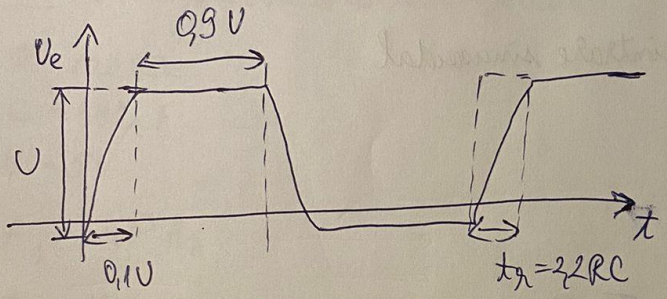
$T_1 = T_2 = \frac{T}{2}$: $U_1 = -\frac{U}{2} \cdot \frac{1-e^{-x}}{1+e^{-x}}$; $U_2 = \frac{U}{2} \cdot \frac{1-e^{-x}}{1+e^{-x}}$

$$x = \frac{T}{2RC}$$

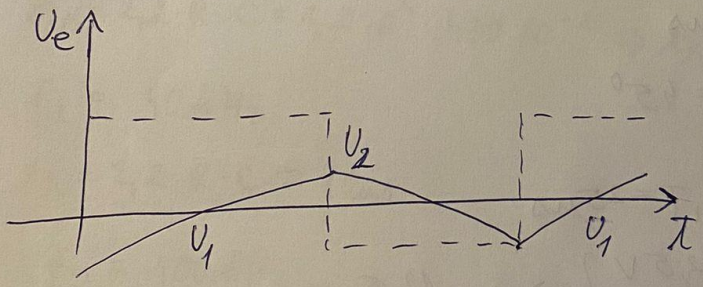
Circuitele RC trece-jos pot fi considerate ca filtre ce permit trecerea semnalelor de frecvență joasă cu distorsiuni minime și atenuarea puternică a semnalelor de frecvență înaltă.

Semnalul de intrare rectangular



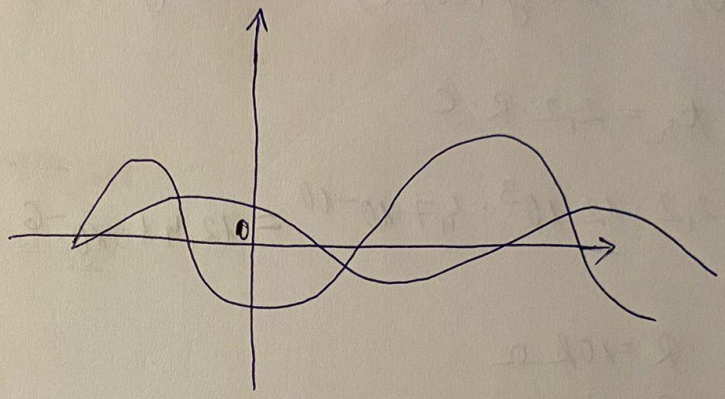


$RC \ll \min(T_1, T_2)$

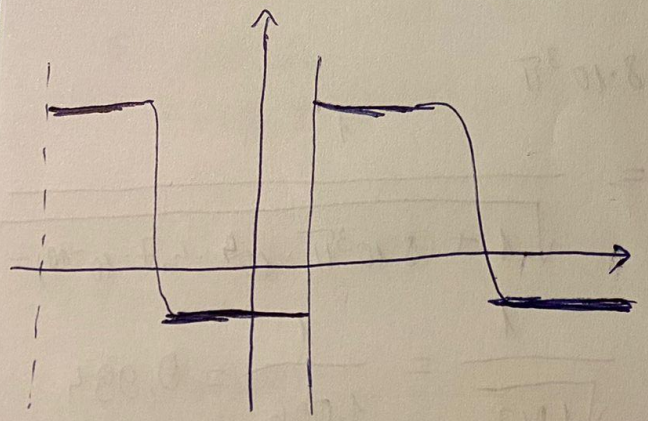


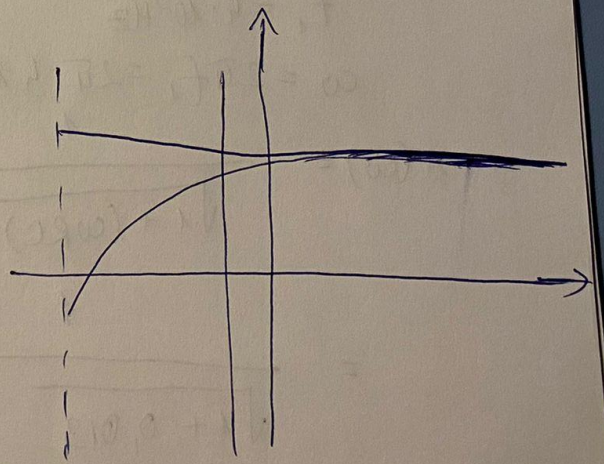
Diagrame de timp

3.1.1. b)



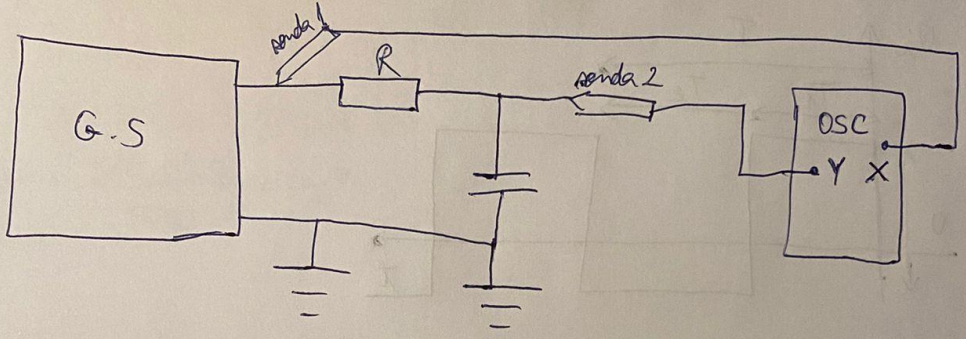
3.1.2. a)





3.1

SINCRONIZARE INTERNĂ



3.1.1. Semnal de intrare sinusoidal

$R = 12\,k\Omega$

$C = 470\,\mu F$

$U = 5V$

a) $f_1 = 4 \cdot 10^3 Hz$, $T = 20\mu s$, $U_e = 20V$

$t = 0,7 \cdot 5 = 3,5\mu s$

$\varphi = \frac{3,5 \cdot 360}{20} = 45^0$

b) $f_2 = 40kHz$, $T = 25\mu s$

$U_e = 2,5 \cdot 5 = 12,5V$

$U_{i_{max}} = 20V$

$\Rightarrow A = \frac{12,5}{20} = 0,62$

$t = 0,75 = 3,5\mu s$

$\varphi = \frac{3,5 \cdot 360}{25} = 50^0$

c) $f_3 = 400kHz$, $T = 2500\mu s$

$U_{iw} = 20V$
$U_{ew} = 1,6 \cdot 1 = 1,6V$ $\Rightarrow A = \frac{1,56}{20} = 0,08$

$t = 1 \cdot 500\mu s = 500\mu s$
$\varphi = \frac{500 \cdot 360}{2500} = 72^0$

3.1.2 Semnal de intrare rectangular

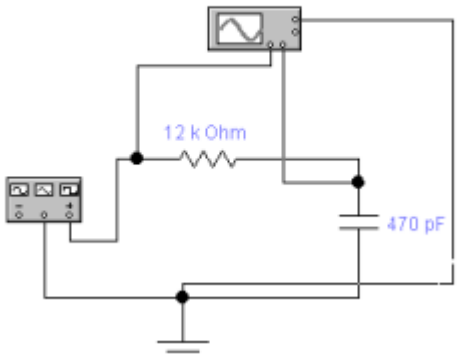
$R = 10k\Omega$
$C = 470nF$
$V = 5V$

a) $f_1 = 4 \cdot 10^3 Hz$
$t_r = 10\mu s$
$t_r = 2,2 \cdot R \cdot C = 2,2 \cdot 10^4 \cdot 470 \cdot 10^{-2} \Rightarrow t_r \simeq 10\mu s$

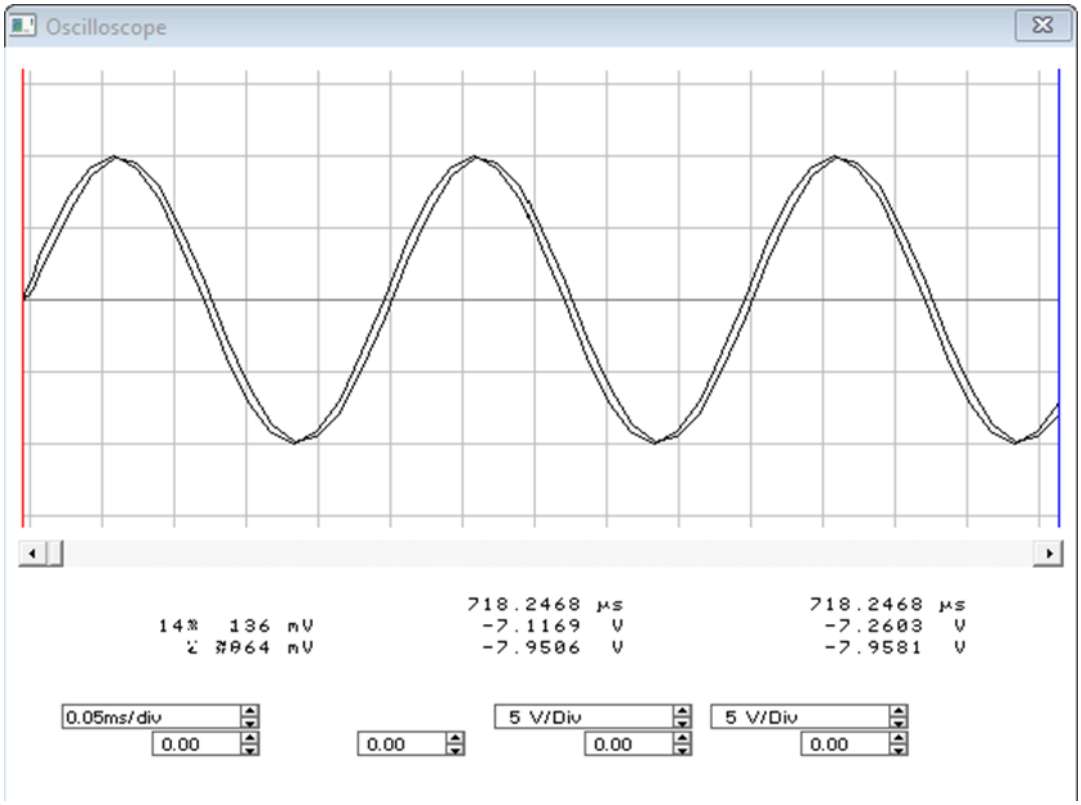
b) $f_2 = 40kHz$
$t_r = 2,2 \cdot R \cdot C \simeq 10\mu s$

c) $f_3 = 400kHz$
$t_r \simeq 10\mu s$

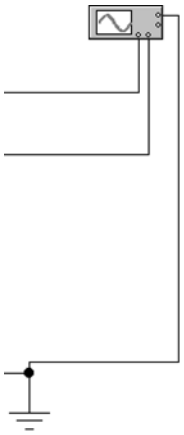
3.1.1

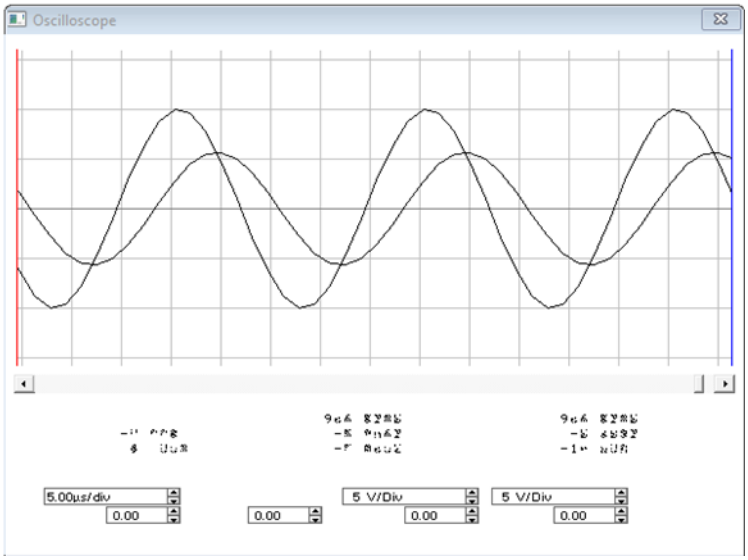

12 k Ohm
470 pF

a) f1 = 4 kHz :

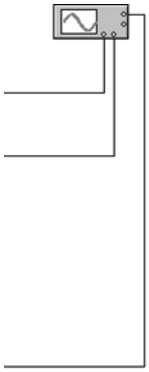

Oscilloscope
718.2468 µs
-7.1169 V
-7.9506 V
718.2468 µs
-7.2603 V
-7.9581 V
0.05ms/div
0.00
0.00
5 V/Div
0.00
5 V/Div
0.00

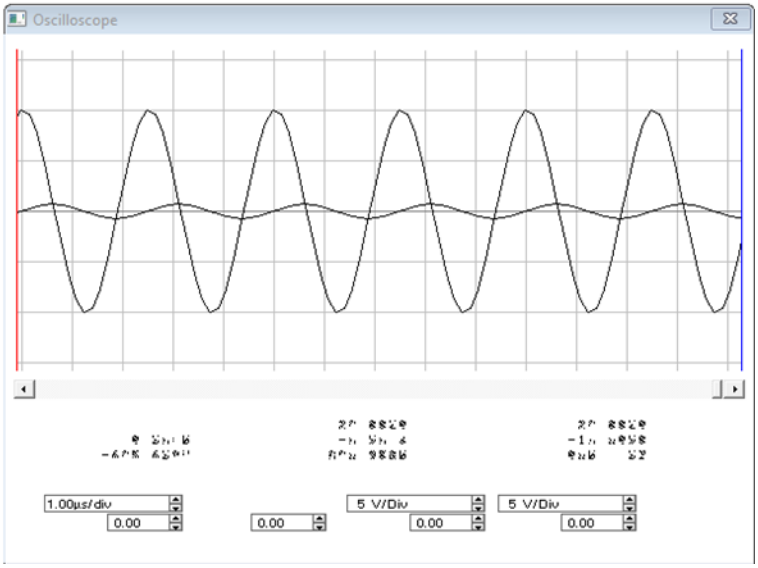
b) f2 = 40 kHz :





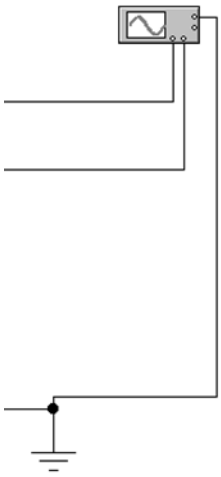
c) f3 = 400 kHz :

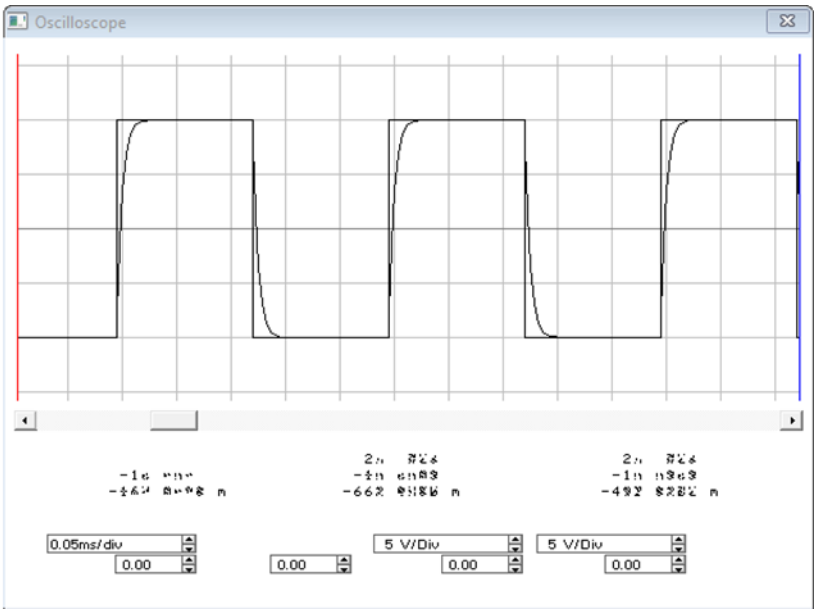




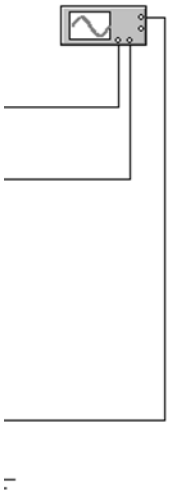
3.1.2

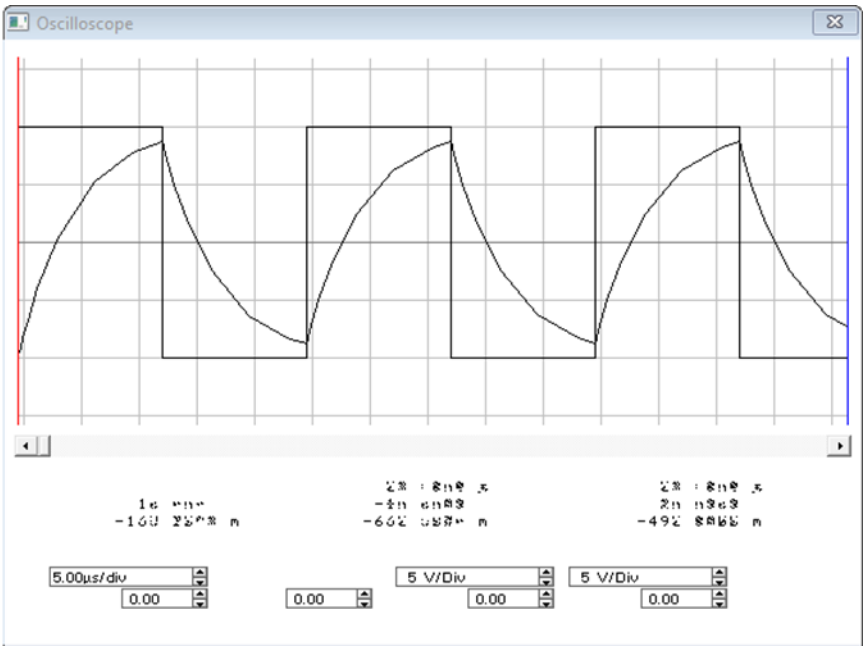
a) f1 = 4 kHz :





b) f2 = 40 kHz :





c) f3 = 400 kHz :