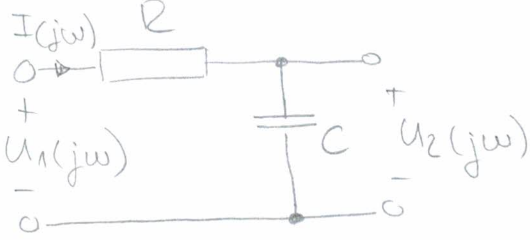


Prenosna oz. prevajalna funkcija vezja

$$U_2(j\omega) = \frac{U_1(j\omega)\cdot\frac{1}{j\omega C}}{R+\frac{1}{j\omega C}} \Rightarrow \frac{U_2(j\omega)}{U_1(j\omega)} = \frac{\frac{1}{j\omega C}}{R+\frac{1}{j\omega C}}$$

$\underbrace{\omega_1 = \frac{1}{RC}}$ (mejna frekvenca)

$\Downarrow$

$\tau_1 = RC$

$$H(j\omega) = \frac{U_2(j\omega)}{U_1(j\omega)} = \frac{\cancel{\frac{1}{j\omega C}}}{\frac{Rj\omega C+1}{\cancel{j\omega C}}} = \frac{1}{1+j\omega RC}$$

$$= \frac{\omega_1}{\omega_1 + j\omega} = \underbrace{\frac{\omega_1^2 - j\omega\omega_1}{\omega_1^2+\omega^2}}$$

$\Downarrow$

Re: $\frac{\omega_1^2}{\omega_1^2+\omega^2}$

Im: $\frac{-j\omega\omega_1}{\omega_1^2+\omega^2}$

Amplitudni odziv $|H(j\omega)|$

$$|H(j\omega)| = \frac{|U_2(j\omega)|}{|U_1(j\omega)|} = \sqrt{Re^2\{H(j\omega)\} + Im^2\{H(j\omega)\}}$$

$$= \sqrt{\left(\frac{\omega_1^2}{\omega_1^2+\omega^2}\right)^2 + \left(\frac{-j\omega\omega_1}{\omega_1^2+\omega^2}\right)^2} =$$

$$= \sqrt{\frac{\omega_1^2\cancel{(\omega_1^2+\omega^2)}}{(\omega_1^2+\omega^2)^{\cancel{2}}}} = \sqrt{\frac{\omega_1^2}{\omega_1^2+\omega^2}}$$

$\omega_1 = \frac{1}{RC}$

$\Downarrow$

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

$$\Rightarrow \boxed{|H(j\omega)| = \frac{1}{\sqrt{1+(\omega RC)^2}}}$$

Fazni odziv

$$\varphi = \operatorname{arctg} \frac{Im\{H(j\omega)\}}{Re\{H(j\omega)\}}$$

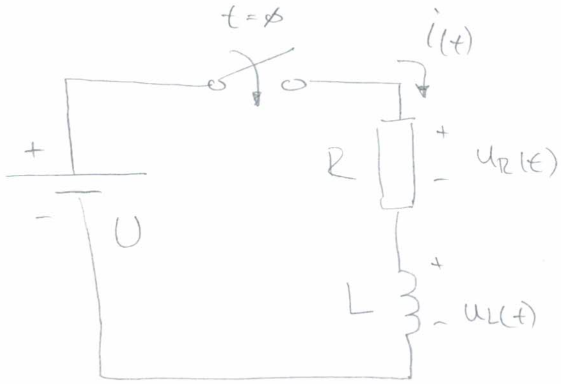
$$\omega_1 = \frac{1}{RC}$$

$$= \operatorname{arctg} \frac{\frac{-\omega_1 \omega}{\cancel{\omega_1^2+\omega^2}}}{\frac{\omega_1^2}{\cancel{\omega_1^2+\omega^2}}} \Rightarrow \frac{-\cancel{\omega_1}\omega}{\omega_1^{\cancel{2}}} \Rightarrow -\frac{\omega}{\omega_1} \Rightarrow -\omega RC$$

$$H(j\omega) = 20 \cdot Log\,|H(j\omega)|$$

$$\Rightarrow -\operatorname{arctg}(\omega RC)$$

ωRC	|H(jω)|	H(jω)[dB]	φ [°]
0,01	0,99995	-0,000434	-0,573
0,1	0,995	-0,0432	-5,710
0,5	0,894	-0,969	-26,565
1	0,707	-3,010	-45,000
2	0,447	-6,989	-63,435
10	0,110	-20,043	-84,289
100	0,010	-40,000	-89,427



v $t = 0^-$:

$$u_R(t) = \emptyset$$

$$u_L(t) = \emptyset$$

v $t = 0^+$:

$$U = u_R(t) + u_L(t)$$

$$U = i(t) R + L \frac{di_L}{dt} \qquad i_L = i(t)$$

$$U = i(t) \cdot R + L \frac{di(t)}{dt}$$

Diferencialna enačba 1. reda (1. odvod)

(1.) Poiščemo splošno rešitev oz. homogeno rešitev:

$$i(t) \cdot R + L \frac{di(t)}{dt} = \emptyset$$

$$L \frac{di(t)}{dt} = -i(t) \cdot R$$

$$\frac{di(t)}{dt} = -\frac{R}{L} \cdot i(t)$$

$$\frac{di(t)}{i(t)} = -\frac{R}{L} \cdot dt \quad / \int$$

$$\int \frac{1}{i(t)} di(t) = -\frac{R}{L} \int dt$$

$$\ln(i(t)) = -\frac{R}{L} \cdot t + k_1 \quad / e^x$$

$$e^{\ln(i(t))} = e^{-\frac{R}{L} \cdot t} + e^{k_1}$$

$$\boxed{i(t) = e^{-\frac{R}{L} \cdot t} \cdot e^{k_1}} \quad e^{k_1} \to k_2 \Rightarrow \boxed{i(t) = k_2 \cdot e^{-\frac{R}{L} \cdot t}}$$

GregorN

METODA VARIACIJE KONSTANT (Partikularna rešitev)

$$i_{(t)} = k_2 \cdot e^{-\frac{R}{L}\cdot t} \qquad k_2 = e^{k_1}$$

* možno da je tudi spremenljiva zato odvajamo po pravilu:

$$(f(x)\cdot g(x))' = f(x)'\cdot g(x) + f(x) g(x)'$$

$$\frac{di_{(t)}}{dt} = \frac{dk_2}{dt}\cdot e^{-\frac{R}{L}\cdot t} + k_2 \cdot e^{-\frac{R}{L}\cdot t}\cdot\left(-\frac{R}{L}\right)$$

$$= \boxed{\frac{dk_2}{dt}\cdot e^{-\frac{R}{L}\cdot t} - k_2\cdot e^{-\frac{R}{L}\cdot t}\cdot\frac{R}{L}}$$

$$U = i_{(t)}R + L\frac{di(t)}{dt}$$

$$U = R\cdot k_2\cdot e^{-\frac{R}{L}\cdot t} + L\cdot\left(\frac{dk_2}{dt}\cdot e^{-\frac{R}{L}\cdot t} - k_2\cdot e^{-\frac{R}{L}\cdot t}\cdot\frac{R}{L}\right)$$

$$U = \cancel{k_2\cdot e^{-\frac{R}{L}\cdot t}\cdot R} + L\frac{dk_2}{dt}\cdot e^{-\frac{R}{L}\cdot t} \cancel{- k_2\cdot e^{-\frac{R}{L}\cdot t}\cdot R}$$

$$U = L\frac{dk_2}{dt}\cdot e^{-\frac{R}{L}\cdot t}$$

$$U\cdot\left(e^{-\frac{R}{L}\cdot t}\right)^{-1} = L\frac{dk_2}{dt} \Rightarrow \frac{U}{L}\cdot e^{\frac{R}{L}\cdot t} = \frac{dk_2}{dt}$$

$$dk_2 = \frac{U}{L}\cdot e^{\frac{R}{L}\cdot t}\, dt \quad // \int$$

$$\int dk_2 = \frac{U}{L}\cdot\int e^{\frac{R}{L}\cdot t}\, dt$$

$$k_2 = \frac{U}{L}\cdot\frac{L}{R}\cdot e^{n} + k_3$$

$$\underbrace{\boxed{k_2 = \frac{U}{R}\cdot e^{\frac{R}{L}\cdot t} + k_3}}_{\text{vstavimo v } i(t)}$$

$$\int e^{\frac{R}{L}\cdot t}\, dt = \int e^{n}\, dt = \int e^{n}\cdot\frac{L}{R}\, dn$$

$$\frac{Rt}{L} = n$$

$$\left(\frac{Rt}{L}\right)' dt = (n)' dn$$

$$\frac{R}{L}\, dt = dn$$

$$dt = \frac{L}{R}\, dn$$

$$= \frac{L}{R}\cdot e^{n} + k_3$$

GregorN

$$i(t) = k_2 \cdot e^{-\frac{R}{L}\cdot t}$$

$$i(t) = \left(\frac{U}{R}\cdot e^{\frac{R}{L}\cdot t} + k_3\right)\cdot e^{-\frac{R}{L}\cdot t}$$

$$\boxed{i(t) = \frac{U}{R} + k_3 e^{-\frac{R}{L}\cdot t}}$$

Za k_3:

$$t(0^+) = i(t) = \emptyset = i(0^+);$$

$$i(0^+) = \frac{U}{R} + k_3 \cdot \underbrace{e^{-\frac{R}{L}\cdot \emptyset}}_{1} \Rightarrow \boxed{k_3 = -\frac{U}{R}}$$

R: $\boxed{i(t) = \frac{U}{R}\left(1 - e^{-\frac{R}{L}\cdot t}\right) A}$

$$u_R(t) = i(t)\cdot R$$

$$= \boxed{U\cdot\left(1 - e^{-\frac{R}{L}\cdot t}\right) V}$$

$$u_L(t) = L\frac{di_L}{dt} = L\frac{di(t)}{dt} = L\frac{U}{R}\cdot\left(-e^{-\frac{R}{L}\cdot t}\right)\cdot\left(-\frac{R}{L}\right)$$

$$u_L(t) = \boxed{U e^{-\frac{R}{L} t}\ V}$$

$$p_R(t) = u_R(t)\cdot i(t)$$

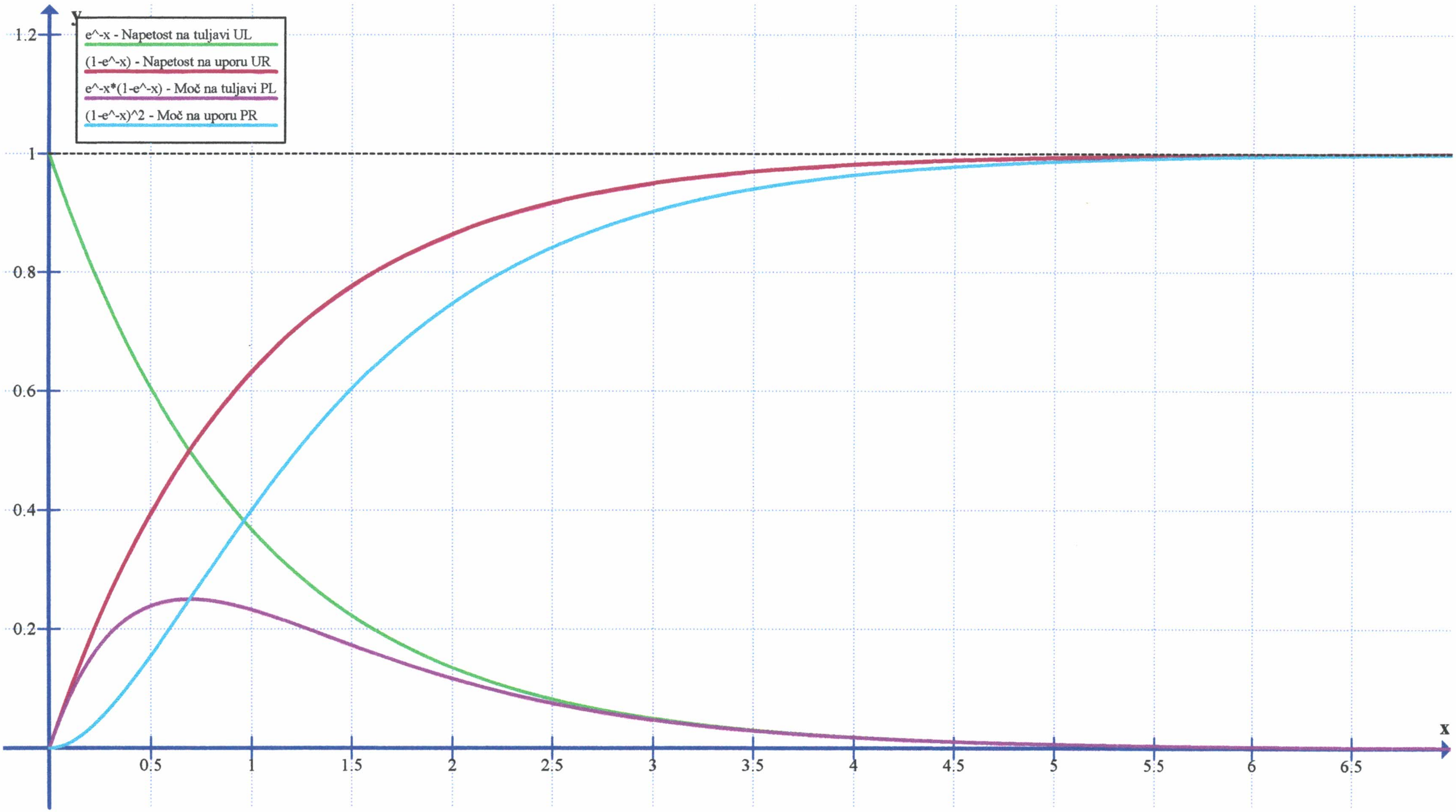
$$= U e^{-\frac{R}{L}\cdot t}\cdot\left(\frac{U}{R}\left(1 - e^{-\frac{R}{L} t}\right)\right)$$

$$= \frac{U^2}{R}\cdot e^{-\frac{R}{L}\cdot t}\left(1 - e^{-\frac{R}{L} t}\right)$$

$$= \boxed{\frac{U^2}{R}\left(1 - e^{-\frac{R}{L}\cdot t}\right)^2}$$

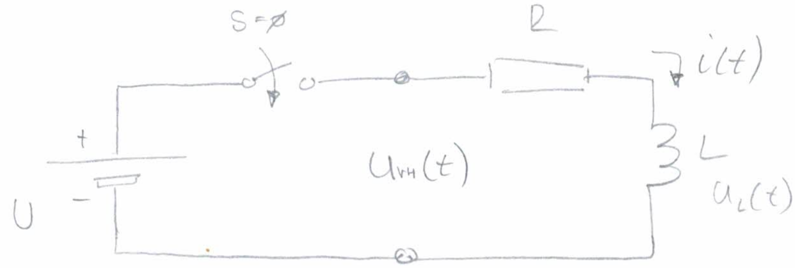
$$p_L(t) = u_L(t)\cdot i(t)$$

$$= \boxed{\frac{U^2}{R}\cdot e^{-\frac{R}{L}\cdot t}\left(1 - e^{-\frac{R}{L}\cdot t}\right)}$$



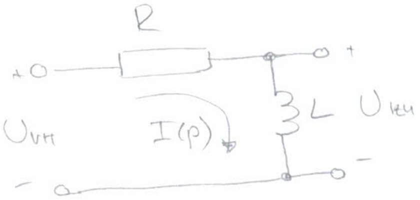
y
e^-x - Napetost na tuljavi UL
(1-e^-x) - Napetost na uporu UR
e^-x*(1-e^-x) - Moč na tuljavi PL
(1-e^-x)^2 - Moč na uporu PR
1.2
1
0.8
0.6
0.4
0.2
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
x

Enotina stopnica



1. $\boxed{U_{vh}(p) = \frac{U}{p}}$

2. $\boxed{H(p) = \frac{U_{izh}(p)}{U_{vh}(p)}}$



$\mathcal{L}$

$\underbrace{j\omega \rightarrow p}$

$$\left.\begin{aligned} U_{vh} &= I(j\omega)\cdot(R + j\omega L) \\ U_{izh} &= I(j\omega)\cdot j\omega L \end{aligned}\right\}$$

$\Downarrow$

$$\left\{\begin{aligned} U_{vh} &= I(p)\cdot(R + pL) \\ U_{izh} &= I(p)\cdot pL \end{aligned}\right.$$

$\Downarrow$

$$H(p) = \frac{\cancel{I(p)}\cdot pL}{\cancel{I(p)}\cdot(R+pL)}$$

$$H(p) = \frac{pL}{R+pL}$$

3. $\boxed{U_{izh}(p) = U_{vh}(p)\cdot H(p)}$

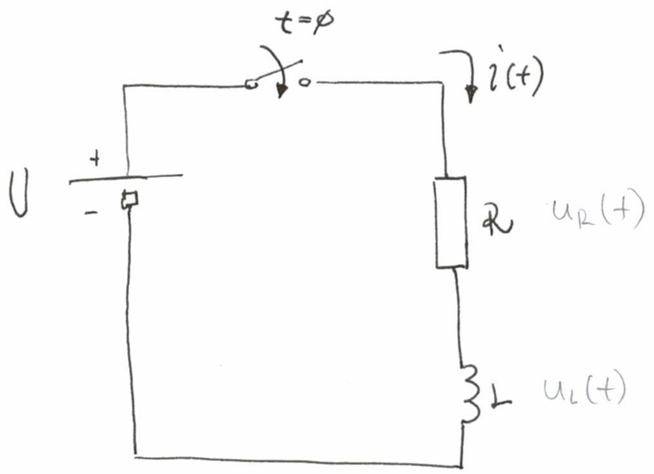
$$U_{izh}(p) = \frac{U}{\cancel{p}}\cdot\frac{\cancel{p}L}{R+pL} = \frac{UL}{R+pL}$$

$$\boxed{\frac{1}{p+a} \rightarrow e^{-at}}$$ transform

$$U_{izh}(p) = U\cdot\frac{1}{\frac{R}{L}+p}$$

4. Preslikava $U_{izh}(p) \rightarrow U_{izh}(t) \rightarrow U_{izh}(t) = e^{-\frac{R}{L}\cdot t}$

PREHODNI POJAVI



POMNI:

$$i_C = C\frac{du_C}{dt}$$

$$u_L = L\frac{di_L}{dt}$$

$\underline{t = 0^-}$

$u_R(t) = 0$

$u_L(t) = 0$

$\underline{t = 0^+}$

$U = u_R(t) + u_L(t)$ $\qquad i_L = i(t)$

$= i(t)\cdot R + L\frac{di_L(t)}{dt}$ ⤳ diferencialna enačba 1. reda

① Homogena rešitev:

$$i(t)\cdot R + L\frac{di(t)}{dt} = 0$$

$$L\frac{di(t)}{dt} = -i(t)\cdot R \quad /:L$$

$$\frac{di(t)}{dt} = -i(t)\cdot\frac{R}{L} \quad /: i(t) \quad /\cdot dt$$

$$\frac{di(t)}{i(t)} = -\frac{R}{L}dt \quad /\int$$

$$\ln(i(t)) = -\frac{R}{L}\int_0^t dt$$

$$\ln(i(t)) = -\frac{R}{L}\cdot t + k_1 \quad / e^x$$

konstanta

$$i(t) = e^{-\frac{R}{L}\cdot t}\cdot e^{k_1}$$

$$e^{k_1} = k_2$$

$$\boxed{i(t) = e^{-\frac{R}{L}\cdot t}\cdot k_2}$$

je lahko tudi spremenljivka

metoda variacije konstant (parcialna rešitev)

- odvajamo homogeno rešitev

homogena: $i(t) = k_2 e^{-\frac{R}{L}t}$ $\left(k_2' e^{-\frac{R}{L}t} + k_2 e^{-\frac{R}{L}t'}\right)$

$$\frac{di(t)}{dt} = \frac{dk_2}{dt} \cdot e^{-\frac{R}{L}\cdot t} + k_2 \cdot e^{-\frac{R}{L}\cdot t} \cdot \left(-\frac{R}{L}\right)$$

1. enačba (na začetku): $u = i(t) \cdot R + L \frac{di(t)}{dt}$

$$\Rightarrow \quad u = k_2 \cdot e^{-\frac{R}{L}t} \cdot R + L\left(\frac{dk_2}{dt} \cdot e^{-\frac{R}{L}t} - k_2 \cdot e^{-\frac{R}{L}\cdot t} \cdot \frac{R}{L}\right)$$

$$u = \cancel{k_2 \cdot e^{-\frac{R}{L}\cdot t} \cdot R} + \frac{dk_2}{dt} \cdot e^{-\frac{R}{L}t} L \cancel{- k_2 \cdot e^{-\frac{R}{L}\cdot t} R}$$

$$u = \frac{dk_2}{dt} \cdot e^{-\frac{R}{L}\cdot t} L$$

$$\frac{dk_2}{dt} = \frac{u}{L e^{-\frac{R}{L}\cdot t}} \quad \Rightarrow \quad \frac{dk_2}{dt} = \frac{u}{L} \cdot e^{\frac{R}{L}\cdot t} \quad / \cdot dt$$

$$1 \cdot dk_2 = \frac{u}{L} \cdot e^{\frac{R}{L}\cdot t} dt \quad // \int \quad \text{- integriramo!}$$

$$k_2 = \frac{u}{\cancel{L}} \cdot e^{\frac{R}{L}\cdot t} \cdot \frac{\cancel{L}}{R} = \boxed{\frac{U}{R} \cdot e^{\frac{R}{L}\cdot t} + k_3}$$

vstavimo v $i(t)$

$$\Rightarrow \quad i(t) = \left(\frac{u}{R} \cdot e^{\frac{R}{L}\cdot t} + k_3\right) \cdot e^{-\frac{R}{L}\cdot t} =$$

$$= \frac{u}{R} + k_3 e^{-\frac{R}{L}\cdot t}$$

$\Longrightarrow$ Za k_3: $t = \emptyset^+$

$i(t) = \emptyset = i(\emptyset^+)$;

$$i(\emptyset^+) = \frac{u}{R} + k_3 \cdot \underbrace{e^{-\frac{R}{L}\cdot \emptyset}}_{1}$$

$$\Rightarrow \boxed{k_3 = -\frac{u}{R}}$$

R: $i(t) = \frac{u}{R} - \frac{u}{R} \cdot e^{-\frac{R}{L}\cdot t}$

$$\Rightarrow \boxed{i(t) = \frac{u}{R}\left(1 - e^{-\frac{R}{L}\cdot t}\right)}$$

$$u_R(t) = i(t)\cdot R = \frac{U}{R}\left(1-e^{-\frac{R}{L}\cdot t}\right)\cdot R = \qquad \frac{L}{R}=\tau$$

$$= \boxed{U\left(1-e^{-\frac{R}{L}\cdot t}\right)} = U\left(1-e^{-\frac{t}{\tau}}\right)$$

$$u_L(t) = L\,\frac{di(t)}{dt} = \frac{-\cancel{L}U}{R}\cdot e^{-\frac{R}{L}\cdot t}\cdot\left(-\frac{R}{\cancel{L}}\right) = \boxed{+U\cdot e^{-\frac{R}{L}\cdot t}}$$

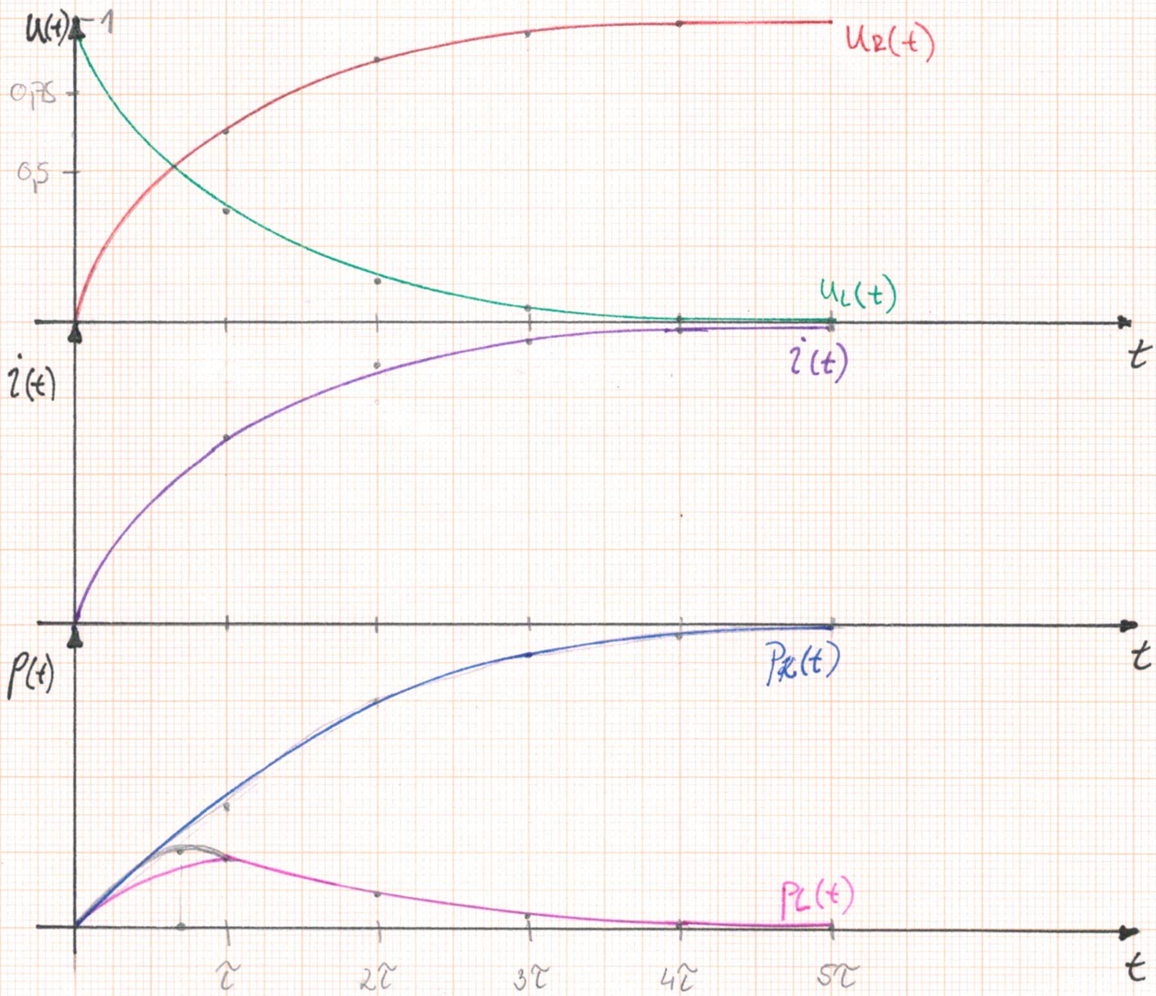
$$P_L(t) = u_L(t)\cdot i(t) =$$

$$= Ue^{-\frac{R}{L}t}\cdot\frac{U}{R}\left(1-e^{-\frac{R}{L}t}\right) = \boxed{\frac{U^2}{R}e^{-\frac{R}{L}t}\cdot\left(1-e^{-\frac{R}{L}t}\right)}$$

$$P_R(t) = u_R(t)\cdot i(t) =$$

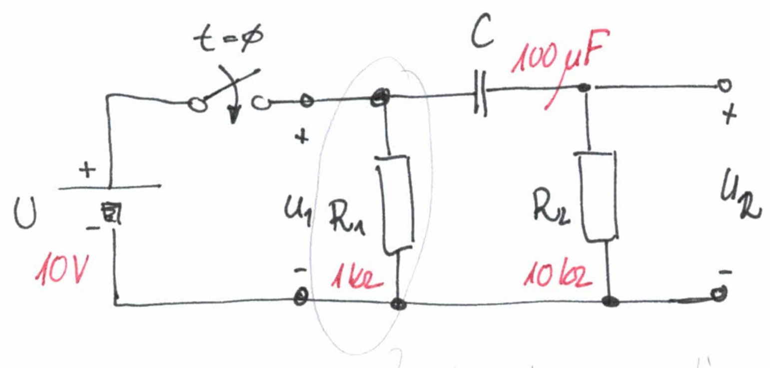
$$= U\left(1-e^{-\frac{R}{L}\cdot t}\right)\cdot\frac{U}{R}\left(1-e^{-\frac{R}{L}\cdot t}\right) = \boxed{\frac{U^2}{R}\left(1-e^{-\frac{R}{L}\cdot t}\right)^2}$$

τ	$u_R(t)=U\left(1-e^{-\frac{t}{\tau}}\right)$	$u_L(t)=U\cdot e^{-\frac{t}{\tau}}$	$i(t)=\frac{U}{R}\left(1-e^{-\frac{t}{\tau}}\right)$	$P_L(t)=\frac{U^2}{R}\left(1-e^{-\frac{t}{\tau}}\right)$	$P_R(t)=\frac{U^2}{R}\left(1-e^{-\frac{t}{\tau}}\right)^2$
1	0,632	0,369	0,632	0,233	0,399
2	0,865	0,135	0,865	0,117	0,748
3	0,950	0,0499	0,950	0,0473	0,903
4	0,982	0,0183	0,982	0,0179	0,964
5	0,993	0,00674	0,993	0,00669	0,987



u(t)
1
0,75
0,5
$u_R(t)$
$u_L(t)$
t
i(t)
i(t)
t
p(t)
$p_R(t)$
$p_L(t)$
τ
2τ
3τ
4τ
5τ
t

6. Zgled – prehodni pojav



$u_2(t) = ?$

$t = 0^-$

(1.) Na vhodu vezja je enotina stopnica

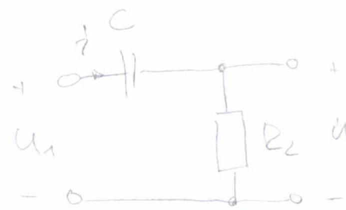
sledi:

F(t)	$\mathcal{L}$
u(t)	$\frac{1}{s}$ (p)

$$U_1(p) = U \cdot \frac{1}{p} = \frac{U}{p}$$

(2.) Zapišemo prevajalno funkcijo vezja:

$p = j\omega$



$$H(p) = \frac{U_2(p)}{U_1(p)}$$

$$H(p) = \frac{R_2}{R_2 + \frac{1}{pC}} = \frac{pR_2C}{pR_2C + 1}$$

(3.) Zapišemo enačbo za izhodno napetost $u_2(t)$ z prevajalno funkcijo $H(p)$:

$$U_2(p) = H(p) \cdot U_1(p) \Rightarrow U_2(p) = \frac{\cancel{p}R_2C}{pR_2C+1} \cdot \frac{U}{\cancel{p}} = \underbrace{U \cdot \frac{1}{p + \frac{1}{R_2C}}}_{\text{Transformiramo v časovni prostor}}$$

$F(p) \rightarrow f(t)$

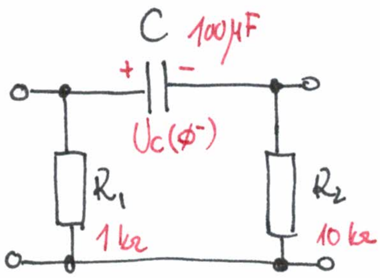
F(p)	f(t) $0 \le t$
$\frac{1}{p+a}$	e^{-at}

$$u_2(t) = U \cdot e^{-\frac{t}{R_2C}} \qquad \tau = R_2C$$

$$\boxed{= U \cdot e^{-\frac{t}{\tau}} \text{ [V]}}$$

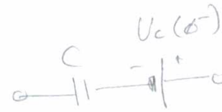

10
u2(t)
τ
2τ
3τ
4τ
5τ
u2(t) ~ nadaljevanje
Rrimena
-5,75
-10

nadaljevanje primera: – izklopimo stikalo v času τ



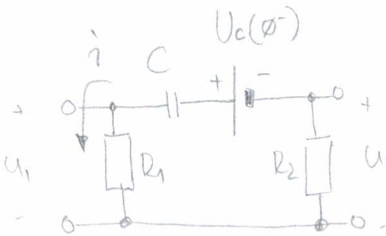
$$U_c(0^-) = U - U_2(0^-) = 10\,V - 3{,}68\,V = \boxed{6{,}32\,V}$$

Nabit kondenzator nadomestimo z modelom:

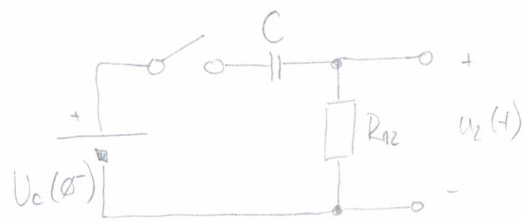


$t = 0^+$

$R_{12} = R_1 + R_2$



=



$$U_c(t) = U_c(0^-)\cdot\left(1 - e^{-\frac{t}{\tau}}\right)$$

$$i_c = C\frac{du_c(t)}{dt} = C\cdot U_c(0^-)\cdot\left(+e^{-\frac{t}{\tau}}\right)\cdot\left(+\frac{1}{\tau}\right) =$$

$$= \cancel{C}\cdot U_c(0^-)\cdot\frac{1}{R_{12}\cancel{C}}\cdot e^{-\frac{t}{\tau}} =$$

$$\tau = R_{12}C$$

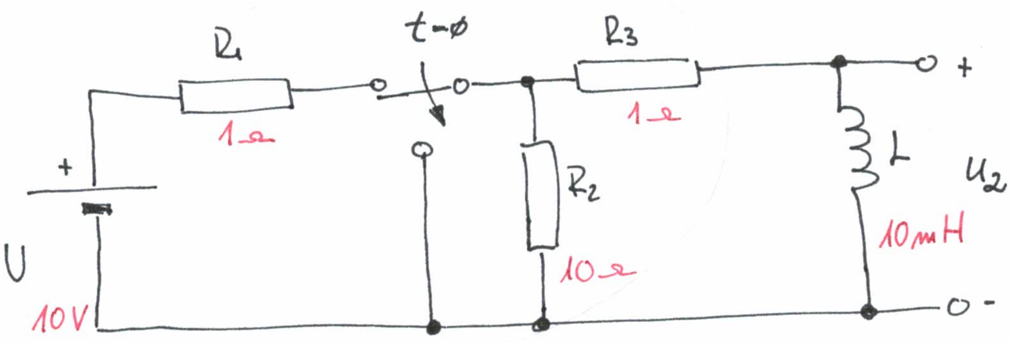
$$= \boxed{\frac{U_c(0^-)\cdot e^{-\frac{t}{\tau}}}{R_{12}}}$$

kondenzator žene tok v obratni smeri

$$u_2(t) = -i_c(t)\cdot R_2$$

$$= -\frac{R_2\,U_c(0^-)}{R_{12}}\cdot e^{-\frac{t}{\tau}} = -\frac{10\,k\Omega\cdot 6{,}32\,V}{11\,k\Omega}\cdot e^{-\frac{t}{\tau}} = \boxed{-5{,}75\cdot e^{-\frac{t}{\tau}}\,[V]}$$

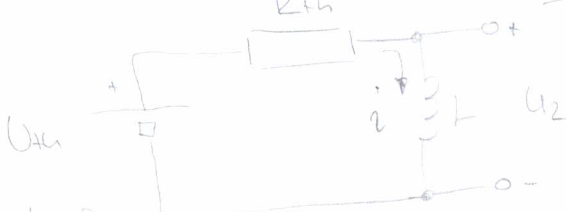
Prehodni pojav – zgled s tuljavo (potek napetosti po preklopu stikala) ($u_L(t)$)



$U_2(t) = ?$

$t = 0^-$

Thevenin

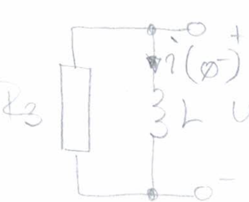


$R_{th} = R_1 \| R_2 + R_3 = \boxed{1{,}91\,\Omega}$

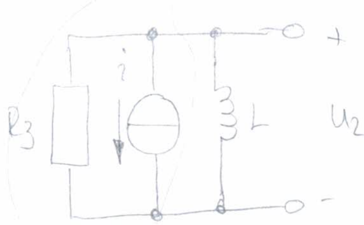
$U_{th} = \dfrac{U \cdot R_2}{R_1 + R_2} = \boxed{9{,}1\,V}$

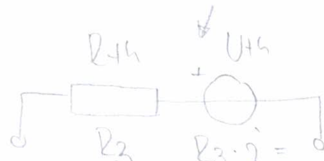
$i(0^-) = \dfrac{U_{th}}{R_{th}} = \dfrac{9{,}1\,V}{1{,}91\,\Omega} = \boxed{4{,}762\,A}$

$t = 0^+$

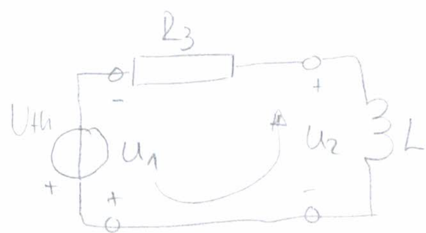


→ nadomestimo z modelom





$R_3 \cdot i = \boxed{4{,}762\,V}$



1. $U(s) = \boxed{U_{th} \cdot \frac{1}{p}}$ (stopnica)

$\| U_1(p)$

2. Prevajalna funkcija:

$$H(p) = \frac{U_2(p)}{U_1(p)} = \boxed{\frac{pL}{pL + R_3}}$$

3. $\underline{U_2(p)}$

$$U_2(p) = U_1(p) \cdot H(p) = \frac{U_{th}}{\cancel{p}} \cdot \frac{\cancel{p}L}{pL + R_3} = \boxed{U_{th} \cdot \frac{1}{p + \frac{R_3}{L}}}$$

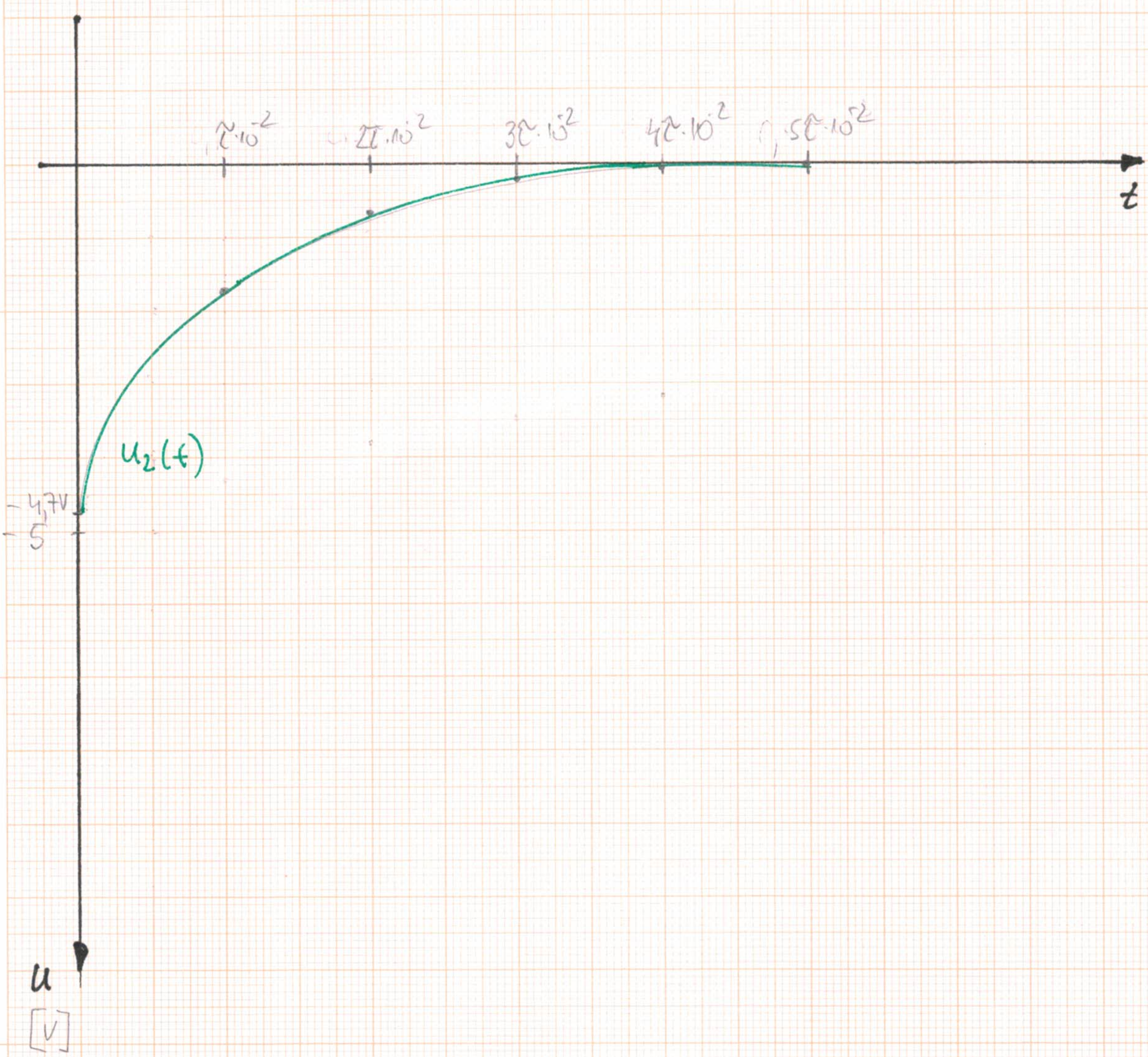
$F(s)$	$f(t)$
$\frac{1}{p+a}$	e^{-at}

4. v časovni prostor

$$\tau = \frac{L}{R_3}$$

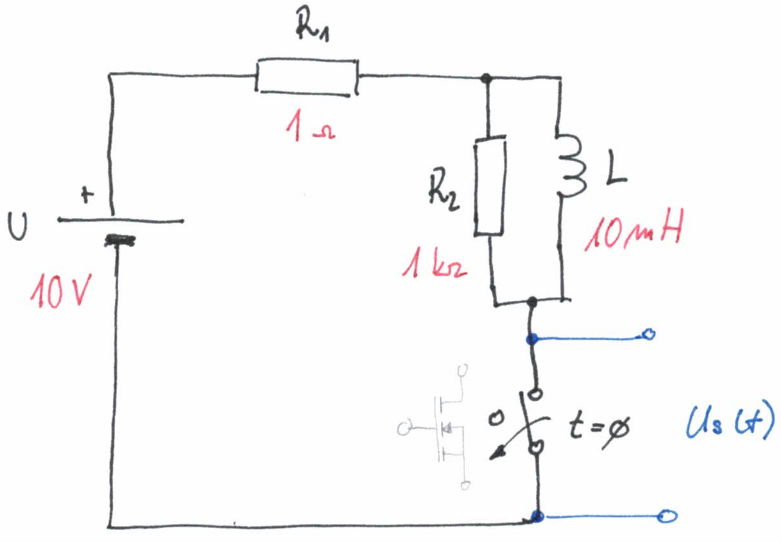
$$U_2(t) = U_{th} \cdot e^{-\frac{R_3}{L} t}$$

$$= \boxed{U_{th} \cdot e^{-\frac{t}{\tau}}}$$

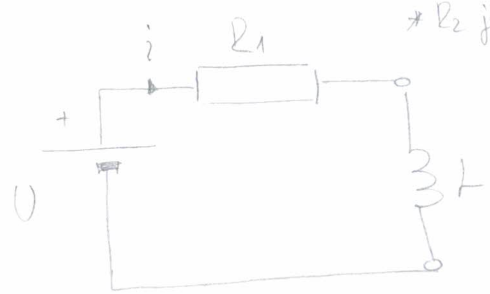


$\tau \cdot 10^{-2}$
$2\tau \cdot 10^{-2}$
$3\tau \cdot 10^{-2}$
$4\tau \cdot 10^{-2}$
$5\tau \cdot 10^{-2}$
t
$u_2(t)$
4,7V
5
u
[V]

Prehodni pojavi – napetost na stikalu ob izklopu



$t = \emptyset^-$

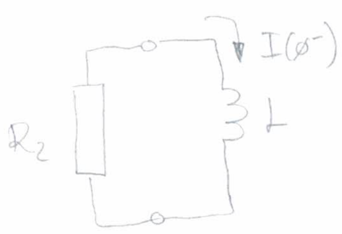


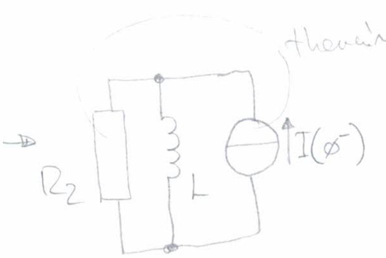
* R_2 je odpadel saj je L v stacionarni normali kratek stik.

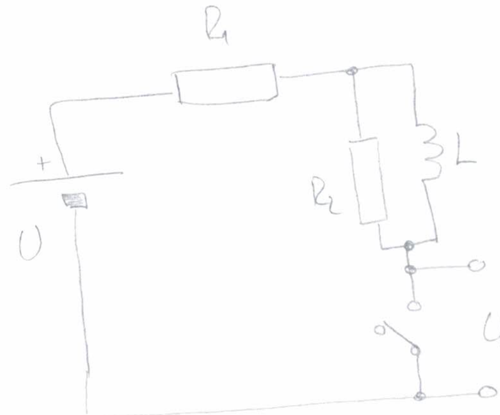
$$I(\emptyset) = \frac{U}{R_1} = \frac{10V}{1\Omega} = \boxed{10A}$$

$t = \emptyset^+$

* V tuljavi je že začetni tok $I(\emptyset^-)$;

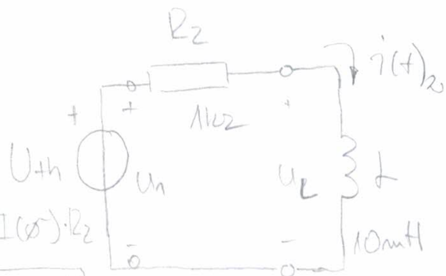






$U_s(t) = U + U_L$

(napetost na R_1 ni, ker tok ne teče skozi)



$= I(\emptyset) \cdot R_2$

$= \boxed{10\,kV}$

$$H(p) = \frac{U_2(p)}{U_1(p)} = \frac{pL}{pL + R_2} = \frac{p}{p + \frac{R_2}{L}}$$

$F(p)$	$f(t)$
$\frac{1}{p+a}$	e^{-at}

$\frac{1}{p} \cdot U_{th}$

$$U_L(p) = H(p) \cdot U_{th}(p)$$

$$= \frac{U_{th}}{\cancel{p}} \cdot \frac{\cancel{p}}{p + \frac{R_2}{L}} = U_{th} \cdot \frac{1}{p + \frac{R_2}{L}} = U_{th} \cdot e^{\dots}$$

$$U_{R_2}(t) = U_{th} - U_L = U_{th} - U_{th} \cdot e^{-\frac{R_2}{L}t} = U_{th}\left(1 - e^{-\frac{t}{\tau}}\right) [V]$$

$$\tau = \frac{L}{R_2}$$

$$i(t)_{R_2} = \frac{U_{R_2}(t)}{R_2} = \frac{U_{th}}{R_2} \cdot \left(1 - e^{-\frac{t}{\tau}}\right) [A]$$

$$i(t) = I(\emptyset^-) + i(t)_{R_2} = I(\emptyset^-) + \frac{U_{th}}{R_2} \cdot \left(1 - e^{-\frac{t}{\tau}}\right)$$

$$i_L(t) = I(\emptyset^-) - i(t) = \cancel{I(\emptyset^-)} - \cancel{I(\emptyset^-)} - \frac{U_{th}}{R_2}\left(1 - e^{-\frac{t}{\tau}}\right) =$$

$$= -\frac{U_{th}}{R_2}\left(1 - e^{-\frac{t}{\tau}}\right)$$

$$U_L(t) = L\frac{di_L(t)}{dt} = + \cancel{L} \cdot \frac{U_{th}}{\cancel{R_2}} \cdot e^{-\frac{t}{\tau}} \cdot \left(-\frac{\cancel{1}}{\cancel{R_2}}\right) =$$

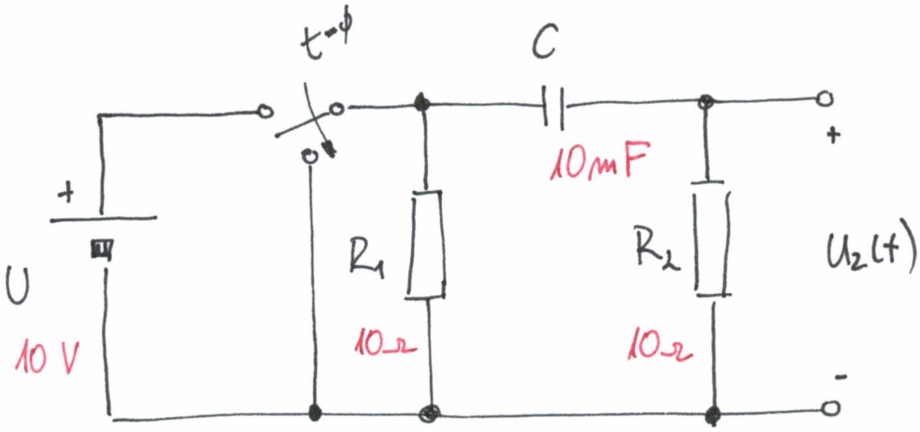
$$= -U_{th} \cdot e^{-\frac{t}{\tau}}$$

$$U_s(t) = U + U_L = \boxed{U - U_{th} \cdot e^{-\frac{t}{\tau}} [V]}$$

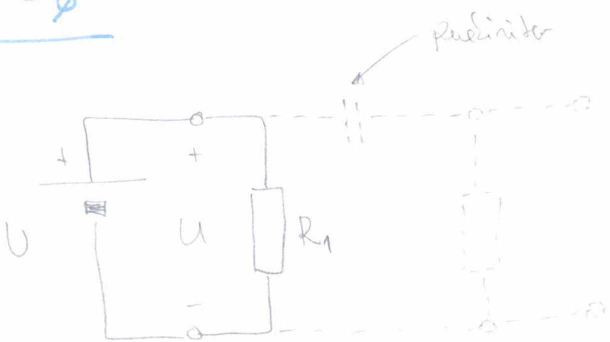
$$P_L(t) = i_L(t) \cdot U_L(t) = -\frac{U_{th}}{R_2}\left(1 - e^{-\frac{t}{\tau}}\right) \cdot \left(-U_{th} \cdot e^{-\frac{t}{\tau}}\right) =$$

$$= \frac{U_{th}^2}{R_2} \cdot e^{-\frac{t}{\tau}}\left(1 - e^{-\frac{t}{\tau}}\right)$$

Prehodni pojavi – določite napetost $U_2(t)$ po sklenitvi stikala proti masi

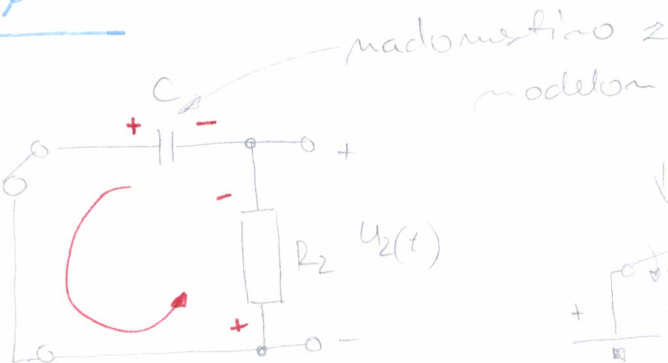


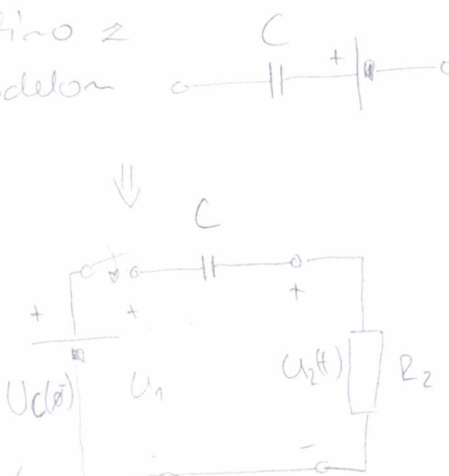
$t = 0^-$



$$U_c(0^-) = U \xrightarrow{\mathcal{L}} U_c(p) = U \cdot \frac{1}{p}$$

$t = 0^+$





$$H(p) = \frac{U_2(p)}{U_1(p)} = \frac{R_2}{\frac{1}{pC} + R_2} = \frac{pR_2C}{pR_2C + 1}$$

$$U_{c(0^-)}(p) = \frac{U_c}{p}$$

$$= U_c(0) = U \cdot \frac{1}{p}$$

$$U_2(p) = H(p) \cdot U_1(p) = \frac{U_c}{\cancel{p}} \cdot \frac{\cancel{p}R_2C}{pR_2C + 1} = U_c \cdot \frac{1}{p + \frac{1}{R_2C}}$$

$F(p)$	$f(t)$
$\frac{1}{p+a}$	e^{-at}

$$U_2(t) = U_c \cdot e^{-\frac{t}{R_2C}} \qquad \tau = R_2C$$

$$= \boxed{U_c \cdot e^{-\frac{t}{\tau}}}$$

$$u_C(t) = U_C(0^-) - u_2(t) = U_C(0^-) - U_C(0^-) \cdot e^{-\frac{t}{\tau}} =$$

$$= \boxed{U_C(0^-)\left(1 - e^{-\frac{t}{\tau}}\right)}$$

$$u_{\text{šip.}}(t) = U_C(0^-) \cdot e^{-\frac{t}{\tau}}$$