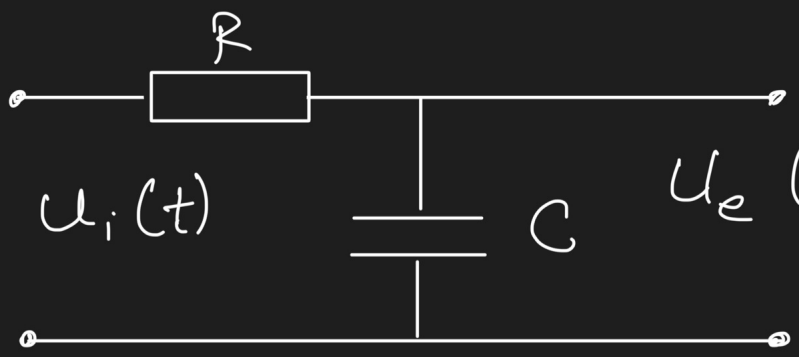
Circuite Liniare RC Trece-Jos

(1) Scopul lucrării

Se va studia experimental trecerea semnalelor de diferite forme: (prin circuitele RC Trece-Jos)

- sinusoidale
- rectangulare
- exponențiale

(2) Circuite RC Trece-Jos



Circuitul de mai sus are proprietatea de a avea atenuarea A în funcție de frecvența semnalului de intrare.

Dacă semnalul aplicat circuitului este unul nesinusoidal, componentele sale de frecvență joasă apar la ieșire cu o atenuare mai mică decât componentele de frecvență mai înaltă.

2.1.1. Semnalul de intrare sinusoidal de frecvență f

→ atenuat → defazat

$$A(\omega) = \frac{1}{\sqrt{1+(\omega RC)^2}}$$

$$\varphi(\omega) = -\operatorname{arctg}(\omega RC)$$

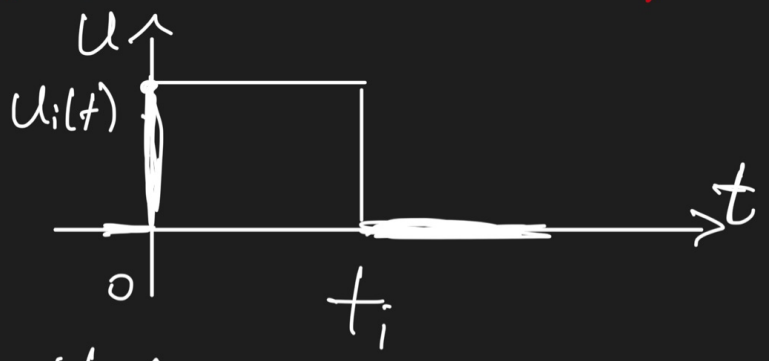
$$\omega = 2\pi f$$

$$A = \frac{U_e}{U_i}$$

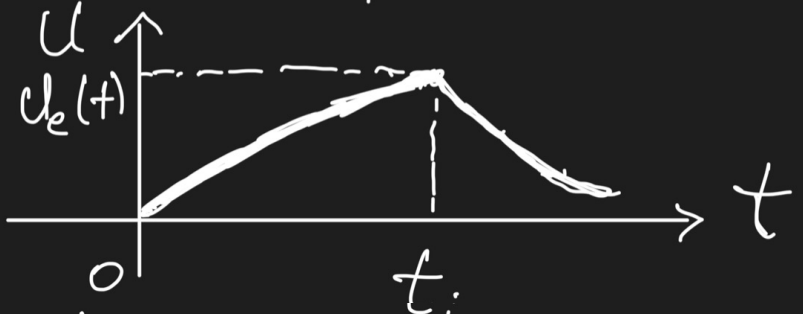
$$\varphi = \frac{t \cdot 360^\circ}{T}$$

2.1.2 Semnalul de intrare impuls

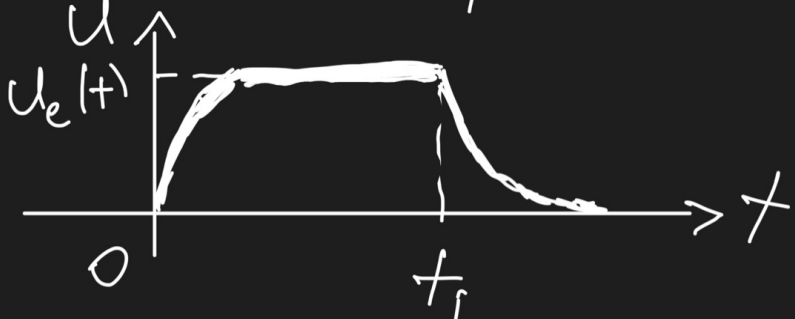
$RC = t_i$



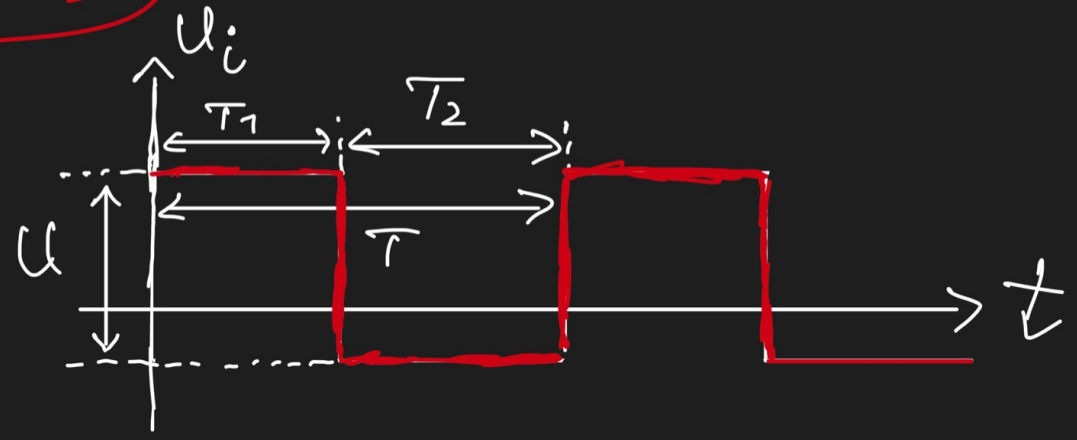
$RC > t_i$

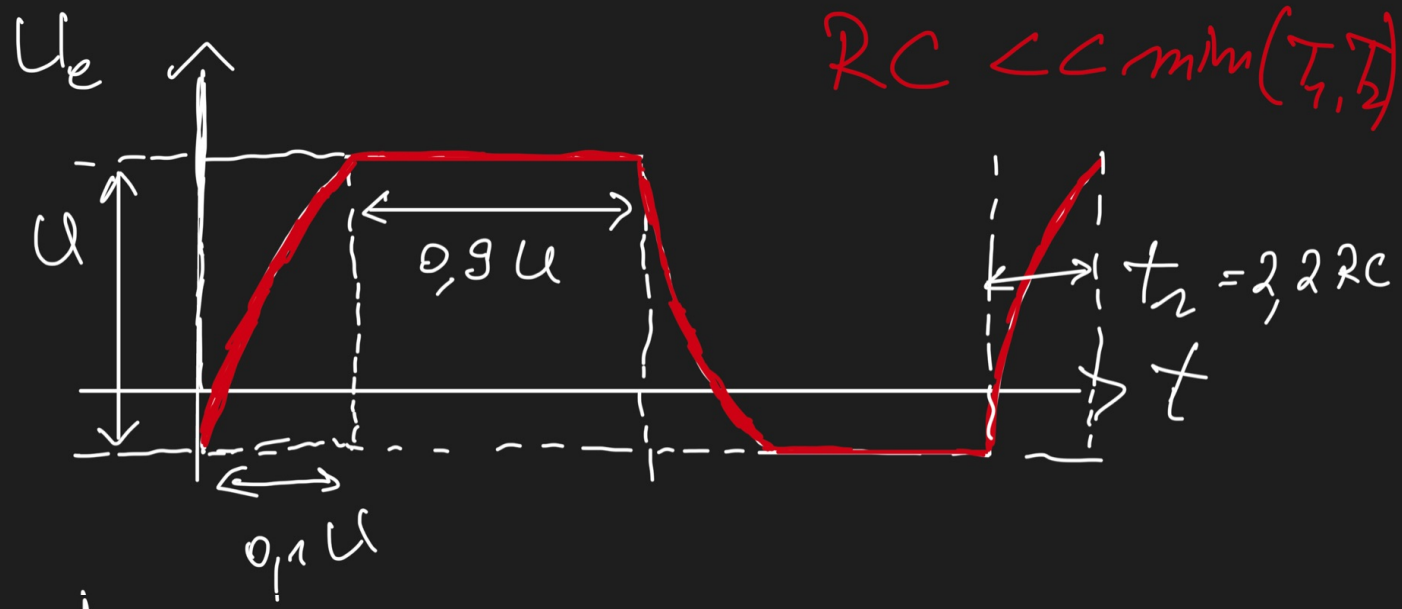


$RC < t_i$

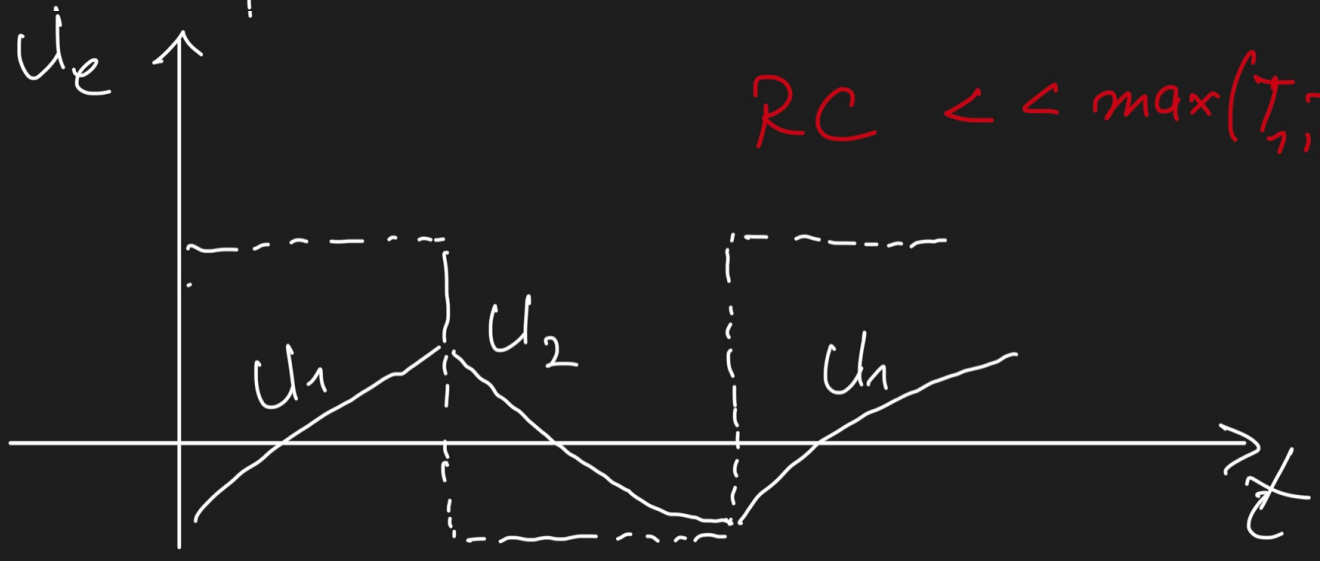


2.1.3 Semnalul de intrare rectangular



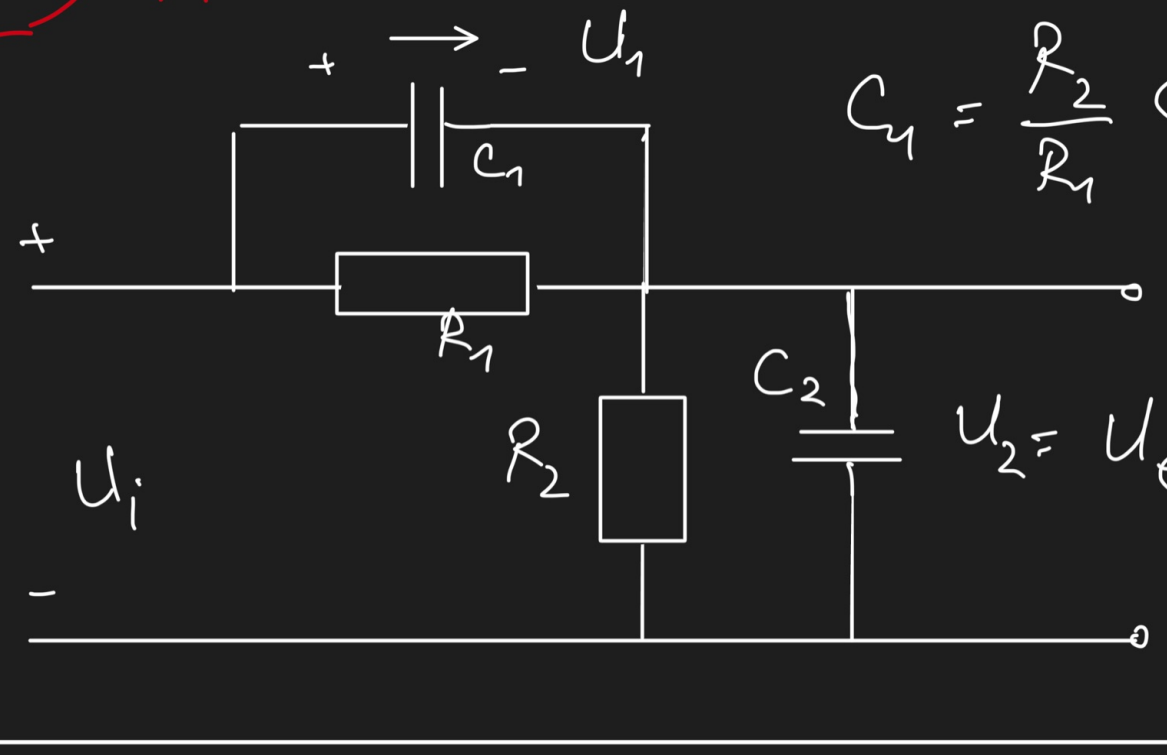


$RC << \min(T_1, T_2)$



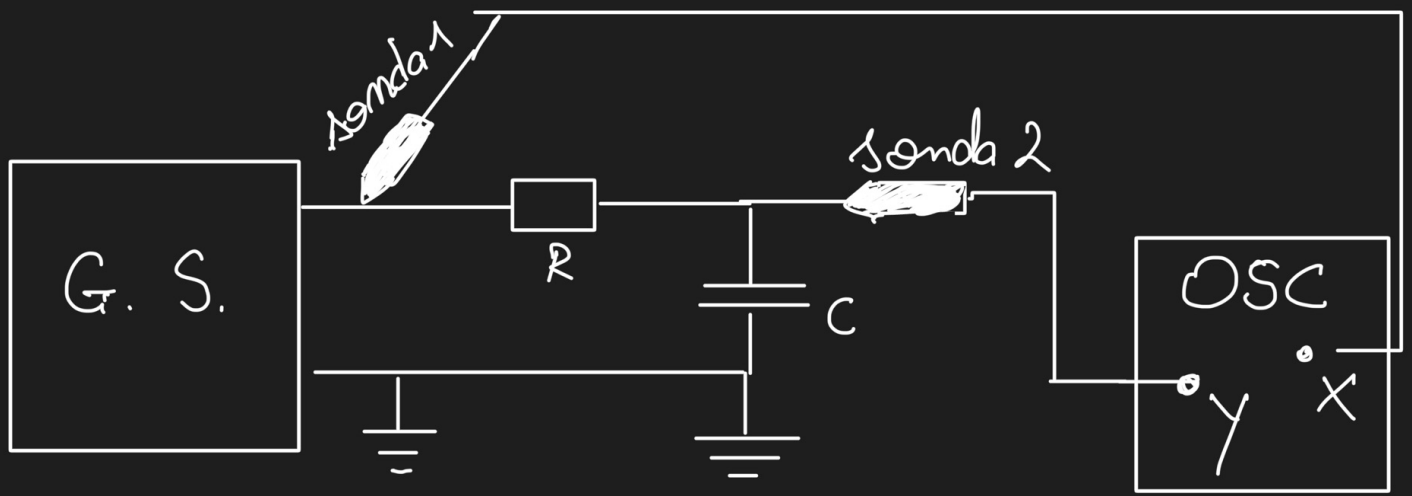
$RC << \max(T_1, T_2)$

(2.3) Atenuatoare RC



$$C_1 = \frac{R_2}{R_1} C_1$$

(3) Mersul lucrării



3.1.1 Semnal de intrare sinusoidal

$R = 12\,k\Omega$

$C = 470\,pF$

$A = 5\,V$

$\begin{cases} f_1 = 4 \cdot 10^3\ Hz \\ f_2 = 4 \cdot 10^4\ Hz \\ f_3 = 4 \cdot 10^5\ Hz \end{cases}$

a) $\begin{cases} f = ? \\ \text{Atenuarea} = ? \end{cases}$

b) Osciloscopul
U_i: intrare
U_e: ieșire

c) U_1, U_2 pt. $f = f_2$; $f = f_3$

3.1.2 Semnal de intrare rectangular

$R = 10\,k\Omega$

$C = 470\,pF$

$f_1 = 4 \cdot 10^3\ Hz$

$f_2 = 4 \cdot 10^4\ Hz$

$f_3 = 4 \cdot 10^5\ Hz$

a) Osciloscopierea pt f_1, f_2, f_3

b) $t_2 = ?$ $f = f_1$

c) U_1 U_2 pt. $f = f_3$; $f = f_4$

3.2 Atenuatoare RC

$R_1 = R_2 = 12\ k\Omega$

$C_2 = 470\ pF$

$C_1 =$ { 0 ; 220 pF ; 470 pF ; 1,5 nF (1500 pF) }

a) Oscilograferea

b) Amplitudinea la $t=0$, $t=t_i$

c) Const. de timp τ pt. capacitați

Semnal rectangular $f = 2 \times 10^3\ Hz$

Lucrare Lab

$T = 250\,\mu s$ $\quad f = 4\,kHz$

$U_{iVV} = 5\,V$

$U_{eVV} = 0{,}54\,V \rightarrow U_e = 0{,}27\,V$

$$A = \frac{U_e}{U_i} = \frac{0{,}54}{5} = 0{,}108\,V$$

$t = 1\,\mu s$ $\quad \varphi = \dfrac{1 \cdot 10^{-6} \cdot 360}{250 \cdot 10^{-6}}$

$\varphi = 1{,}44^\circ$

$T = 250\,\mu s$ $\quad f = 40\,KHz$

$U_{iVV} = 5\,V$

$U_{eVV} = 0{,}6\,V$ $\quad \varphi = \dfrac{2 \cdot 360^\circ}{250} = 2{,}88^\circ$

$t = 2\,\mu s$ $\quad A = \dfrac{0{,}6}{5} = 0{,}12$

$T = 250\ \mu s$ $\quad f = 400\ kHz$

$U_{in} = 5V$ $\quad A = \frac{0,64}{5} = 0,128$

$U_{exit} = 0,64$

$t = 3\ \mu s$ $\quad f = \frac{3 \cdot 360}{250} = 13,468$

Zadaca 6