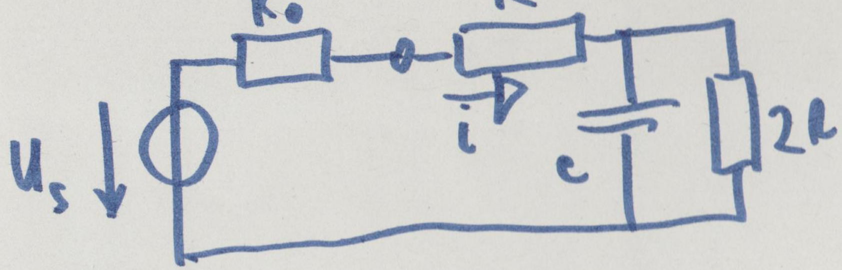
uvx1

1.) Bevezető feladat – 1. rendű



$R = 5R_0 = 1\ k\Omega$; $C = 10\ nF$

a) $i(t) = ?$ $u_s = (10V)\cdot\varepsilon(t)$

b.) $i(t) = ?$ $u_s = 10V \cdot e^{-\alpha t}\,\varepsilon(t)$

c.) $i(t) = ?$ $u_s = 5V\cdot\delta(t)$

$R_0 = 0{,}2\ k\Omega$; $\alpha = 0{,}2\ \mu s^{-1}$

$k\Omega$, nF, μs,

$$i(t) = \frac{u_s - u_c}{R+R_0} = \frac{u_s - u_c}{6R_0}$$

a) belépő gerjesztés $\rightarrow \underline{x}(0) = 0$

$\vec{i}$ $u\downarrow$

$$\frac{u - U_s}{R+R_0} + Cu' + \frac{u}{2R} = 0$$

$$\underbrace{-\left(\frac{1}{6R_0} + \frac{1}{10R_0}\right)\frac{1}{C}}_{\frac{16}{60R_0C} = 0{,}1333}\cdot u + \underbrace{\frac{1}{6R_0C}}_{0{,}0833}\cdot u_s = u'$$

$\tau = 7{,}5\ \mu s$

- $U_c = U$ $0 = -0{,}1333\cdot U + 0{,}0833\cdot U_0$

$$U = \frac{0{,}8333}{0{,}1333} = 6{,}251\ V$$

- $0 = Me^{\lambda\cdot 0} + U \Rightarrow M = -U$
- $u(t) = \varepsilon(t)\cdot 6{,}251V\left(1 - e^{-t/7{,}5}\right)$

UVX1/2

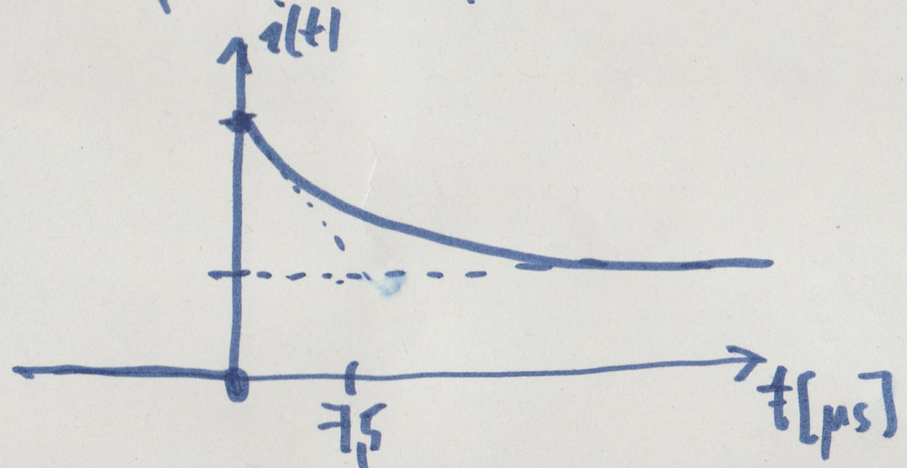
$i(t) = -\frac{1}{6k_0} \cdot u_c + \frac{1}{6k_0} u_s$

$= -0{,}8333 \cdot \left(6{,}25144 \varepsilon(t)\left(1-e^{-t/7{,}5}\right)\right) +$

$+ 0{,}8333 \cdot 10V \cdot \varepsilon(t) =$

$= \varepsilon(t)\left(\underbrace{(8{,}333 - 5{,}2089)}_{3{,}124} + 5{,}2089 \cdot e^{-t/7{,}5}\right)$

$i(t) = \left(3{,}124V + 5{,}2089V \cdot e^{-t/7{,}5}\right) \varepsilon(t)$



b) → gerjesztés változott!

↳ gerjesztett válasz is változik

$u_{cg} = \hat{U} \cdot e^{-\alpha t}$, mert $\alpha \neq \lambda$

$-\alpha \cdot \hat{u} e^{-\alpha t} = -0{,}1333 \cdot \hat{u} e^{-\alpha t} + 0{,}0833 \cdot 10 e^{-\alpha t}$

$-\alpha \cdot \hat{u} = -0{,}1333 \cdot \hat{u} + 0{,}8333$

$\hat{u} = \frac{0{,}8333}{-0{,}2+0{,}1333} = -12{,}493$

$t=0$ $\quad 0 = M \cdot + -12{,}493 \cdot 1$

$M = 12{,}493$

$u(t) = 12{,}493V \cdot \varepsilon(t)\left(e^{-t/7{,}5} - e^{-0{,}2t}\right)$

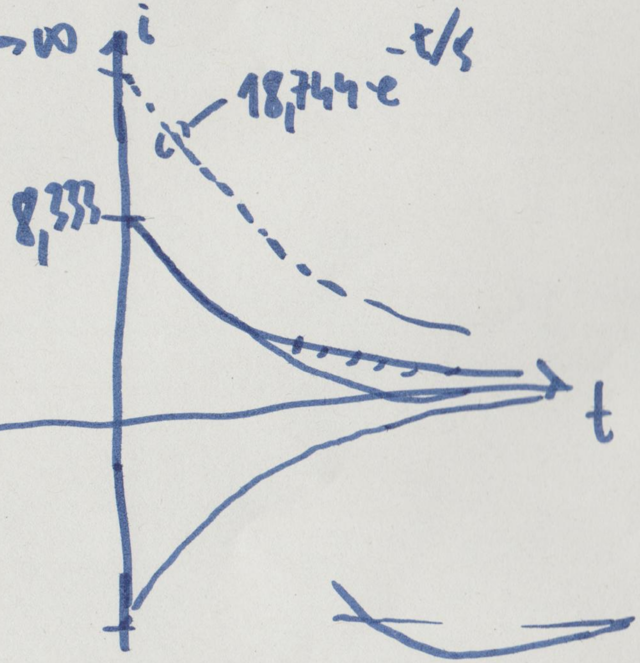
$$i(t) = -0{,}8333 \cdot 12{,}493\cancel{V} \cdot \varepsilon(t)\left(e^{-t/7{,}5} - e^{-t/5}\right) +$$

$$+ 0{,}8333 \cdot 10\cancel{V} \cdot \varepsilon(t) \cdot e^{-t/5} =$$

$$= 18{,}744 \cdot e^{-t/5} - 10{,}41 \cdot e^{-t/7{,}5}$$

$$\lim_{t \to 0+} i(t) = 8{,}334\,\cancel{V}\,\mathrm{mA}$$

$$\lim_{t \to \infty} i(t) = 0$$



Mikor lesz szélsőértéke?

$$i(t) = P e^{-t/7{,}5} + Q \cdot e^{-t/5}$$

$$\frac{di}{dt} = 0$$

$$-\frac{1}{7{,}5} P e^{-t/7{,}5} + -\frac{1}{5} \cdot Q e^{-t/5} = 0$$

$$\frac{e^{-t/7{,}5}}{e^{-t/5}} = e^{-\frac{t}{7{,}5} + \frac{t}{5}} = e^{\frac{+2{,}5t}{37{,}5}} = \frac{Q/5}{-P/7{,}5}$$

$$\frac{2{,}5}{37{,}5} t = \ln\left(-\frac{7{,}5}{5} \cdot \frac{Q}{P}\right)$$

$$\boxed{t_m = \frac{37{,}5}{2{,}5} \cdot \ln\left(-1{,}5 \cdot \frac{Q}{P}\right)} \quad 15 \cdot \ln(2{,}7)$$

$$P = -10{,}41 \;;\; Q = 18{,}744 \;;\; t_m = 14{,}899$$

B) impulzusválasz → $5\delta(t)$-re adott válasz uvx1 /4

$\underline{x}(+0) \neq \underline{x}(-0)$

$\underline{x}(+0) = \underline{B}$, ha $u_s(t) = \delta(t)$

$i(t) \to h(t)$

$u_c(+0) = 0{,}0833 \cdot 5 \quad = 0{,}41665$

$u_{cg}(t) = 0$ (!) $u_s(t) = 0$, ha $t > 0$

$u_c(+0) = M e^{\lambda \cdot 0} + 0 = M$

$u(t) = 0{,}41665 \cdot \varepsilon(t) \cdot V \cdot e^{-t/7{,}5}$

$i(t) = -0{,}8333 \cdot u(t) + 0{,}8333 \cdot (u_s(t)) =$

$= 4{,}166 \overset{mA}{\cdot} \delta(t) - 0{,}347\, e^{-t/7{,}5}\ mA\ \varepsilon(t)$

$h(t) = \dfrac{i(t)}{5V} = (0{,}8333\ \delta(t) - 0{,}0694\, e^{-t/7{,}5})\, \varepsilon(t)$

$$\frac{di_s}{dt} = \frac{d}{dt}\left(\frac{\left(3{,}124 + 5{,}2089\, e^{-t/7{,}5}\right)\varepsilon(t)}{10}\right) =$$

$$= 0{,}8333\,\delta(t) + \varepsilon(t)\cdot\underbrace{\left(-\frac{1}{7{,}5}\cdot 0{,}52089\right)}_{0{,}0694} e^{-t/7{,}5}$$

ami azonos a korábbival!

Mi történik általános esetben?

$$u_s(t) = U_0\cdot\varepsilon(t)$$

$$x'(t) = a\cdot x + b\cdot u_s \quad\Rightarrow$$

$$y(t) = c^T\cdot x + d\cdot u_s$$

$$\Rightarrow y(t) = P\cdot\varepsilon(t) + Q\,\varepsilon(t)\cdot e^{-a\cdot t}$$

$$g(t) = \frac{y(t)}{U_0} = \frac{P}{U_0}\varepsilon(t) + \frac{Q}{U_0}\cdot\varepsilon(t)\, e^{-a\cdot t}$$

$$\boxed{h(t) = (g(t))' = \frac{P+Q}{U_0}\delta(t) + -a\cdot\frac{Q}{U_0}\varepsilon(t)\, e^{-a t}}$$

mert $\lim_{t\to 0}\left(\frac{P}{U_0} + \frac{Q}{U_0} e^{-a t}\right) = \frac{P+Q}{U_0}$

és $\delta(t) \neq 0$, ha $t \to 0$

(nem elegáns függvényt hagyni, legyen inkább határérték!)