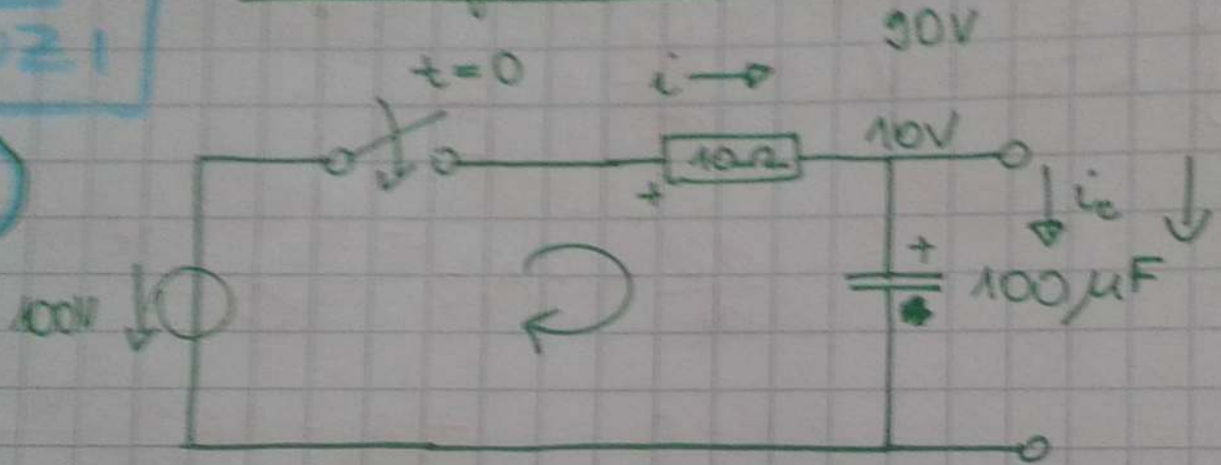
10.33.
KONZ1

HF megoldása

1.



1. lépés: $\sum v = -100 + V_0 + \frac{1}{C}\int_0^t i_c\,d\tau + Ri$

$$0 = -100 + V_0 + \frac{1}{C}\int_0^t i_c\,d\tau + Ri$$

$$0 = -100 + V_0 + \frac{1}{10^{-4}}\int_0^t i_c\,d\tau + 10i \;/\; \frac{d}{dt}$$

$$0 = \frac{1}{10^{-4}}\,i + 10\frac{di}{dt}$$

2. lépés:

$i = Ae^{st}$

s: analóg volt...

$\frac{1}{C}i + R\frac{di}{dt} = \frac{1}{C}(Ae^{st}) + R\frac{d}{dt}(Ae^{st})$

$$0 = -100 + u_0 + \frac{1}{10^{-4}} \int_0^t i_c \, d\tau + 10i \quad / \frac{d}{dt}$$

$$0 = \frac{1}{10^{-4}} i + 10 \frac{di}{dt}$$

2. lépés:

$i = Ae^{st}$ s: valamit 1 volt...

$$\frac{1}{C} i + R \frac{di}{dt} \cdot \frac{1}{C}\left(Ae^{st}\right) + R \frac{di}{dt} Ae^{st} =$$

$$= \frac{1}{C}\left(Ae^{st}\right) + RsAe^{st} =$$

$$= \underbrace{Ae^{st}}_{\neq 0}\left(\frac{1}{C} + Rs\right) = 0$$

$$1 + RCs = 0$$

$$\frac{1}{10^{-4}} + 10s = 0$$

$$10s = -10^4 - \frac{1}{9001}$$

$$s = \frac{-10^4}{10} = -10^3$$

$$10s = 10000$$

$$s = 1000$$

$i = Ae^{1000t}$ $A = ?$ amint Ae^{st} akarom rendük, s megvan

$= \underbrace{Ae^{st}}_{\neq 0}\left(\frac{1}{C} + R_s\right) = 0$

$1 + RCs = 0$

$\frac{1}{10^{-4}} + 10s = 0$

$10s = -\frac{1}{0{,}001}$

$s = \frac{-10^4}{10} = -10^5$

$10s = 10000$

$s = 1000$

$i = Ae^{1000t}$ $\quad A = ?$

$i(t)\big|_{t=0+} = i(0+) = Ae^{1000\cdot 0}$ ($e^{1000\cdot 0} = 1$)

$i(0+) = A$

$V_R(0+) = 90V$

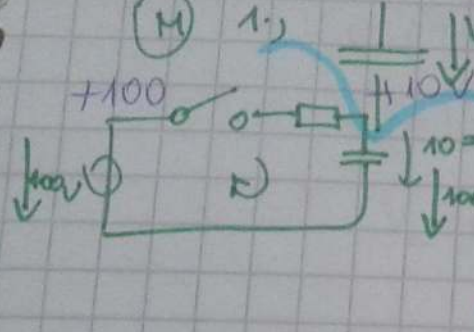
$i(0+) = \frac{V_R(0+)}{R} = \frac{90V}{10\,\Omega} = 9A$

$A = 9A$

$i = 9e^{1000\cdot t}\ [A]$

áramot Ae^{st} alakban keressük, s megvan A a kérdés

(M) 1.)

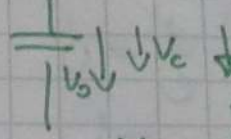


V_0 V_c i — la rísic

$V_0 - \int_0^t i\,d\tau$

V_c

la kötőair

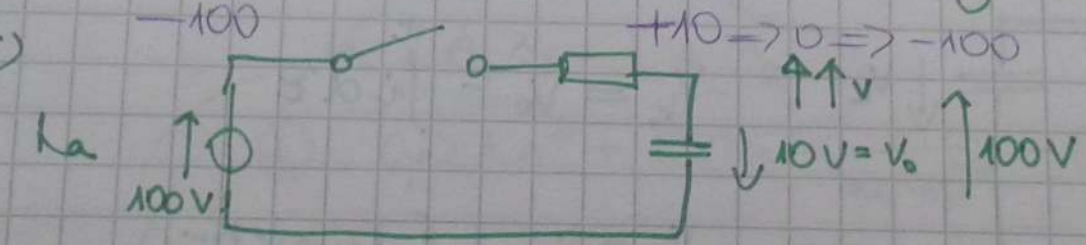


$V_0 + \int_0^t i\,d\tau$

elinő áramörnél.

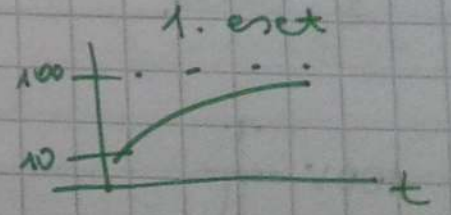
$-V_y + V_{a\ rondi\ a\ végein} = 0$

2.)



földhöz képest

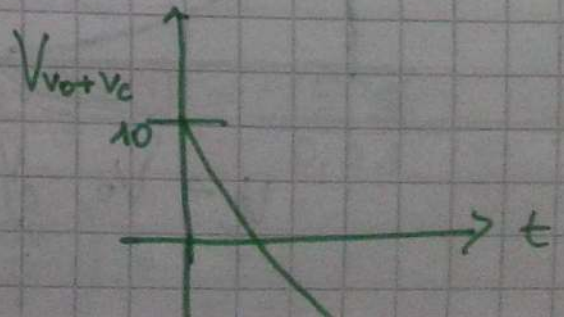
V_{v0+vc} = Vkondiban elinő ömtera.



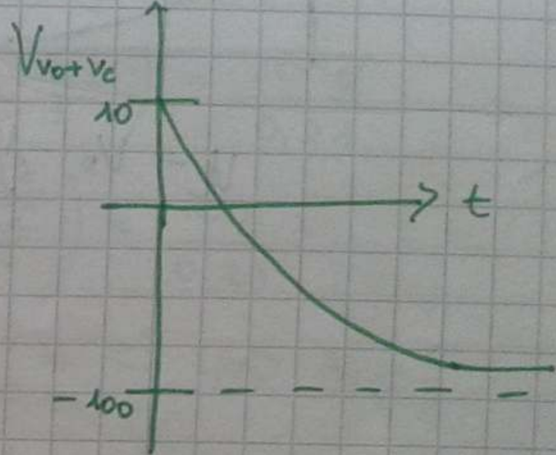
$V_{kond}(0-) = V_{kond}(0+)$

$i_{tekercs}(0-) = i_{tekercs}(0+)$

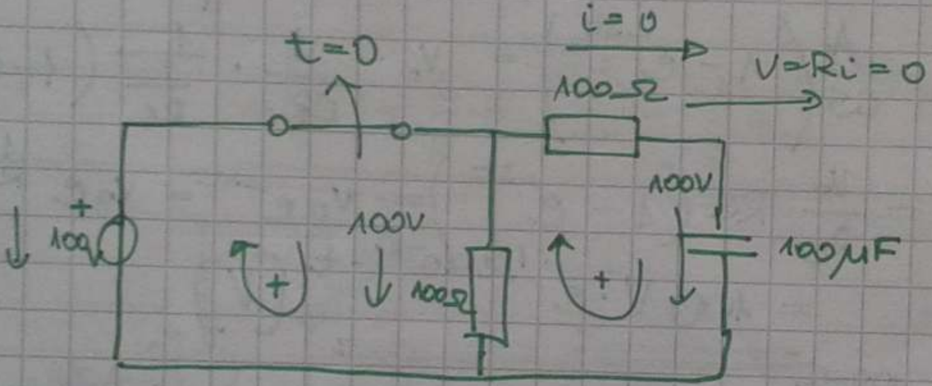
2. eset



$i_{tekercs}(0-) = i_{tekercs}(0+)$



2.



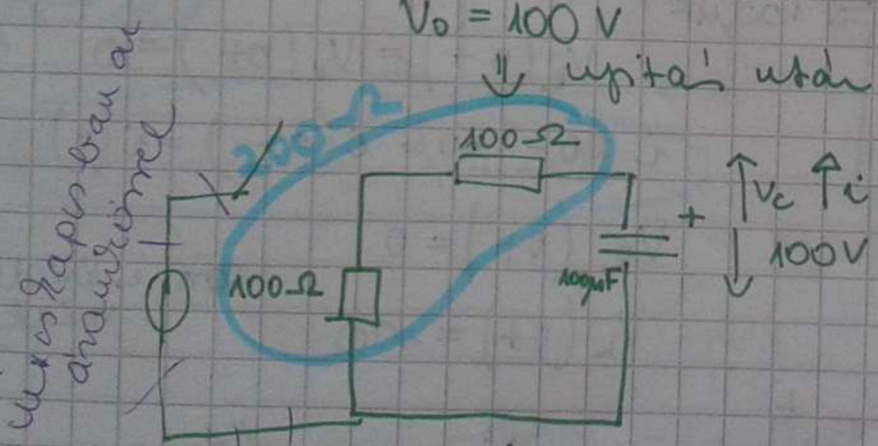
állandósult áll.
RC hálózat

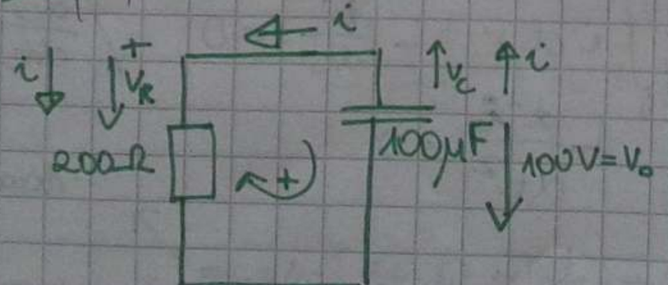
kondi - szakadásként viselk.

~~áramforrás kondi áramforrás feszültsége és kondi kezdeti fesz-e~~

$V_0 = 100\ V$

⇓ nyitás után





$-V_R - V_c + V_0 = 0$

$-Ri - \frac{1}{C}\int_0^t i\, d\tau + V_0 = 0$ $\quad / \frac{d}{dt}$

$100\ V = V_R(0+) = RAe^{-1/RC \cdot t} \Big|_{t=0}$

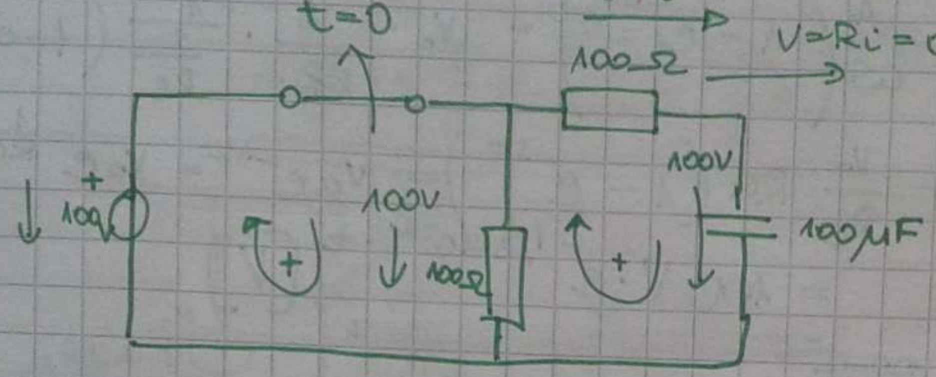
$100 = RA$

$A = \frac{100}{200} = \frac{1}{2} A$

⇓

$i(t) = \frac{1}{2} e^{-\frac{1}{200 \cdot 100 \cdot 10^{-6}}}$ A

2.



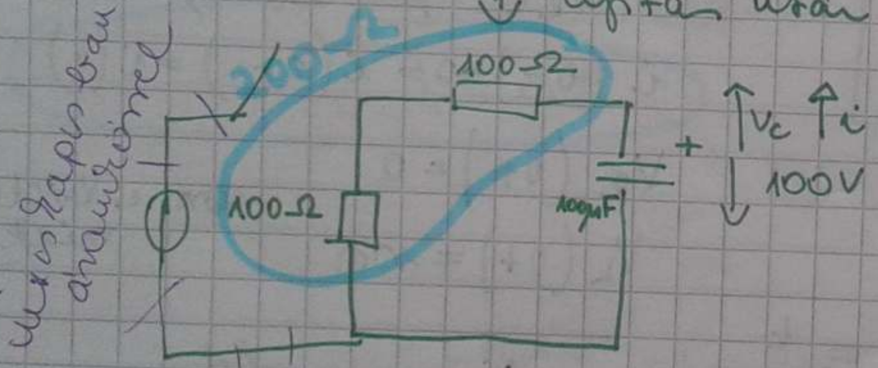
állandósult áll. RC hálózat

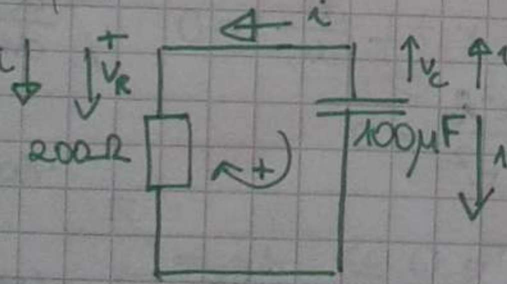
kondi - szakadásként viselk.

~~áramforrás feszültsége és kondi kezdeti fesz-e~~

$V_0 = 100\ V$

⇓ nyitás után





$$-V_R - V_C + V_0 = 0$$

$$-Ri - \frac{1}{C}\int_0^t i\,d\tau + V_0 = 0 \quad \Big/ \frac{d}{dt}$$

$$-R\frac{di}{dt} - \frac{1}{C}i = 0$$

$$100\ V = V_R(0+) = RAe^{-1/RC \cdot t} \Big|_{t=0}$$

$$100 = RA$$

$$A = \frac{100}{200} = \frac{1}{2}A$$

⇓

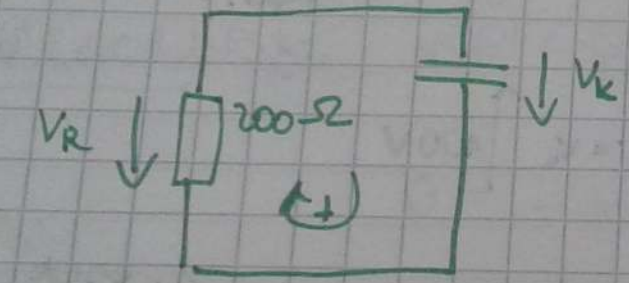
$$i(t) = \frac{1}{2}e^{-\frac{1}{200 \cdot 100 \cdot 10^{-6}}}\ A$$

$$Rs + \frac{1}{C} = 0$$

$$s = -\frac{1}{RC}$$

Id: előző oldal

$$i(t) = \frac{1}{2} e^{\frac{-1}{200 \cdot 100 \cdot 10^{-6}}} \; [A]$$

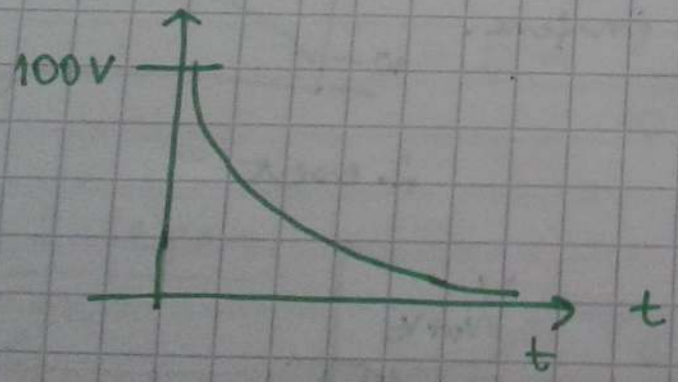


$$V_k = V_0 - \int_0^t i \, d\tau$$

$$V_R = V_k \quad \text{(kirchh.)}$$

$$R i = 200 \cdot \frac{1}{2} \cdot e^{\frac{-1t}{2 \cdot 10^{-2}}} = V$$

$$= 100 e^{\frac{-1}{2 \cdot 10^{-2}} \cdot t} \; [V]$$



$$V_k = V_0 - \frac{1}{C} \int_0^t i \, d\tau = V_0 - \frac{1}{C} \int_0^t A e^{-s\tau} \, d\tau =$$

$$= V_0 - \frac{1}{C} \left[\frac{A e^{-s\tau}}{-s} \right]_0^t = V_0 - \frac{1}{C} \left(\frac{A e^{-st}}{-s} + \frac{A}{s} \right) \quad 1/s \cdot$$

$$V_k = V_0 - \frac{1}{C}\int_0^t i\,d\tau = V_0 - \frac{1}{C}\int_0^t Ae^{-s\tau}\,d\tau =$$

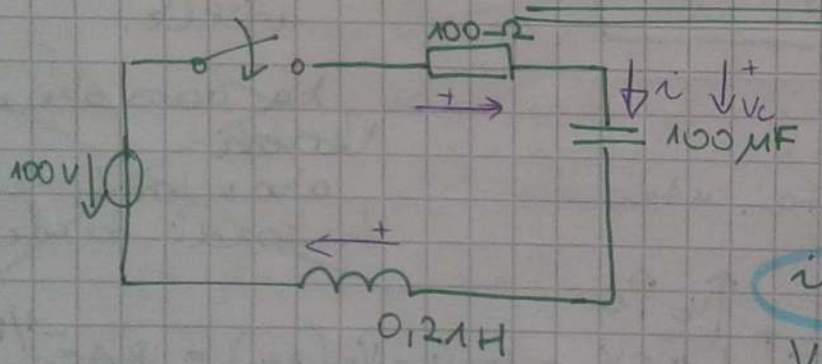
$$= V_0 - \frac{1}{C}\left[\frac{Ae^{-s\tau}}{-s}\right]_0^t = V_0 - \frac{1}{C}\left(\frac{Ae^{-st}}{-s} + \frac{Ae^{-1/s\cdot 0}}{+s}\right) =$$

$$= V_0 - \frac{A}{Cs}\left(1 - e^{-st}\right) = V_0 - \frac{V_0}{CR}\cdot\frac{1}{\frac{1}{RC}}\left(1 - e^{-st}\right) =$$

$$= V_0 - \frac{V_0}{RC}RC\left(1 - e^{-st}\right) = V_0 e^{-st} = V_0 e^{-\frac{1}{RC}\cdot t} =$$

$$= 100\,V \cdot e^{-1/2\cdot 10^{-2}\cdot t}\ [V]$$

(3)



$V_0 = 0$ (kezdő feltétel)

$V_k(0-) = V_k(0+) = 0$

$i(0-) = 0 = i(0+) = i(0)$

$V_R(0+) = 0$

$V_L(0+) = 100$ (mert ez Kirchh.)

$$-100 + Ri + \overset{0}{V_0} + \frac{1}{C}\int_0^t i\,d\tau + L\frac{di}{dt} = 0 \quad / \frac{d}{dt}$$

$$R\frac{di}{dt} + i\frac{1}{C} + L\frac{d^2i}{dt^2} = 0$$

$$Ls^2 + Rs + \frac{1}{C} = 0 \Rightarrow s_{1,2} = \begin{cases} -1000/7 = s_1 \\ -1000/3 = s_2 \end{cases}$$

$$i(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t} \qquad A_1, A_2 = ?$$

$$i(0) = A_1 + A_2 = 0 \Rightarrow A_1 = -A_2$$

$$V_L(0) = 100 = L \left.\frac{di}{dt}\right|_{t=0} =$$

$$= L \cdot \left(A_1 s_1 e^{s_1 t} + A_2 s_2 e^{s_2 t}\right)\Big|_{t=0} =$$

$$= L A_1 s_1 + L A_2 s_2$$

$$(*) \quad 0{,}21 s^2 + 100 s + \frac{1}{100 \cdot 10^{-6}} = 0$$

$$s_1 = -1000/7 \qquad s_2 = -1000/3$$

$$A_1 = -A_2$$

$$A_1 s_1 = A_1 \left(-\frac{1000}{7}\right) + A_2 \cdot \left(-\frac{1000}{3}\right) = \frac{100}{0{,}21}$$

$$-A_2 \left(-\frac{1000}{7}\right) + A_2 \left(-\frac{1000}{3}\right) = \frac{100}{0{,}21}$$

$$A_2 \left(\frac{1000}{7} - \frac{1000}{3}\right) = \frac{100}{0{,}21}$$

$= L A_1 s_1 + L A_2 s_2$

(*) $0{,}21 s^2 + 100 s + \frac{1}{100 \cdot 10^{-6}} = 0$

$s_1 = -1000/7 \quad s_2 = -1000/3$

$A_1 = -A_2$

$A_1 \cdot \left(-\frac{1000}{7}\right) + A_2 \cdot \left(-\frac{1000}{3}\right) = \frac{100}{0{,}21}$

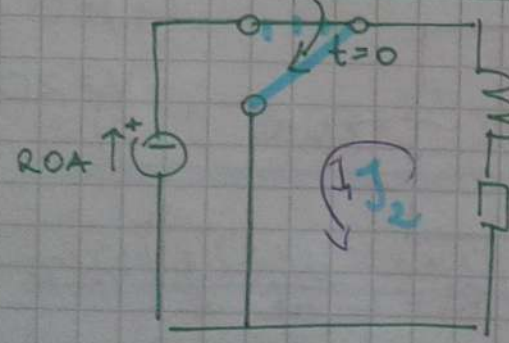
$-A_2\left(-\frac{1000}{7}\right) + A_2\left(-\frac{1000}{3}\right) = \frac{100}{0{,}21}$

$A_2\left(\frac{1000}{7} - \frac{1000}{3}\right) = \frac{100}{0{,}21}$

$A_2 = -\frac{5}{2} \Rightarrow A_1 = \frac{5}{2}$

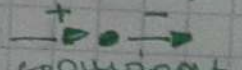
$i(t) = \frac{5}{2} \cdot e^{-\frac{1000}{7}t} - \frac{5}{2} e^{-\frac{1000}{3}t}$ [A]

(4)



Keressük áramot NEM ugrik

$t = 0{,}2\,s \quad I(t=0{,}2) = ?$



$J_2 = -RJ - L\frac{di}{dt} = 0$

$\frac{di}{dt} = sAe^{st}$

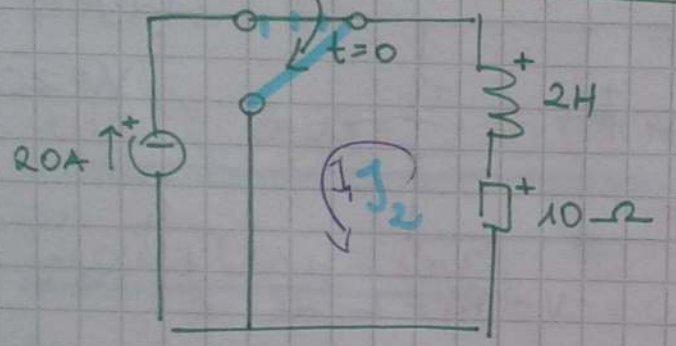
$i = Ae^{st}$

$$A_2\left(\frac{1000}{7} - \frac{1000}{3}\right) = \frac{100}{0,21}$$

$$A_2 = \frac{-5}{2} \Rightarrow A_1 = \frac{5}{2}$$

$$i(t) = \frac{5}{2}\cdot e^{-\frac{1000}{7}t} - \frac{5}{2}e^{-\frac{1000}{3}t} \quad [A]$$

(4)



Tekercsen áram NEM ugrik

$t = 0,2s \quad I(t=0,2) = ?$

+ → • → − (azonos irányú)

$$I_2 = -RI - L\frac{di}{dt} = 0$$

$$\frac{di}{dt} = sAe^{st}$$

$$i = Ae^{st}$$

$$-RAe^{st} - LsAe^{st} = 0$$

$$-Ae^{st}(R + Ls) = 0$$

$$R + Ls = 0$$

$$\hookrightarrow s = \frac{-R}{L} = \frac{-10}{2} = -5\ \frac{1}{s}$$

mar. jorsel @ laugaro. hpre.hu (letöltés v amivel) google: áramköri szimulátor: 1. ch. lap

~~$-R \quad -RAe^{-5t} - L\cdot(-5)\,Ae^{-5t} = 0$~~

$$i = Ae^{-5t}$$

$$20 = Ae^{-5t}\Big|_{t=0} = A$$

$$\underline{\underline{i(t)}} = 20e^{-5t}\Big|_{t=0,2} = \underline{\underline{20e^{-1}}}$$

(M) időfv : kis betű

egyenáram : nagy betű

(r, ϑ) (x, y)

Számológép: Pol → Rec mod?

komplexet tudja-e?

Descartes-ba váltani

10.03. Gyakorlat

Jövő hétre kis zh!

Állandósult állapot fázelemekre ...