

# 15. PRIJELAZNE POJAVE

## Serijska RC

UKLAPANJE

$$i(t) = \frac{U}{R} e^{-t/\tau}$$

$$U_R(t) = U e^{-t/\tau}$$

$$U_C(t) = U (1 - e^{-t/\tau})$$

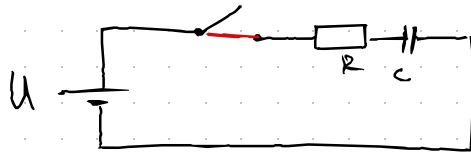
ISKLAPANJE

$$i(t) = -\frac{U}{R} e^{-t/\tau}$$

$$U_R(t) = -U e^{-t/\tau}$$

$$U_C(t) = U e^{-t/\tau}$$

$$\tau = RC$$



u  $t=0$  zatvorimo preklopku.

$$X_C = \frac{1}{\omega C} = \frac{1}{0 \cdot C} = \infty$$

— jer je istosmjerni spoj

— to nije instantno jer C treba neko vrijeme da se napuni

$$\rightarrow U_C = U (1 - e^{-t/\tau})$$

ta prijelazna pojava  
je gotova nakon  $5\tau$

$$U = U_C + U_R \rightarrow \text{ako je } U_C = U \rightarrow U_R = 0$$

$$I = 0$$

$\rightarrow$  između  $0-5\tau$  postoji neka promjena

**ICE** — struja je počela, ali  
naponu treba neko  
vrijeme da dođe (kasni)

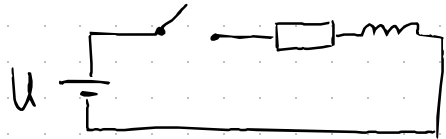
## Serijska RL

$$i(t) = \frac{U}{R} (1 - e^{-t/\tau})$$

$$U_R(t) = U (1 - e^{-t/\tau})$$

$$U_L(t) = U e^{-t/\tau}$$

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

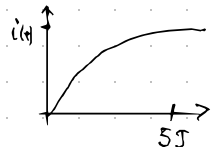
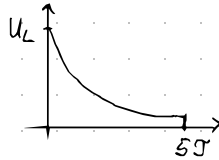


$X_L = \omega L = 0$  — kao žica

Cali treba neko vrijeme da se  
emne teži  
povašaju

— stvara se napon na L (napon U)

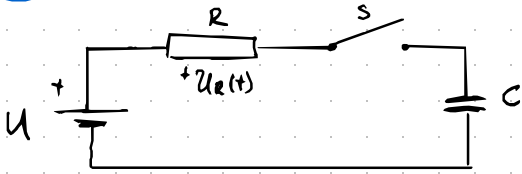
$\rightarrow$  i od te vrijednosti samo  
pada i kako pada  $U \rightarrow 0$ ,  
tako brže teći struja



**ELI** — upravo se stvara napon  
na toj zavojnici, ali  
struji treba neko vrijeme  
da protече

# Zadaci

## 1. Zadatak LJ 20./21. 20.)



$$t=0 \rightarrow S \text{ --- } \bullet$$

$$U = 20V$$

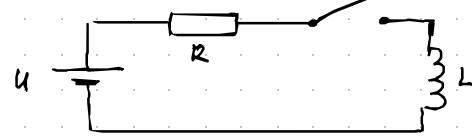
$$U_R(t) = ? \quad t = 1ms$$

$$R = 50\Omega$$

$$C = 50\mu F$$

$$U_R(t) = U e^{-t/\tau} \quad \left\{ \begin{array}{l} U_R(1ms) = 20 \cdot e^{-\frac{1 \times 10^{-3}}{50 \cdot 50 \times 10^{-6}}} \\ \tau = R \cdot C \end{array} \right. \quad \boxed{= 13,41V}$$

## 2. Zadatak DEK 19./20. 20.)



$$U = 20V$$

$$t = 1ms$$

$$U_L = U(1 - e^{-t/\tau})$$

$$R = 5\Omega$$

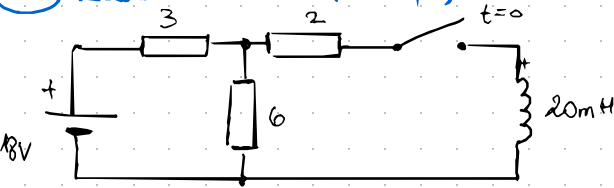
$$U_L = ?$$

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

$$L = 0,01H$$

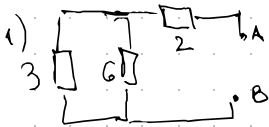
$$\boxed{U_L = 7,87V}$$

## 3. Zadatak LJ 18./19. 4.)



$$t = 0ms$$

ovde šemce napravis u obliku pomoću Thevenina



$$\left(\frac{1}{3} + \frac{1}{6}\right)^{-1} + 2 = 2\Omega$$

$$\underline{\underline{2\Omega = 4\Omega}}$$

$$2) U_{TH}$$



$$U_{AB} = 18 \cdot \frac{6}{9}$$

$$\underline{\underline{U_{AB} = 12V}}$$

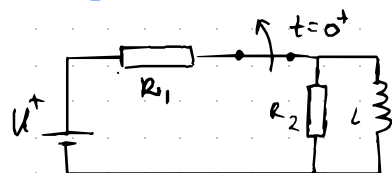


$$\tau = \frac{L}{R}$$

$$U_L = U e^{-t/\tau} = 12 \cdot e^{-\frac{10 \times 10^{-3}}{\frac{20 \times 10^{-3}}{4}}}$$

$$\boxed{U_L = 1,62V}$$

#### 4. Zadatak DOD 19./20. 7.)



$$R_1 = 5 \Omega$$

$$R_2 = 5 \Omega$$

$$L = 5 \text{ mH}$$

$$U = 10 \text{ V}$$

$$W_{R_2} = ?$$

↳ nakon dugog postojanja u sklopu,  $L$  se ponaša kao odličan vodič →  $R_2$  je kratko spojen i struja teče samo kroz  $R_1$

$$\hookrightarrow I = \frac{U}{R_1} = 2 \text{ A}$$

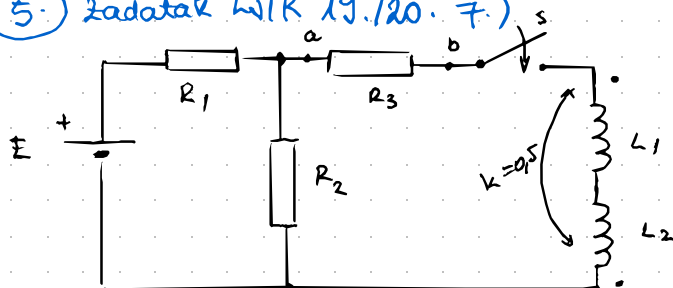
• kada odspojimo, i dalje postoji ta struja i ona se troši na  $R_2$  i to je energija na  $R_2$

$$W = P(t) \rightarrow \text{ali mi nemamo } t$$

- znamo da u zavojnici kada teče struja, u njoj se sprema energija i to kasnije troši  $R_2$

$$\hookrightarrow W_L = \frac{I^2 \cdot L}{2} = W_{R_2} \rightarrow W_{R_2} = \frac{2^2 \cdot (5 \times 10^{-3})}{2} = \boxed{10 \text{ mJ}}$$

#### 5. Zadatak WIR 19./20. 7.)



$$E = 30 \text{ V}$$

$$R_1 = R_2 = 4 \Omega \quad R_3 = 1 \Omega$$

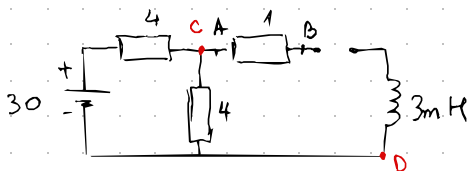
$$L_1 = L_2 = 3 \text{ mH} \quad U_{AB} = ?$$

$$t = 1 \text{ ms}$$

$$M = k \cdot \sqrt{L_1 L_2} = 1.5 \text{ mH}$$

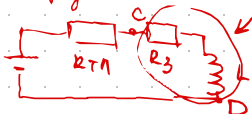
↳ nesuglasno vez →  $L = L_1 + L_2 - 2M$

$$L = 3 \text{ mH}$$



- Želimo preko Therenina ali očuvati  $R_3$

→ odspojimo C-D i vratimo kasnije

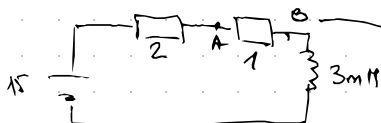


$$T = \frac{L}{R} = \frac{3 \times 10^{-3}}{8}$$

$$T = 1 \text{ ms}$$

$$\Rightarrow R_{TH} = 2 \Omega$$

$$U_{CD} = 30 \cdot \frac{4}{8} = 15$$

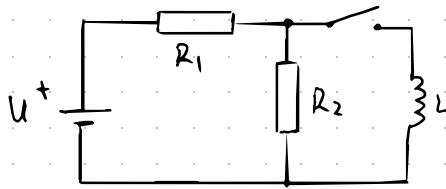


→ tražimo  $i(t)$  da bi došli do tog napona

$$\hookrightarrow i(t) = \frac{U}{R} (1 - e^{-\frac{t}{T}}) = \frac{15}{3} (1 - e^{-\frac{t}{1}}) = 3.16 \text{ A}$$

$$\rightarrow U = 1 \cdot I = \boxed{3.16 \text{ V}}$$

6. DEK 18./19. 16.)



$$U = 12V$$

$$R_1 = 4\Omega$$

$$R_2 = 12\Omega$$

$$L = 3mH$$

$$t = 1ms$$

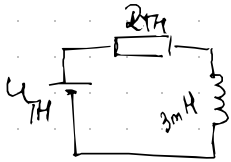
→ nemamo serijski R i L → Thevenin

→ nađemo preko Theveninove napon na L koji ćemo (zjednačiti sa  $U_2$  jer su u paraleli

$$I_2 = ?$$

$$\gamma = \frac{L}{R_2} \rightarrow 3\Omega$$

$$U_L = U e^{-t/\gamma} = \underline{\underline{3.31V}}$$



$$\frac{1}{4} + \frac{1}{12} = \frac{1}{R} = \frac{1}{3\Omega}$$

$$U_{TH} = 12V \cdot \frac{3}{4+3} = 9V$$

$$U_L = U_2 \rightarrow I_2 = \frac{U_2}{R_2} = \frac{U_L}{R_2}$$

$$I_2 = \frac{3.31V}{12\Omega} = \underline{\underline{276mA}}$$