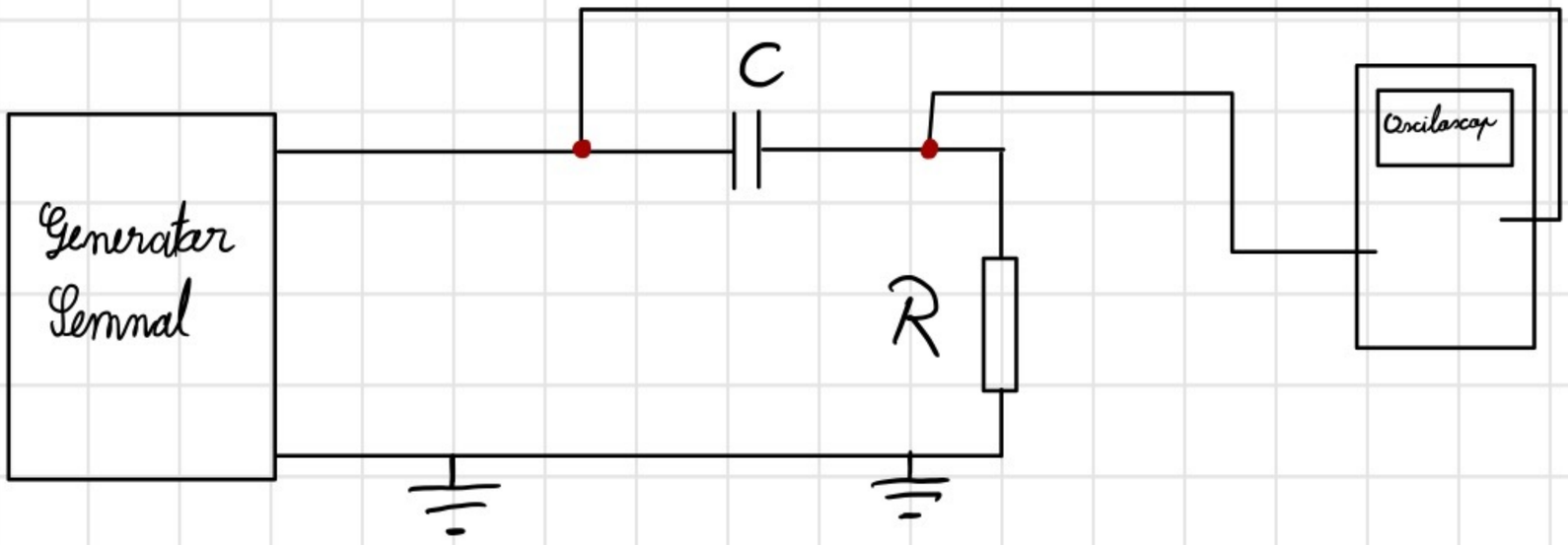
Săptămâna 3 → Laborator

Bârsan Glad

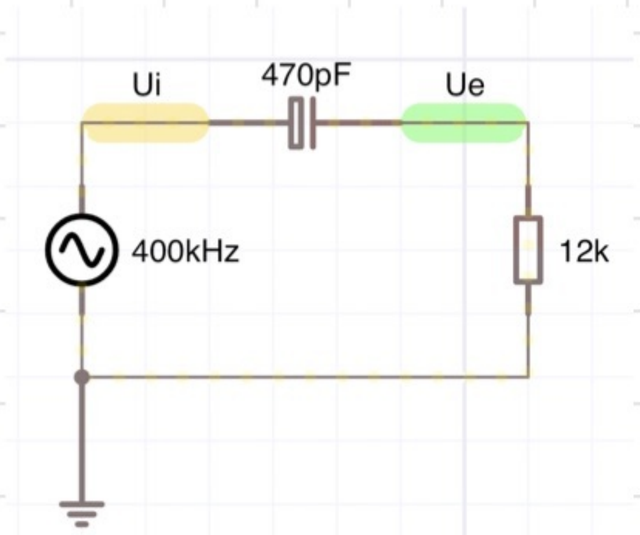
Circuite liniare RC trece-jos

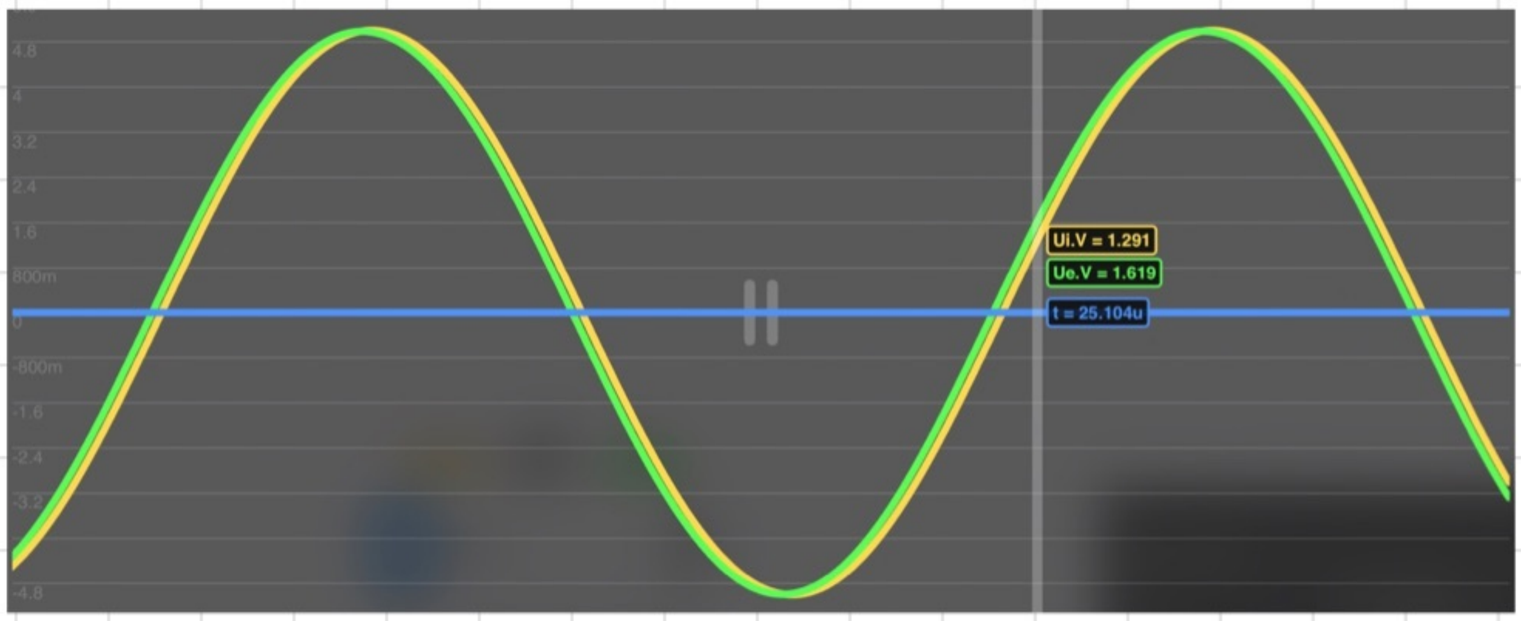


→ Considerăm $R = 12\,k\Omega$; $C = 470\,\mu F$ și aplicăm circuitului diferite semnale sinusoidale de intrare cu $A = 5V$ și frecvența:

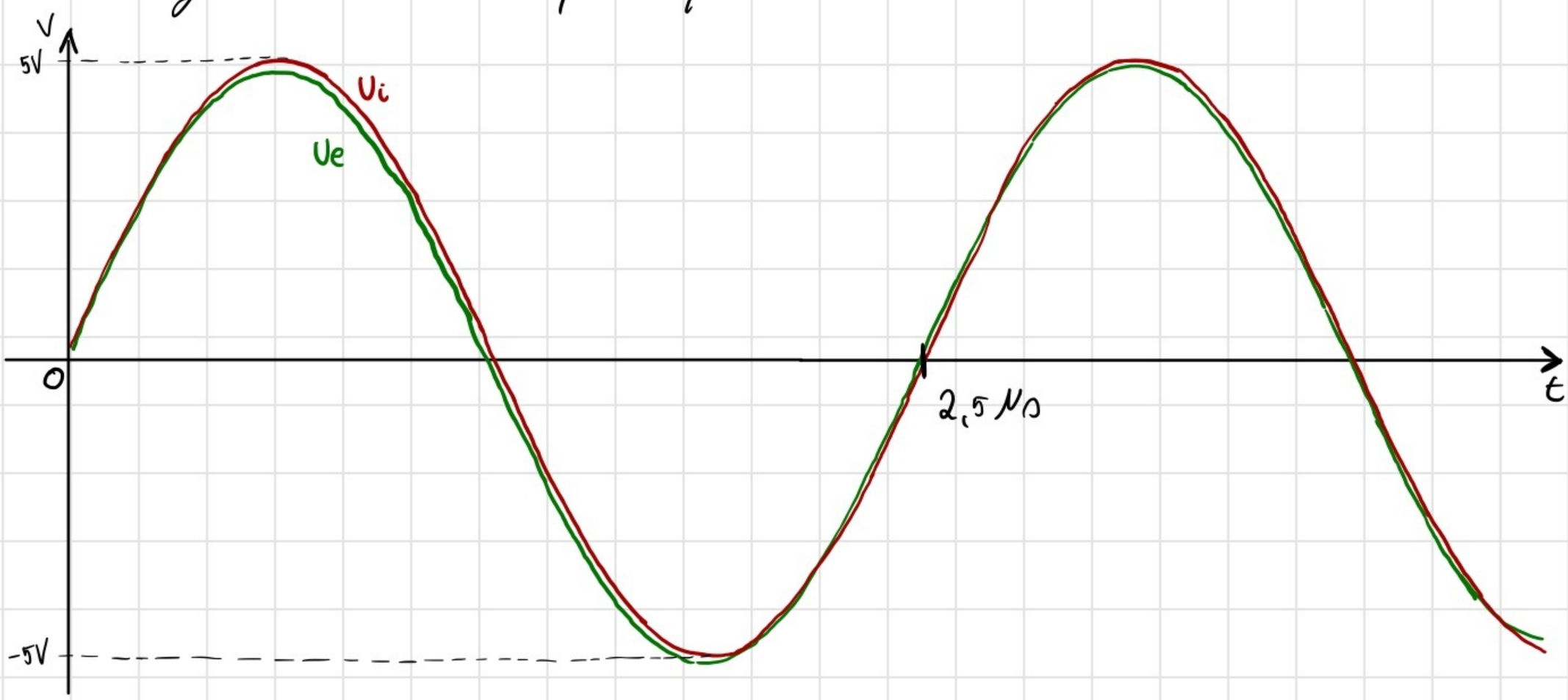
a) $f = 4 \cdot 10^5\,Hz$

- Simulator:





- Diagrama de timp reprezentată de mână:



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- **Calcule teoretice**

$$\omega = 2\pi f = 8\pi 10^5$$

- Atenuarea

$$A = \frac{1}{\sqrt{1+\left(\frac{1}{\omega RC}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{1417\cdot 10^{-2}}\right)^2}} = \frac{1}{\sqrt{1+\frac{1}{200,7}}}$$

$$= \frac{1}{\sqrt{1,004}} = \frac{1}{1,001} \cong 0,99$$

- Defazajul

$$\varphi = arctg\left(\frac{1}{\omega RC}\right) = arctg\left(\frac{1}{14,17}\right) = arctg(0,07)$$

$$= 4^\circ = 0,06$$

- **Măsurători**
  - Atenuarea

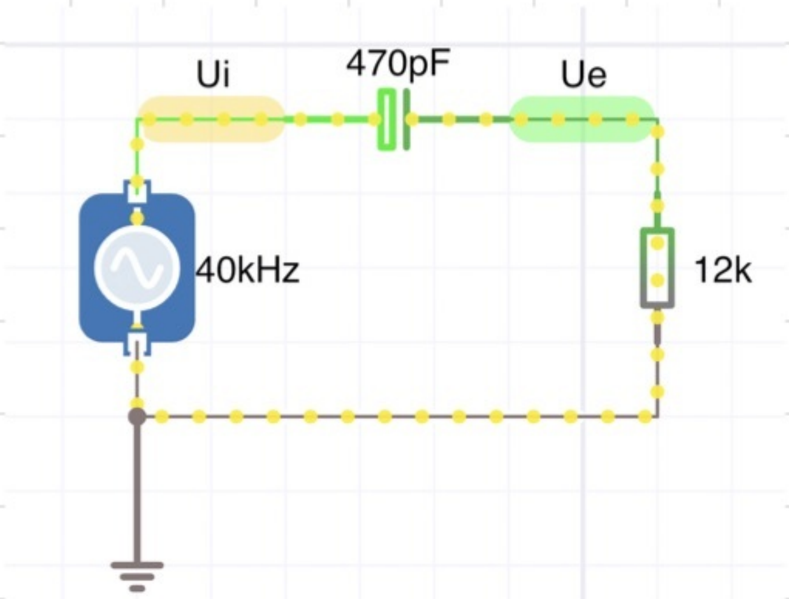
$$A = \frac{U_{iv}}{Ue_{vv}} = \frac{10V}{9,98V} = 0,99 \quad \checkmark$$

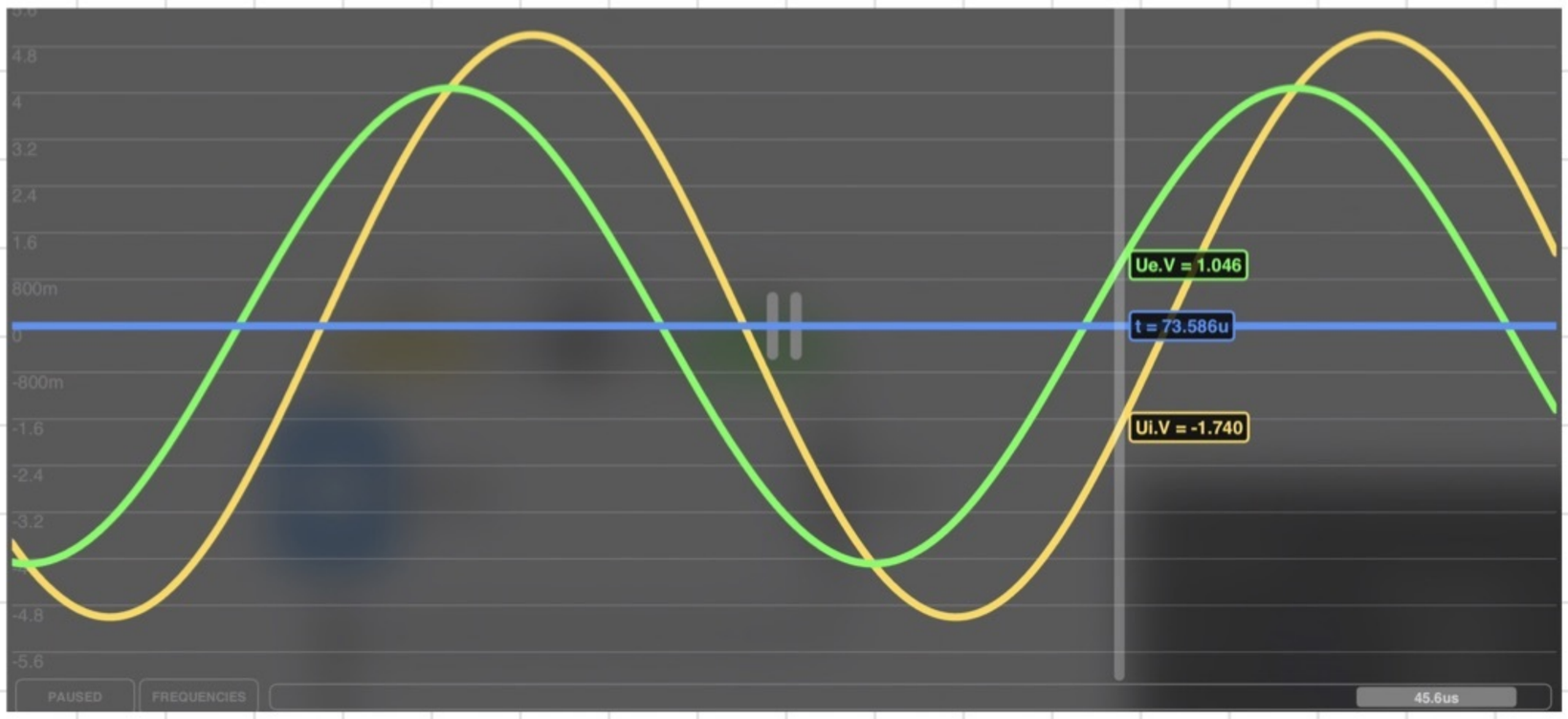
  - Defazajul

$$\varphi = \frac{t\cdot 360^\circ}{T} = \frac{0,03\cdot 360^\circ}{2,5} = 4,32^\circ \quad \checkmark$$

b) $f = 4\cdot 10^4 Hz$

- **Simulator:**





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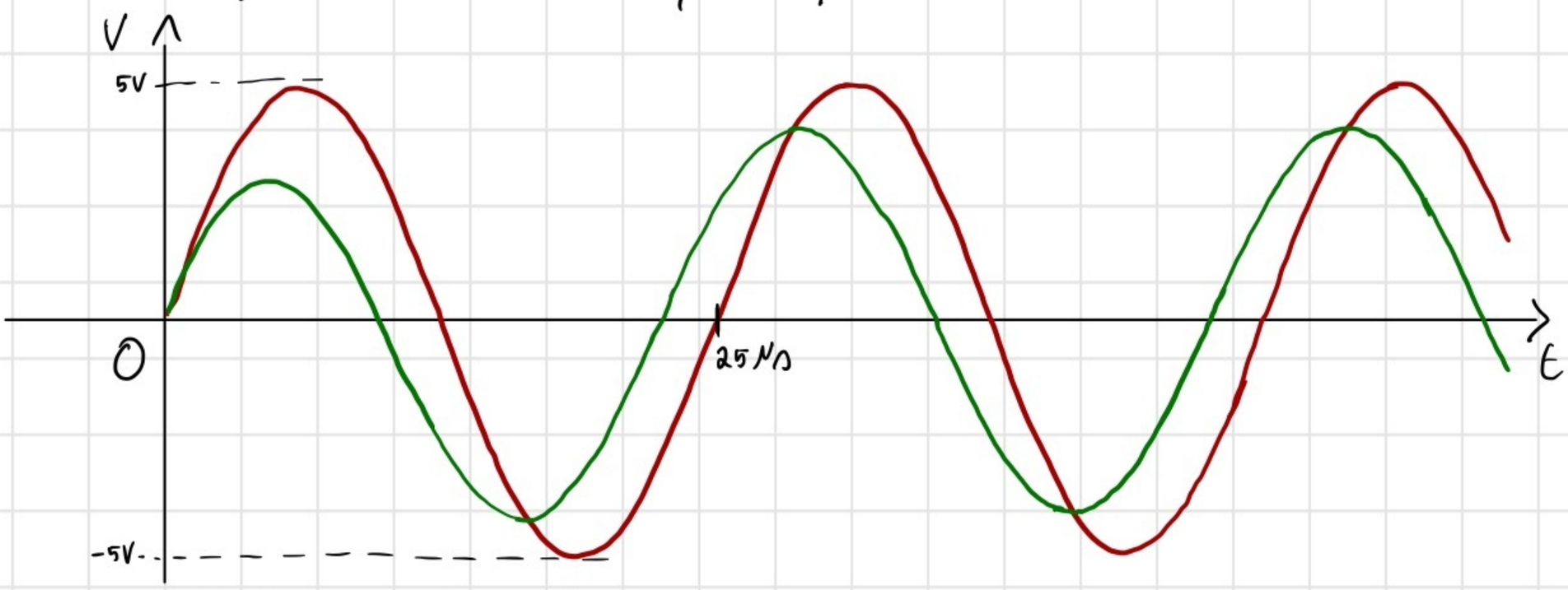
- Diagrama de timp reprezentată de mână



- Calcule teoretice

$$\omega = 2\pi f = 8\pi \cdot 10^4$$

- Atenuarea

$$A = \frac{1}{\sqrt{1+\left(\frac{1}{\omega RC}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{8\pi \cdot 10^4 \cdot 12 \cdot 10^3 \cdot 4{,}7 \cdot 10^{-10}}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{1417{,}486 \cdot 10^{-3}}\right)^2}}$$

$$= \frac{1}{\sqrt{1+\frac{1}{2}}} = \frac{1}{1{,}224} \cong 0{,}816$$

- Defazajul

$$\varphi = \operatorname{arctg}\left(\frac{1}{\omega RC}\right) = \operatorname{arctg}\left(\frac{1}{1{,}417}\right) = \operatorname{arctg}(0{,}705)$$

$$\cong 35{,}18^\circ = 0{,}614$$

- Măsurători:
  - Atenuarea

$$A = \frac{U_{e_w}}{U_{i_w}} = \frac{8{,}17}{10} = 0{,}817 \checkmark$$

  - Defazajul

$$T = \frac{1}{f} = 25\ \mu s$$

$$\varphi = \frac{t \cdot 360^\circ}{T} = \frac{2{,}6 \cdot 360^\circ}{25} = 37{,}4^\circ \checkmark$$

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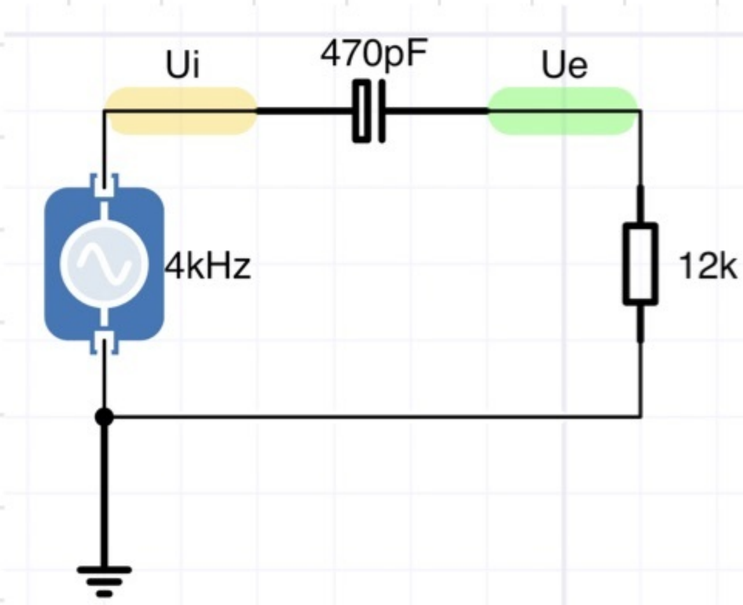
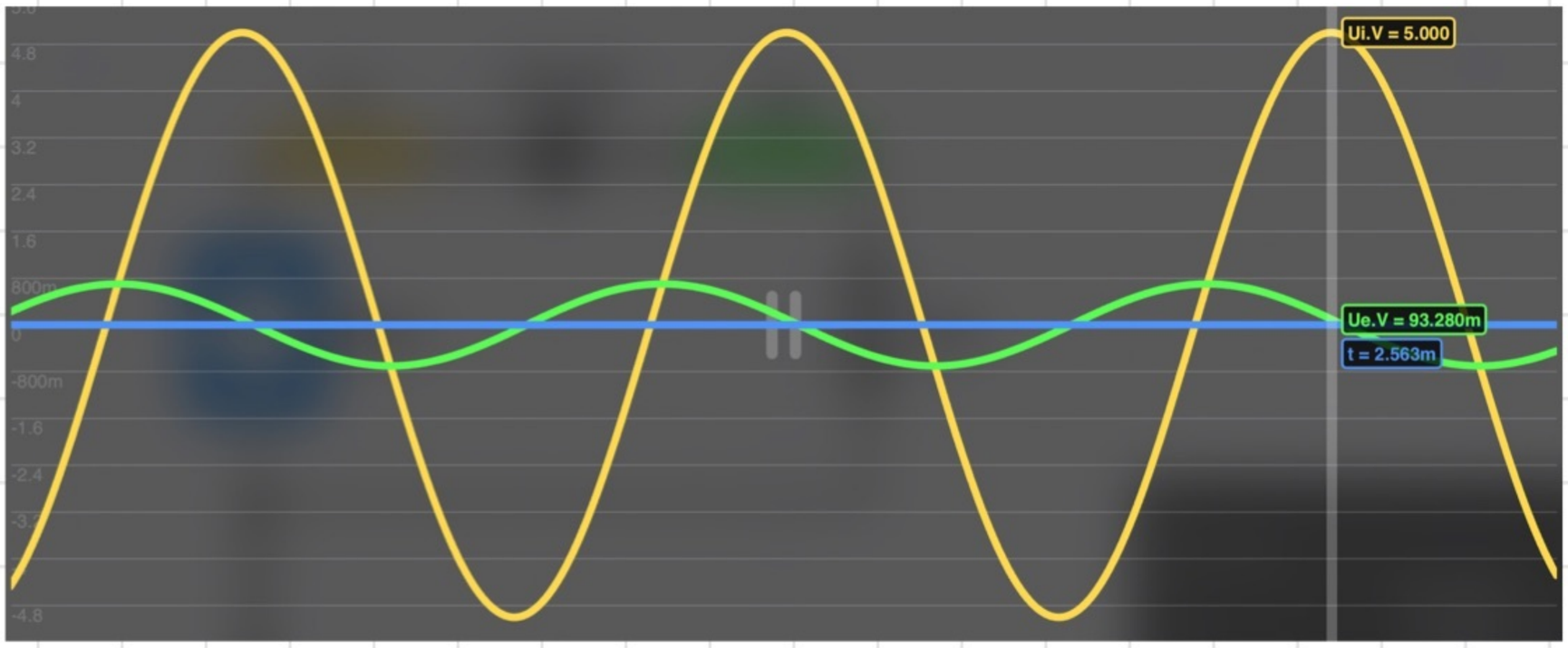
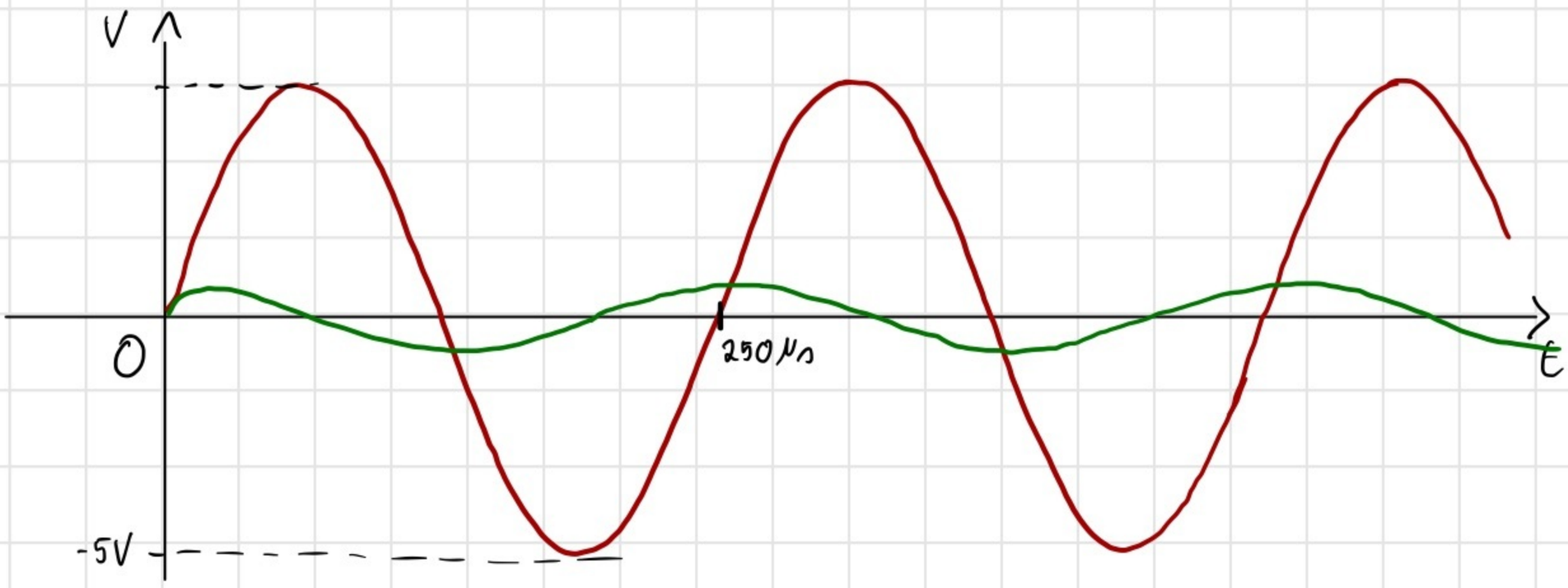
c) $f = 4 \cdot 10^3$ Hz

- Simulator





- Diagrama de timp reprezentată de mână



- Calcule teoretice

$\omega = 2\pi f = 8\pi 10^3$

- Atenuarea

$$A = \frac{1}{\sqrt{1+\left(\frac{1}{\omega RC}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{1417 \cdot 10^{-5}}\right)^2}} \quad \sqrt{50,8} = \frac{1}{7,05} \cong 0,141$$

- Defazajul

$$\varphi = \operatorname{arctg}\left(\frac{1}{\omega RC}\right) = \operatorname{arctg}(7,05) = 81^\circ = 1,42$$

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- **Măsurători**
  - Atenuarea

$$A = \frac{Ue_{vv}}{Ui_{vv}} = \frac{1.4}{10} = 0.14 \checkmark$$

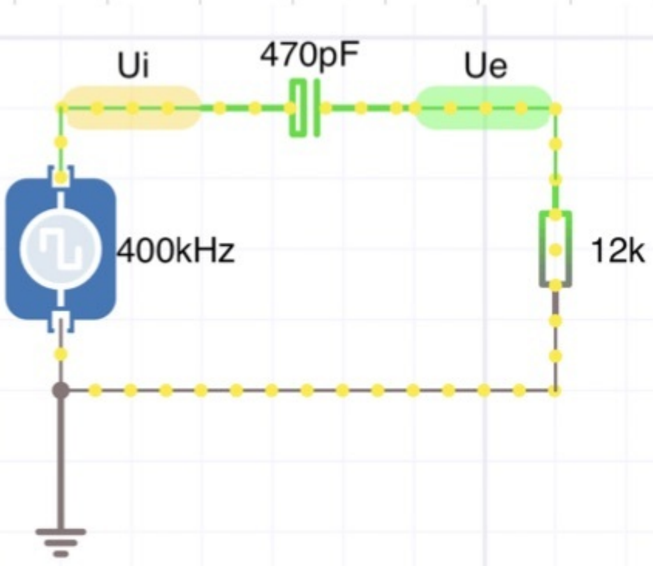
  - Defazajul

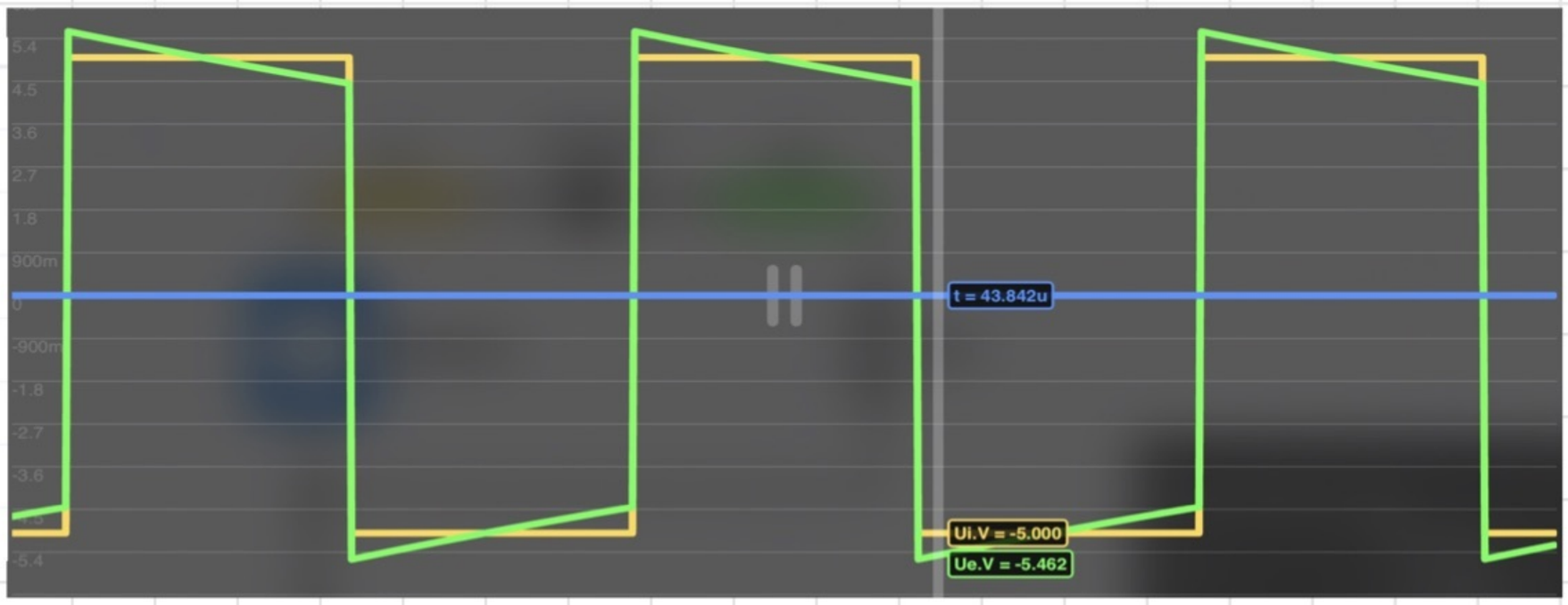
$$\varphi = \frac{t \cdot 360^\circ}{T} = \frac{57 \cdot 360}{250} = 82^\circ \checkmark$$

⇒ Considerăm $R = 12\,k\Omega$, $C = 470\,nF$ și aplicăm circuitului diferite semnale rectangulare cu $A = 5V$ și frecvența:

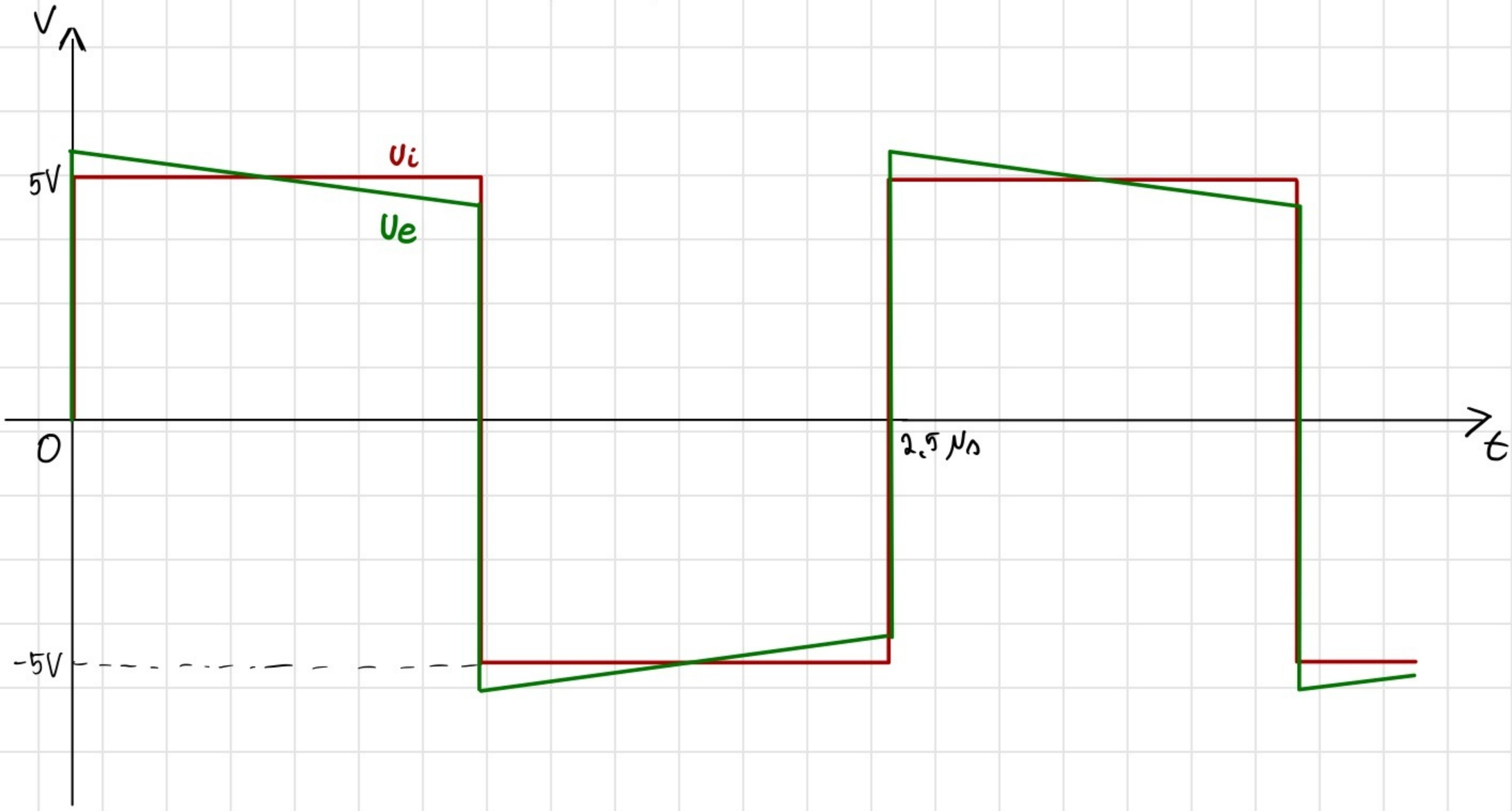
a) $f = 4 \cdot 10^5\,Hz$

- Simulator





- Diagrama de timp reprezentată de mână



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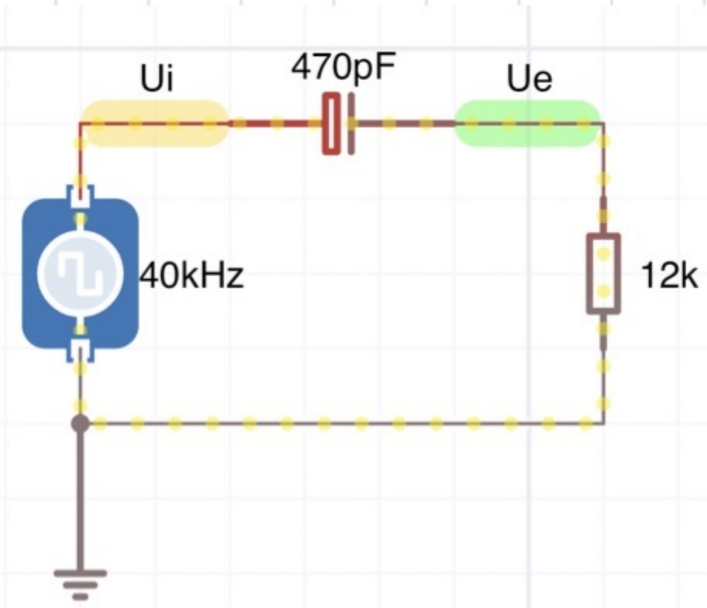
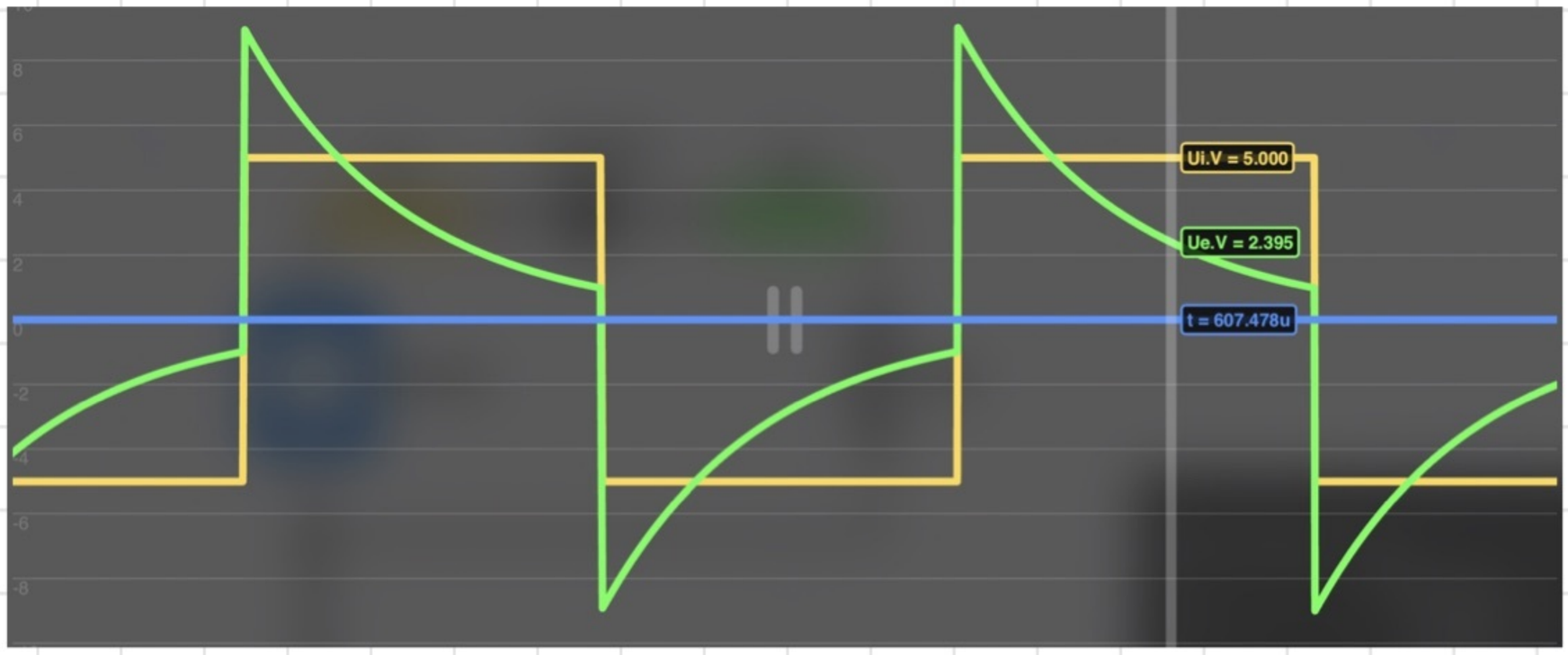
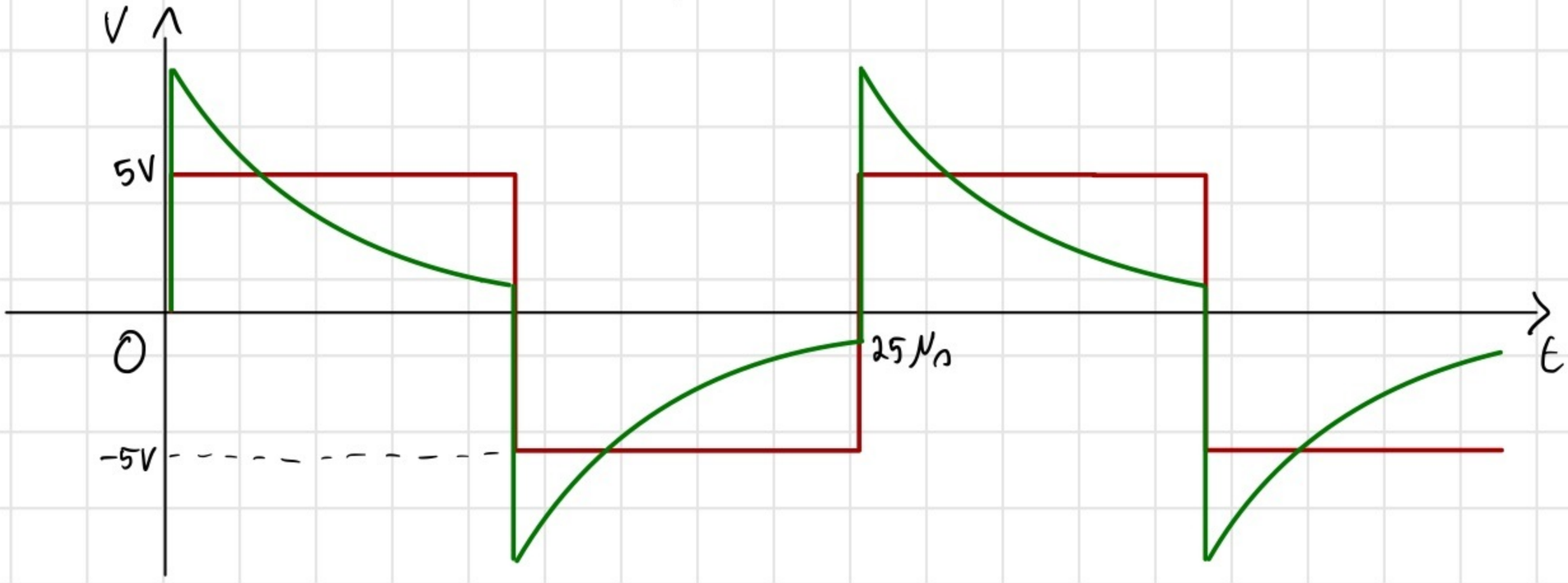
b) $f = 4 \cdot 10^3 Hz$

- Simulator



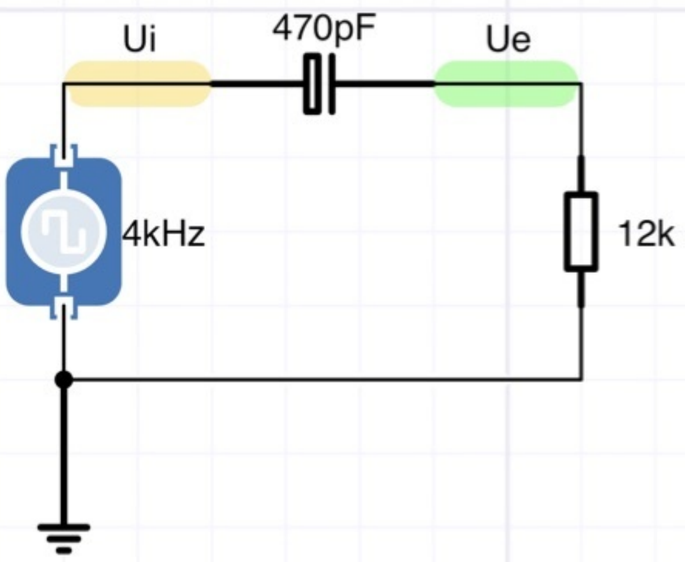


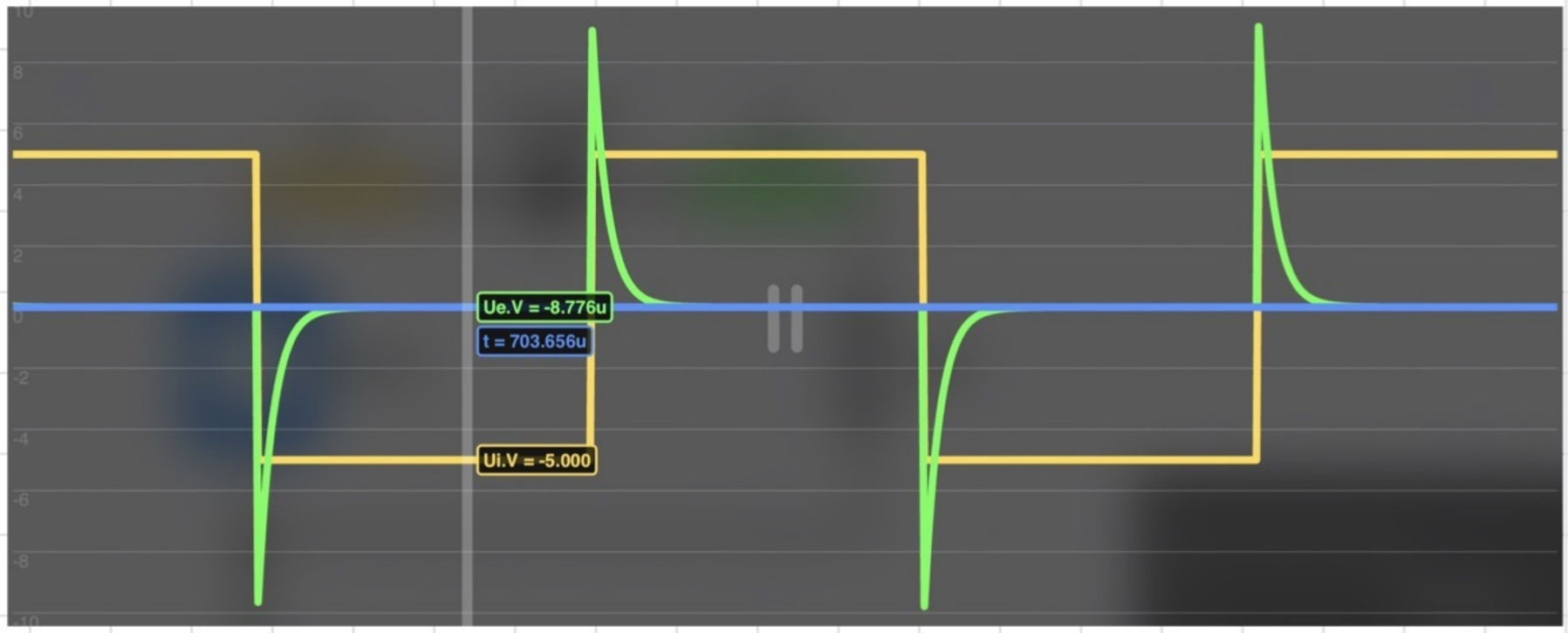
- Diagrama de timp reprezentată de mână:



c) $f = 4 \cdot 10^3 Hz$

- Simulator





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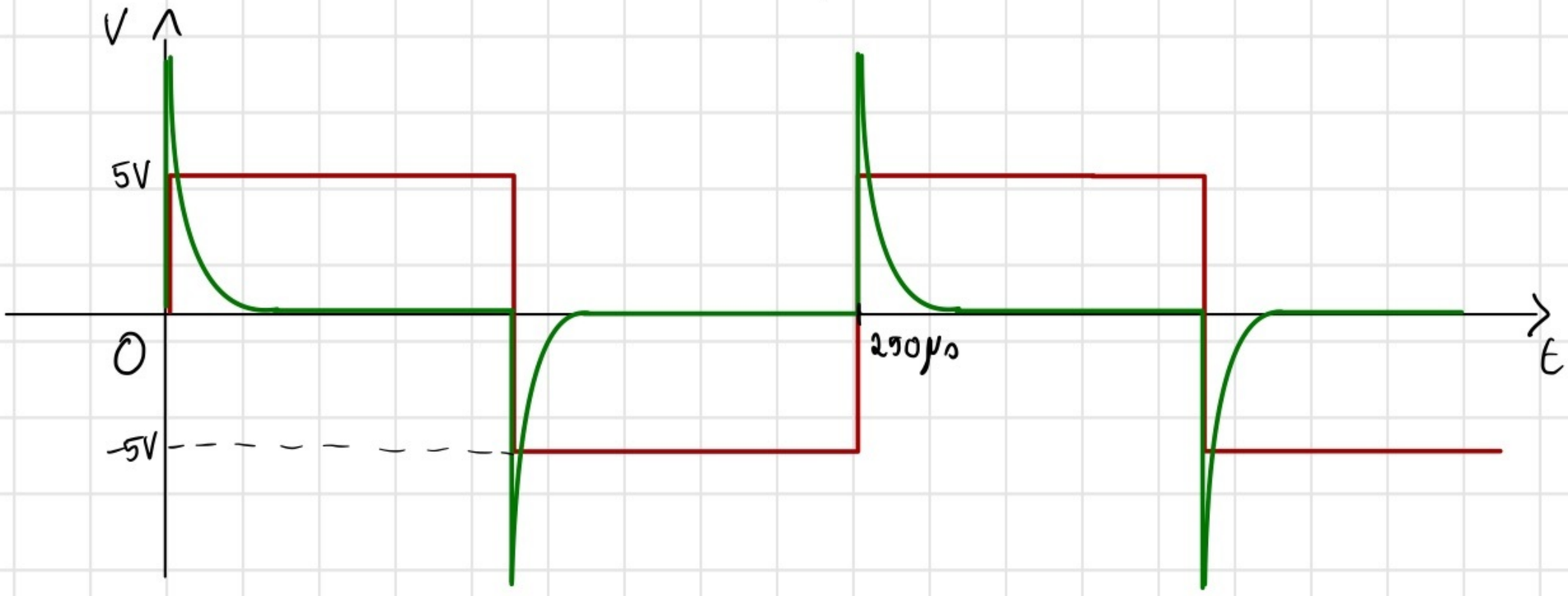
- Diagrama de timp reprezentată de mână



- Calcule teoretice

  - Timpul de coborâre

    $t_c = 2,2\,RC = 2,2 \cdot 12 \cdot 10^3 \cdot 4,7 \cdot 10^{-10} = 124,08 \cdot 10^{-7} = 12,408\ \mu s$

- Măsurători

  - Timpul de coborâre

    $t_c = 12,9\ \mu s$ ✓