

# OE - konzultacije

24. travnja 2020.

$$R_1 = 6\Omega$$

$$R_2 = 10\Omega$$

$$R_3 = 3\Omega$$

$$R_4 = 10\Omega$$

$$R_5 = 3\Omega$$

$$R_6 = 10\Omega$$

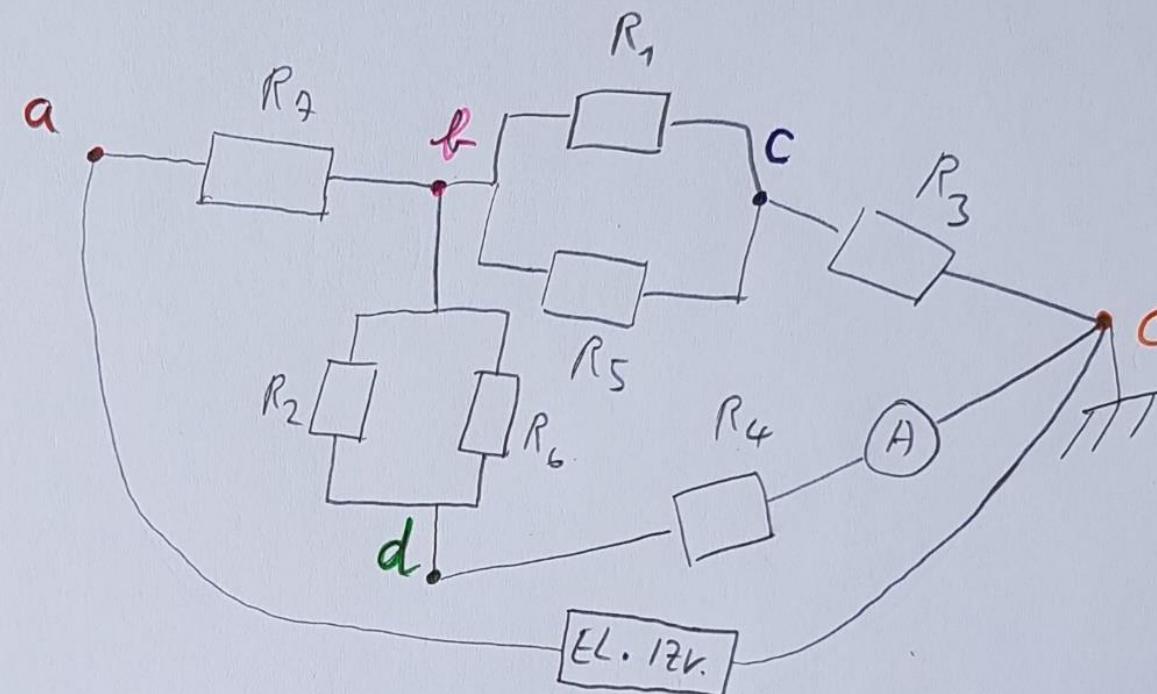
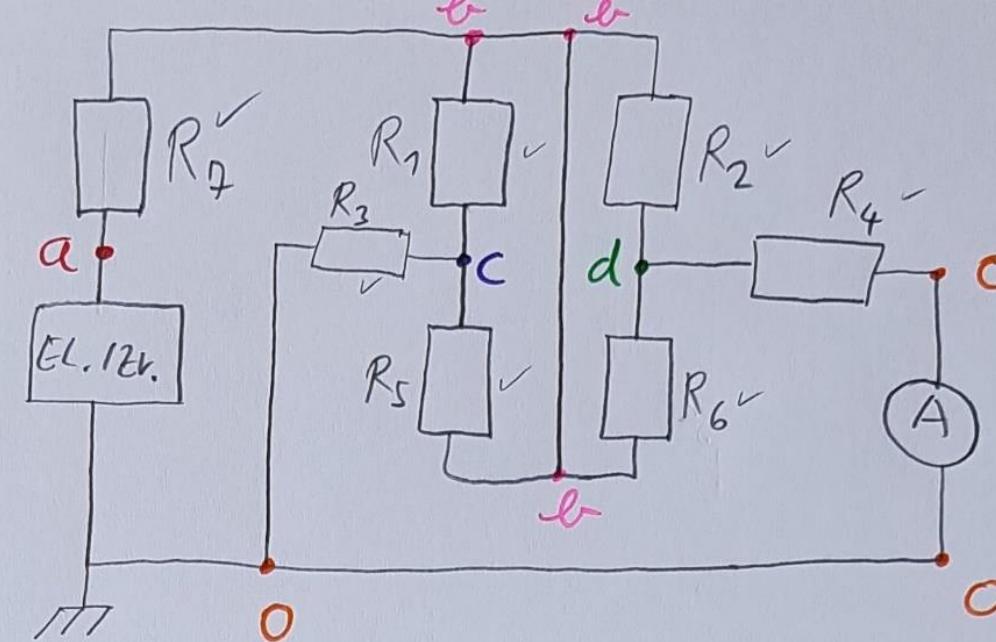
$$R_7 = 1\Omega$$

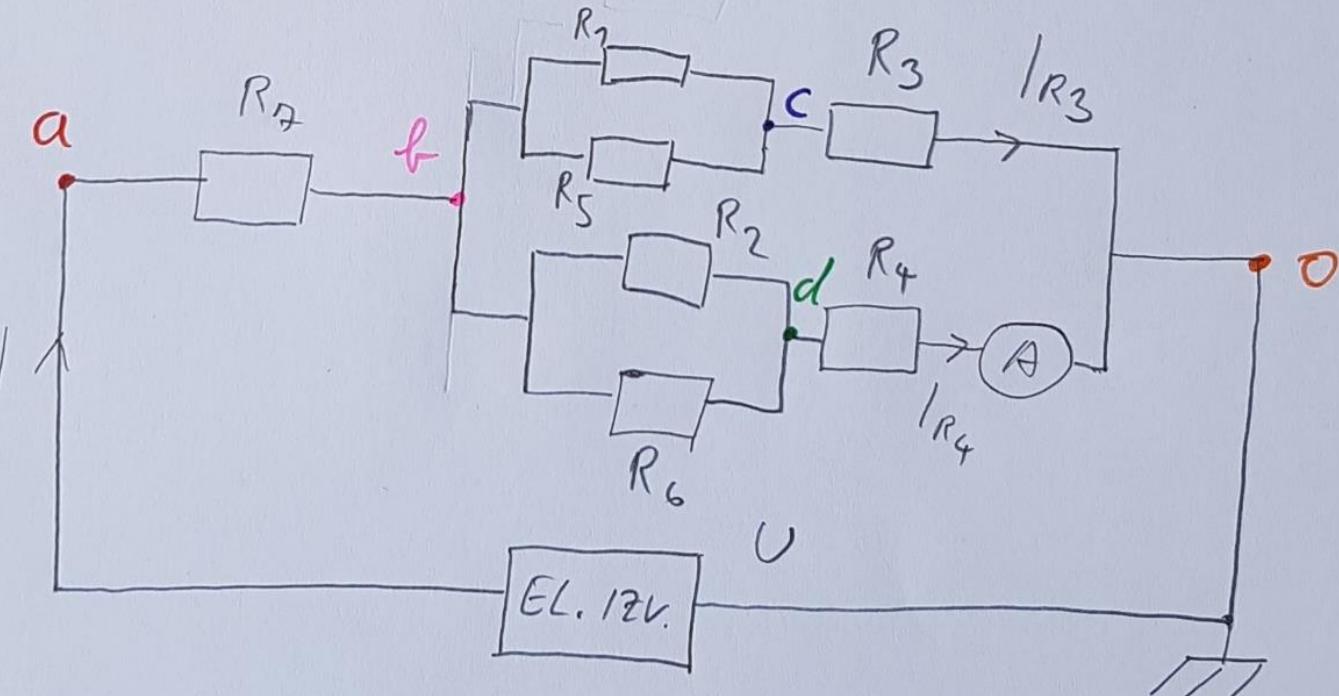
$$I_{R_4} = 1A$$

$$I, V = ?$$

$$\varphi_A, \varphi_B, \varphi_C, \varphi_D = ?$$

III. 1-11  
PRVI 010





$$R_1 \parallel R_5 = \frac{R_1 \cdot R_5}{R_1 + R_5} = \frac{6\Omega \cdot 3\Omega}{6\Omega + 3\Omega} = 2\Omega \rightarrow R_1 \parallel R_5 + R_3 = 2\Omega + 3\Omega = 5\Omega$$

$$R_2 \parallel R_6 = \frac{10\Omega \cdot 10\Omega}{10\Omega + 10\Omega} = 5\Omega \rightarrow R_2 \parallel R_6 + R_4 = 5\Omega + 10\Omega = 15\Omega$$

$$I = I_{R3} + I_{R4} \rightarrow I_{R4} = I \cdot \frac{R_1 \parallel R_5 + R_3}{(R_1 \parallel R_5 + R_3) + (R_2 \parallel R_6 + R_4)} = \frac{5\Omega}{5\Omega + 15\Omega} = \frac{1}{4}$$

$$I = 4 \cdot I_{R4} = 4 \cdot 1A = 4A$$

(III.1-11)

$$- \frac{IR_{VH1}}{R_{10}}$$

$$I = I_{R_3} + I_{R_4} \Rightarrow I_{R_3} = I - I_{R_4} = 4A - 1A = \boxed{3A}$$

$$R_{VH} = R_7 + (R_1 \parallel R_5 + R_3) \parallel (R_2 \parallel R_6 + R_4)$$

$$R_{VH} = 1\Omega + \frac{5\Omega \cdot 15\Omega}{5\Omega + 15\Omega} = \boxed{4,75\Omega}$$

$$U = I \cdot R_{VH} = 4A \cdot 4,75\Omega = \boxed{19V}$$

$$\varphi_d = 0 + I_{R_4} \cdot R_4 = 1A \cdot 10\Omega = \boxed{10V}$$

$$\varphi_c = 0 + I_{R_3} \cdot R_3 = 3A \cdot 3\Omega = \boxed{9V}$$

$$\varphi_h = \varphi_c + I_{R_3} \cdot (R_1 \parallel R_5) = 9V + 3A \cdot 2\Omega = \boxed{15V}$$

$$\varphi_g = \varphi_h + I \cdot R_7 = 15V + 4A \cdot 1\Omega = \boxed{19V}$$

U KUTIJI BI MOGZO BITI STRUJNI IZVOR  $I = 4A$   $1L1$   
NAPONSKI IZVOR  $U = 19V$ .

IV-3

$$R_3 = 4\Omega$$

$$R_2 = 6\Omega$$

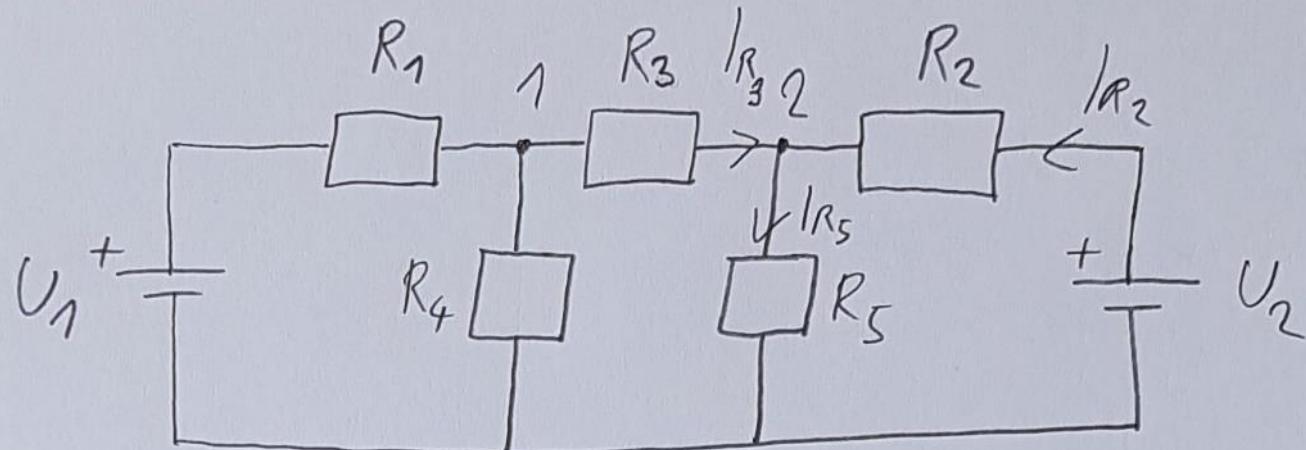
$$U_2 = 12V$$

$$\varphi_1 = 12V$$

$$\varphi_2 = 9,96V$$

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$$I_{R_2}, I_{R_3}, I_{R_5} = ?$$



$$I_{R_3} = \frac{U_{R_3}}{R_3} = \frac{\varphi_1 - \varphi_2}{R_3} = \frac{12V - 9,96V}{4\Omega} = 0,51A$$

$$I_{R_2} = \frac{U_{R_2}}{R_2} = \frac{U_2 - \varphi_2}{R_2} = \frac{12V - 9,96V}{6\Omega} = 0,34A$$

$$I_{R_5} = I_{R_2} + I_{R_3} = 0,34A + 0,51A = 0,85A$$

IV. - 5

$$U = 12 \text{ V}$$

$$R = 59,735 \Omega$$

$$R_T = 100 \Omega$$

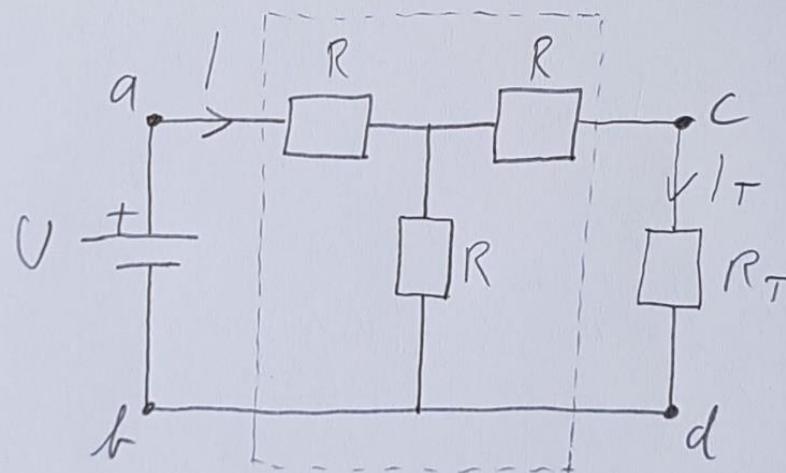
$$\frac{U_{CD}}{U_{AB}} = ?$$

$$R_{UV} = R + R \parallel (R + R_T)$$

$$R_{UV} = R + \frac{R \cdot (R + R_T)}{R + R + R_T}$$

$$R_{UV} = 100,02 \Omega$$

$$I = \frac{U}{R_{UV}} = \frac{12 \text{ V}}{100,02 \Omega} = 0,12 \text{ A}$$



$$I_T = I \cdot \frac{R}{R + R + R_T}$$

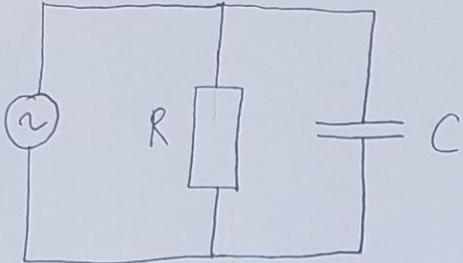
$$I_T = 0,12 \text{ A} \cdot \frac{59,735 \Omega}{2 \cdot 59,735 \Omega + 100 \Omega} = 0,032 \text{ A}$$

$$U_{CD} = R_T \cdot I_T = 100 \Omega \cdot 0,032 \text{ A} = 3,2 \text{ V}$$

$$U_{AB} = U = 12 \text{ V}$$

$$\frac{U_{CD}}{U_{AB}} = \frac{3,2 \text{ V}}{12 \text{ V}} = 0,27$$

1.2



$$\cos \varphi_p = 0,5$$

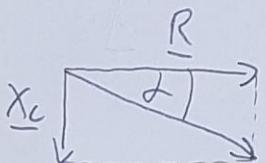


$$\varphi_p = -60^\circ$$

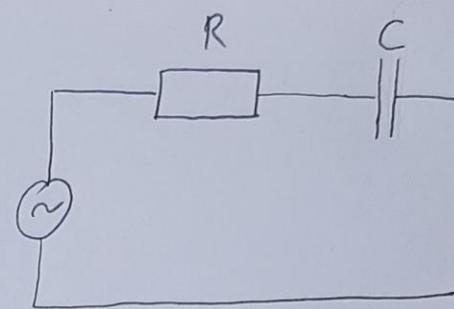
$$\underline{z} = |z| \angle -60^\circ$$

$$\underline{z}_p = \underline{R} \parallel \underline{x}_c = \frac{\underline{R} \cdot \underline{x}_c}{\underline{R} + \underline{x}_c} = \frac{|R| \angle 0^\circ \cdot |x_c| \angle -90^\circ}{|R| \angle 0^\circ + |x_c| \angle -90^\circ}$$

$$\underline{z}_p = \frac{(|R| \cdot |x_c|) \angle -90^\circ}{|R| \angle 0^\circ + |x_c| \angle -90^\circ} = |z| \angle -60^\circ \Rightarrow \frac{-90^\circ}{-60^\circ} = \angle -60^\circ$$

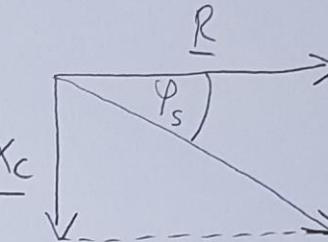


$$\tan \varphi_p = \frac{|x_c|}{|R|} = \tan 30^\circ = \frac{\sqrt{3}}{3} \Rightarrow |x_c| = \frac{\sqrt{3}}{3} |R|$$



$$\cos \varphi_s = ?$$

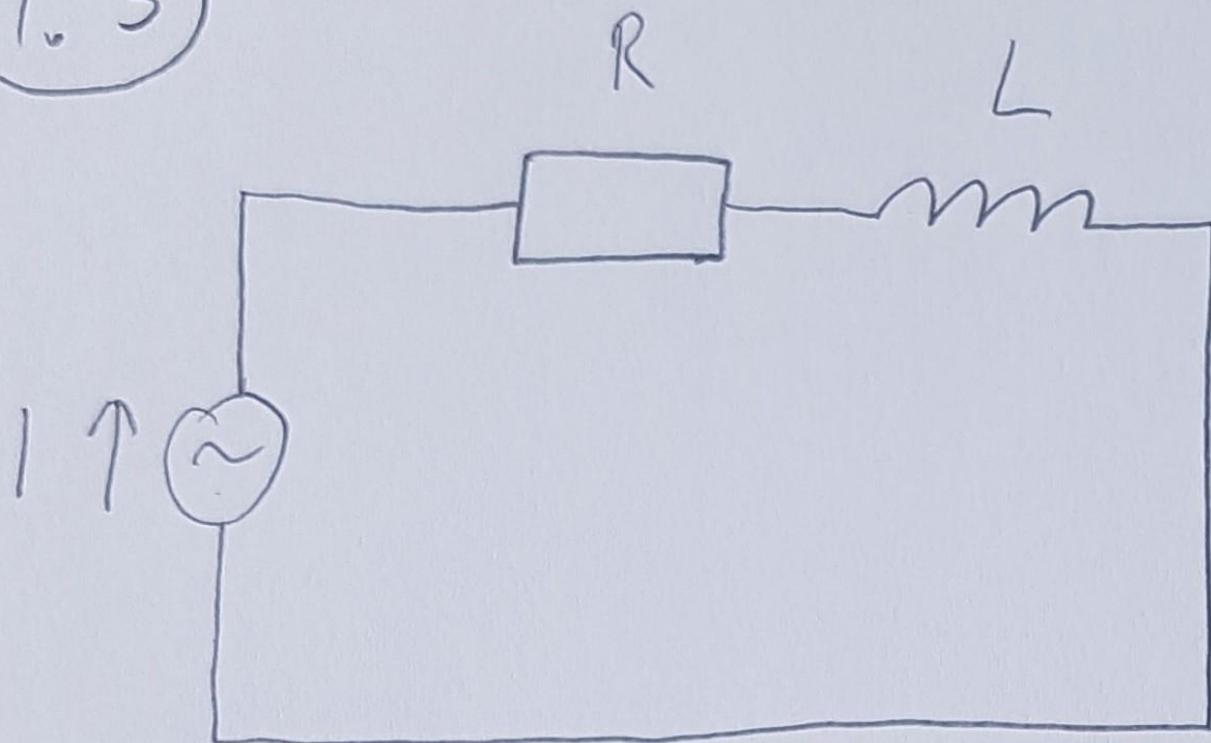
$$\underline{z}_s = \underline{R} + \underline{x}_c$$



$$\varphi_s = \angle = -30^\circ$$

$$\cos \varphi_s = \frac{\sqrt{3}}{2}$$

1.5

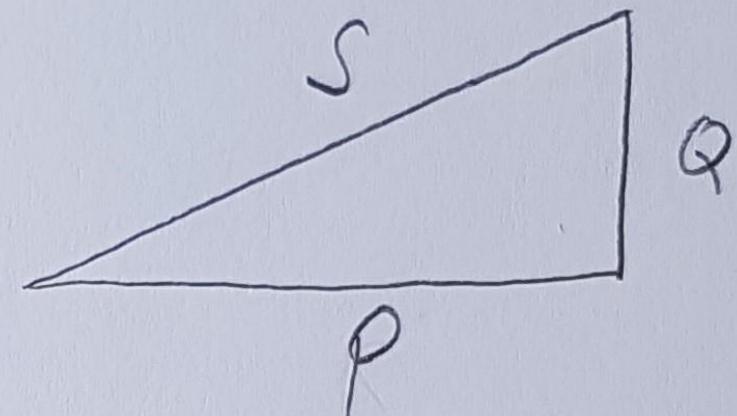


$$P = |I|^2 \cdot |R|$$

$\downarrow$  konst.     $\downarrow$  konst.     $\downarrow$  konst.

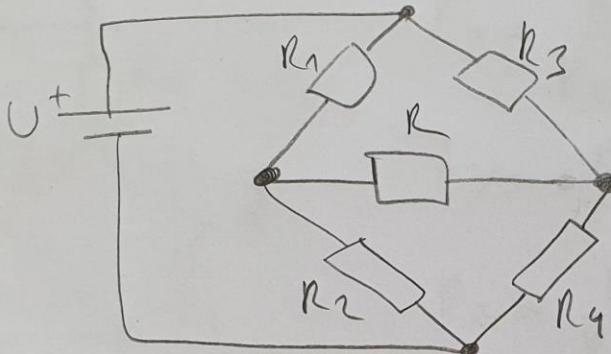
$$\not f \uparrow \quad P = ?$$

$$|X_L| = \omega L = 2\pi f L$$



1. DIO ZBIRICE

IV-7

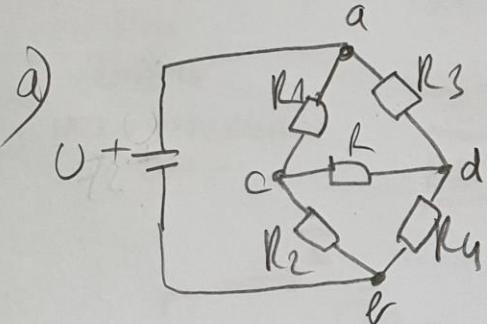


$$U = 72V \quad R_1 = 6\Omega \quad R_2 = 3\Omega$$

$$R_3 = 12\Omega \quad R_4 = 4\Omega$$

$$R = 5\Omega$$

- a) STRUJA KROZ  $R$   
 b) STRUJA KROZ  $R=0\Omega$   
 c) KOUKA TREBA BITI  $R_1$   
 TAKO DA STRUJA KROZ  $R$  BUDE OA



PROVERA  
 JE U MOST U RAVNOTEZI?

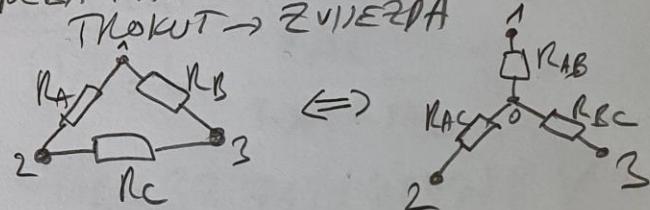
$$R_1 \cdot R_4 = R_2 \cdot R_3$$

$$6 \cdot 4 \neq 3 \cdot 12$$

$$24 \neq 36 \quad \boxed{\text{NIJE}}$$

KROZ  $R$  NIJE STRUJA  
 $= 0$

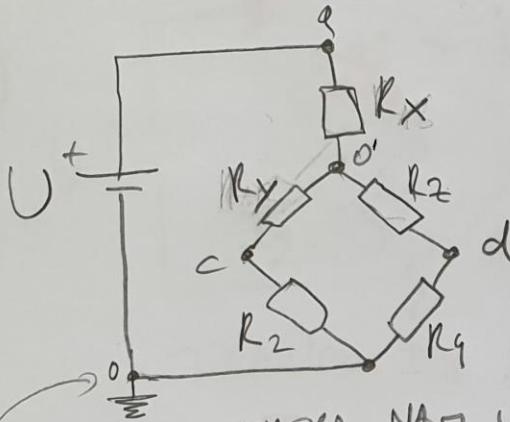
→ TRELA NAM TRANSFORMACIJA  
 TROKUT → ZVIJERZA



$$R_{AB} = \frac{R_A \cdot R_B}{R_A + R_B + R_C}$$

$$R_{BC} = \frac{R_B \cdot R_C}{R_A + R_B + R_C}$$

$$R_{AC} = \frac{R_A \cdot R_C}{R_A + R_B + R_C}$$



$$R_X = \frac{R_1 \cdot R_3}{R_1 + R + R_3} = \frac{72}{23} \Omega$$

$$R_Y = \frac{R_1 \cdot R}{R_1 + R + R_3} = \frac{30}{23} \Omega$$

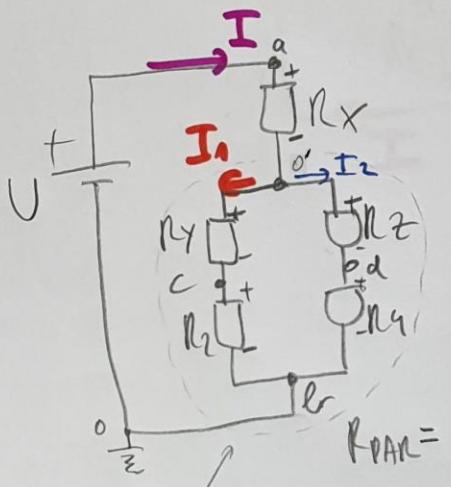
$$R_Z = \frac{R_3 \cdot R}{R_1 + R + R_3} = \frac{60}{23} \Omega$$

SAKU  
ZADAMO  
NEKU REFERENTNU  
TOCKU

TREBA NAPISATI  $\varphi_c - \varphi_d$

ONDA SE VIMATIMO NA  
POCETNU STAVNU RASTA  
RACUNAMO

$$I_R = \frac{U_{cd}}{R} = \frac{\varphi_c - \varphi_d}{R}$$



$$\varphi_c = U_{ca} = I_1 \cdot R_2$$

$$\varphi_d = U_{da} = I_2 \cdot R_4$$

$$R_{PAR} = \frac{(R_1 + R_2)(R_2 + R_4)}{R_1 + R_2 + R_2 + R_4} = 2,6066170102 \Omega$$

PAMALJUA  
 $R_{PAR}$

VELIKO  
NAPONSKO DJELOVLO:

$$U_{PAR} = U \cdot \frac{R_{PAR}}{R_X + R_{PAR}}$$

$$U_{PAR} = 32.7130434782 V$$

MALO NAPONSKO DJELOVLO:

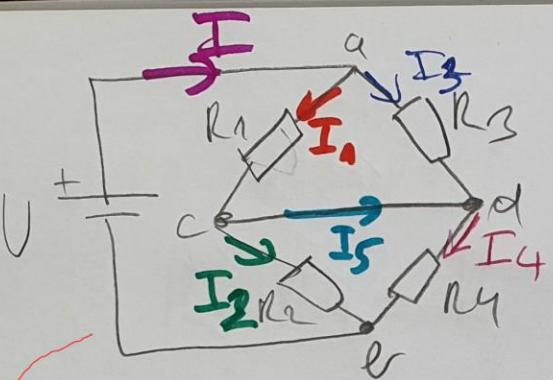
$$U_{cer} = U_{PAR} \cdot \frac{R_2}{R_2 + R_Y} = 22.8 V$$

$$U_{der} = U_{PAR} \cdot \frac{R_4}{R_4 + R_Z} = 19.8 V$$

DAKLE:  $U_{cd} = \varphi_c - \varphi_d = U_{cer} - U_{der} = 22.8 - 19.8 = 3 V$

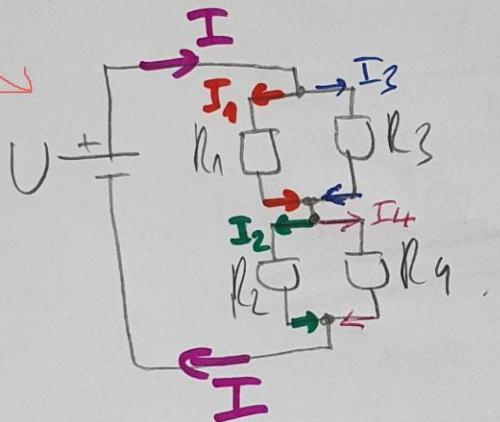
$I_R = \frac{U_{cd}}{R} = \frac{3}{5} = 0.6 A$

b)



TLAČENO  $I_1$  i  $I_2$

spojimo točke c i d u jednu točku (na istom su potencijalu!) i tako pojednostavimo spoj!



$$R = 0\Omega$$

KOJKA JE STRUJA Kroz DIJAGONALU MOSTA?

KZS za redak C:

$$I_1 = I_5 + I_2 \Rightarrow I_5 = I_1 - I_2$$

$$R_{13} = R_1 \parallel R_3 = \frac{R_1 \cdot R_3}{R_1 + R_3} = \frac{6 \cdot 12}{6 + 12} = \frac{72}{18} = 4\Omega$$

$$R_{24} = R_2 \parallel R_4 = \frac{R_2 \cdot R_4}{R_2 + R_4} = \frac{3 \cdot 4}{3 + 4} = \frac{12}{7} \Omega$$

$$I = \frac{U}{R_{13} + R_{24}} = 12,6 A$$

STRUJNA DVELA:

$$I_1 = I \frac{R_3}{R_1 + R_3} = 12,6 \frac{12}{12 + 12} = 12,6 \cdot \frac{12}{24} = \frac{25,2}{2} = 12,6 A$$

$$I_2 = I \frac{R_4}{R_2 + R_4} = 12,6 \frac{4}{3 + 4} = 12,6 \cdot \frac{4}{7} = 7,2 A$$

ONDA:  $I_5 = I_1 - I_2 = 12,6 - 7,2 = 5,4 A$

1,2 A TEĆE KROZ DIJAGONALU MOSTA AKO JE  $R = 0\Omega$

9) MONA VRVEDITI:

$$R_1 \cdot R_4 = R_2 \cdot R_3$$

$$R_1 \cdot 4 = 3 \cdot 12$$

$$R_1 = \frac{3 \cdot 12}{4}$$

$$\cancel{R_1 = 9R_2}$$

ONDA JE MOST

U RAVNOTEŽI:

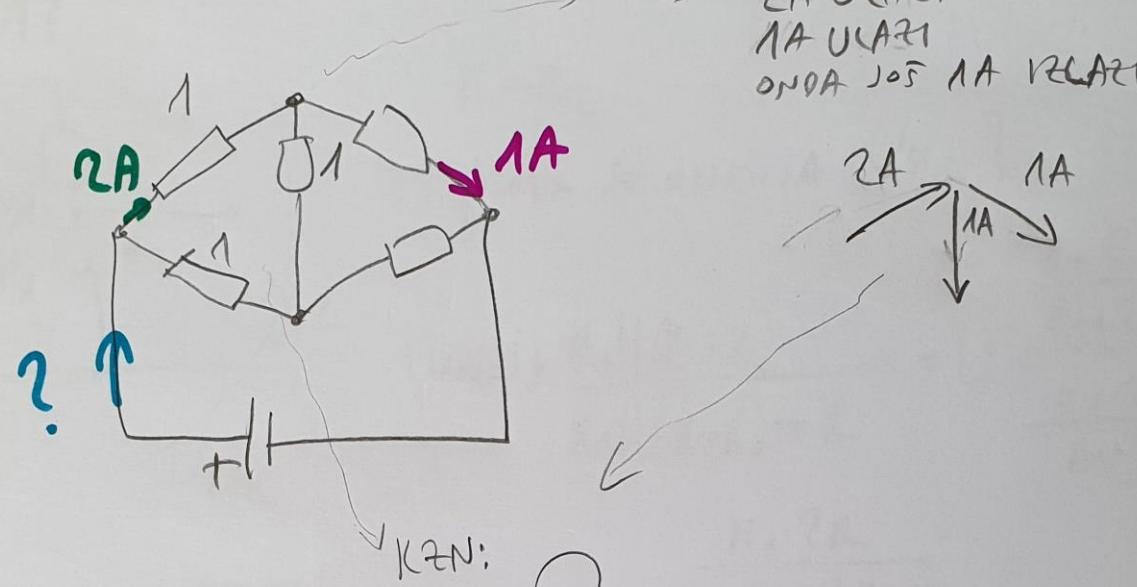
ako je most u ravnoteži onda se dijagonala mosta može maknuti ili kratko spojiti sa žicom te se tako značajno pojednostavi spoj!  
(serija dvije paralele ili paralela dviju serijski grana)

$y_c = y_d$   
KROZ DIJAGONALU MOSTA  
NE REĆE SPOJA

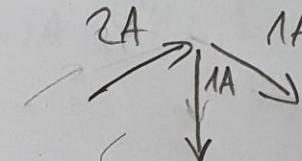
! !  
↳ PROVJERITE STAVI ZA VJEŽBU!

1. DIO. ZPINKA

IV-TEST 1



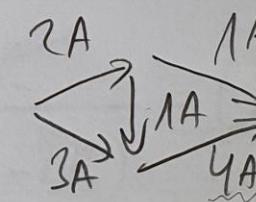
KZS  
2A ULARI  
1A ULARI  
ONDA JOS 1A RELAZI



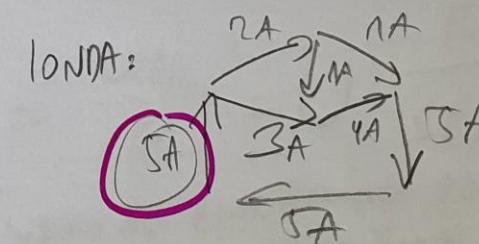
KZN:

Diagram illustrating the KZN (Zero Voltage Source) model. It shows a 2A current source pointing upwards, a 1A current source pointing downwards, and a 1A current source pointing to the right. A question mark is placed next to the 1A current source.

$$+ 2 \cdot 1 + 1 \cdot 1 - I_x \cdot 1 = 0$$
$$I_x = \underline{3A}$$

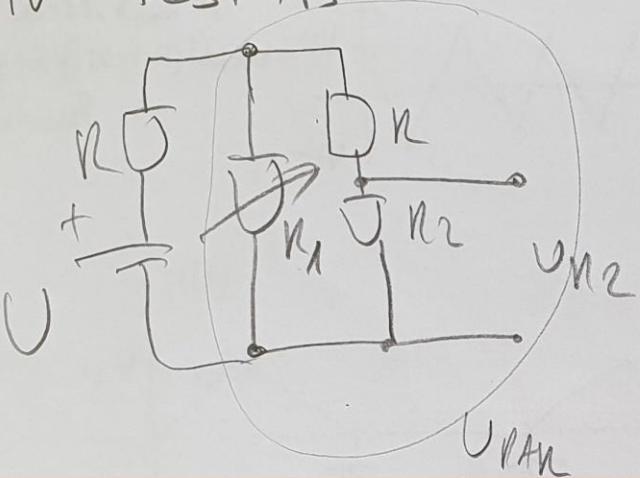


D



## 1. DIO ZIRKUS

# IV - TEST 13



kraća analiza:

ako je  $R_1=0$  onda je i grana  $R-R_2$  kratko spojena, na cijeloj paraleli  $R_1||(R+R_2)$  je onda napon nula pa je i  $UR_2=0$  V

ako je  $R_1 = \text{besk.}$  onda ga maknemo iz sheme, ostaje serija  $R + R + R_2$ , a vrijedi  $R = R_2$ , dakle to su tri jednaka otpornika spojena serijski na  $U \rightarrow$  na svakom je napon  $U/3$

dakle:

graf UR2 ide od 0 V za  $R_1=0$  do  $U/3$  za  $R_1=\text{besk.}$  (odgovor pod d)

$R_1 \text{ or } 0 \text{ or } \infty$

$$R=R_2$$

$(A) \in \pi_1(\Omega)$  A  $\cup$   $\pi_2$ ?

$$U_{PAE} = \cup \frac{R_1 || (R+R)}{R_1 || (R+R) + R} = U \frac{\frac{R_1 \cdot R}{R_1 + 2R}}{\frac{R_1 \cdot 2R}{R_1 + 2R} + R} =$$

$$= U \frac{\frac{R_1 \cdot 2R}{R_1 + 2R}}{2R_1 R + R R_1 + 2R^2} = U \frac{R_1 \cdot 2R}{3R_1 R + 2R^2} =$$

$$= U \frac{n_1 \cdot 2R}{R(3R_1 + 2R)} = U \frac{2R_1}{3n_1 + 2R}$$

$$\frac{R}{2R} = \frac{0.5n_0}{2} = U \frac{n_1}{3n_1 + 2R}$$

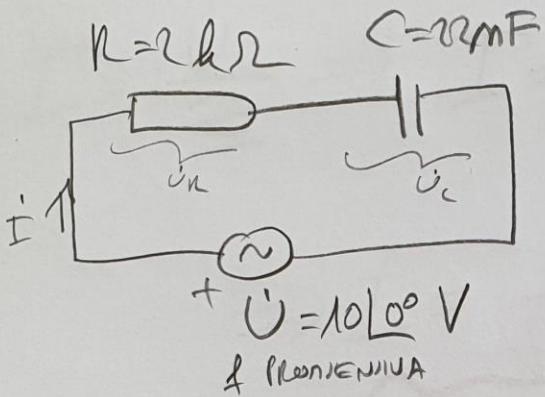
$$U_{R_2} = U_{PAN} \frac{R_2}{R_2 + R} = U_{PAN}$$

OKUONK JE  
D

$$0 \leq u_{n=0} < \infty \quad \text{and} \quad \lim_{n \rightarrow \infty} u_n = \infty$$

ZBIRKA 1.10

VII-2-2



$$U_R = U_C \text{ Ako } X_C = R$$

DAKLE:

$$X_C = 2000$$

$$\frac{1}{\omega \cdot C} = 2000$$

$$\omega = \frac{1}{2000 \cdot C}$$

$$\omega = 22727.2727 \text{ s}^{-1}$$

$$\omega = 2\pi f$$

$$f = \frac{\omega}{2\pi} = 3617.1578 \text{ Hz}$$

KOKIKA SU  
NAPONI:

$$U_R = U \frac{R}{R - jX_C}$$

$$U_R = U \frac{2000}{2000 - j2000}$$

$$U_R = U \frac{2000}{\sqrt{2000^2 + 2000^2}}$$

$$U_R = 10 \cdot \frac{2000}{2000\sqrt{2}}$$

$$U_R = \frac{10}{\sqrt{2}} \approx 7.07 \text{ V}$$

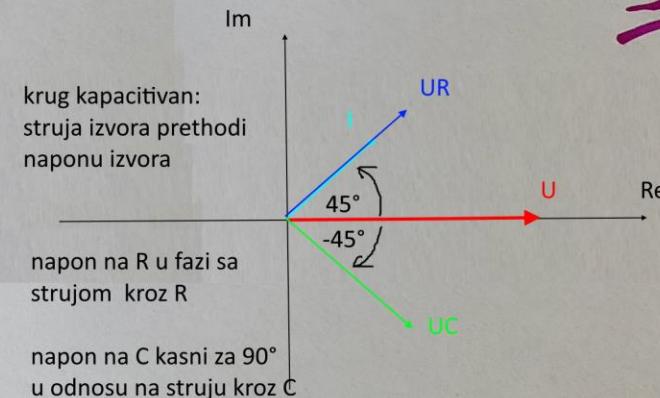
$$U_C = U \frac{-jX_C}{R - jX_C}$$

$$U_C = U \frac{-j2000}{2000 - j2000}$$

$$U_C = U \frac{2000}{\sqrt{2000^2 + 2000^2}}$$

$$U_C = 10 \frac{2000}{2000\sqrt{2}}$$

$$U_C = \frac{10}{\sqrt{2}} \approx 7.07 \text{ V}$$



$$I = \frac{U}{Z} \Rightarrow I = \frac{U}{\sqrt{R^2 + X_C^2}} = \frac{U}{\sqrt{R^2 + \frac{1}{\omega C^2}}} = \frac{U}{\sqrt{\frac{R^2 \omega^2 C^2 + 1}{\omega^2 C^2}}} =$$

$$\Rightarrow I = \frac{U \omega C}{\sqrt{R^2 \omega^2 C^2 + 1}}$$

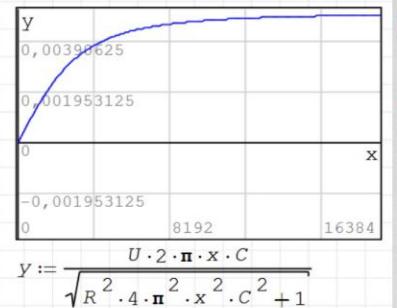
$$Z = R + jX_C \Rightarrow$$

$$Z = \sqrt{R^2 + X_C^2} = \sqrt{R^2 + \frac{1}{\omega^2 C^2}} = \sqrt{\frac{R^2 \omega^2 C^2 + 1}{\omega^2 C^2}} = \frac{\sqrt{R^2 \omega^2 C^2 + 1}}{\omega C}$$

$$Z = R - jX_C \Rightarrow Y = \arctan \frac{-X_C}{R} = \arctan \frac{-\frac{1}{\omega C}}{R} = \arctan \left( -\frac{1}{\omega C R} \right)$$

graf za I (y=struja I, x=frekvencija f)

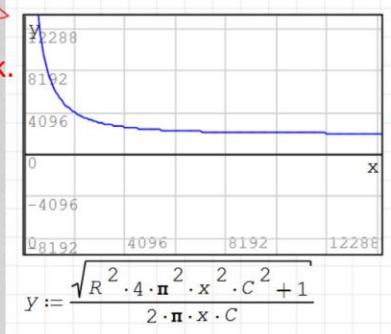
za f=0  
I=0 A



za f>>  
I=U/R

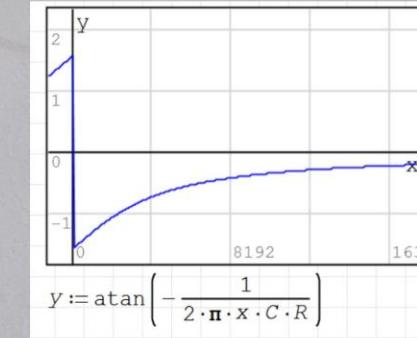
graf za Z (y=impedancija Z, x=frekvencija f)

za f=0  
Z=besk.  
zbog  
XC  
=besk.



za f>>  
Z=R=2000 Ω  
jer XC=0

graf za fi (y=kut fi, x=frekvencija f)



fi je negativan jer je spoj  
kapacitivan  
(za f=0 ide prema -90°, a  
za f>> pada XC pa kut ide  
prema 0°)

ZBIRNIKA 1.010

VII-2-3

je plavotinog zanaka

$$U_R = U \frac{R}{R - jX_C}$$

$$U_R = U \frac{R}{\sqrt{R^2 + X_C^2}} = U$$

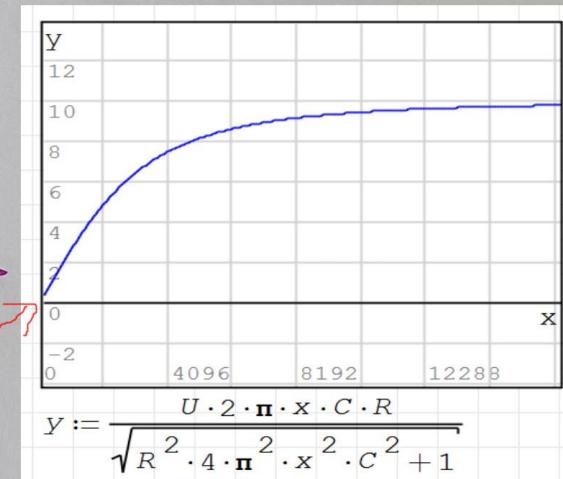
$$\frac{R}{\sqrt{R^2 + \frac{1}{\omega C^2}}} = U \frac{R}{\sqrt{\frac{R^2 \omega^2 C^2}{\omega^2 C^2} + 1}} =$$

$$= U \frac{R \omega C}{\sqrt{R^2 \omega^2 C^2 + 1}} = \frac{UR \omega C}{\sqrt{R^2 \omega^2 C^2 + 1}}$$



za  $f=0$  Hz struja je  $I=0$  A (zbog  $X_C=\text{besk.}$ ) pa je  $U_R=0$   
za  $f>>$  opada  $X_C$  (ide prema 0) pa  $U_R$  ide prema  $U=10$  V

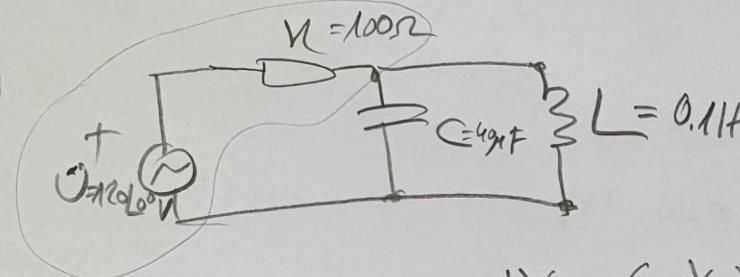
graf za  $U_R$  (x: napon  $U_R$ , y: frekvencija f)



ZBIRKA 1. DIO

VII-2-5

NEALNI  
NAP.  
PREDK



$\omega_0 = ?$   
 $U_R = ?$   $U_{LC} = ?$  PM  $\omega = \omega_0$   
 $I(\omega)$  i  $\varphi(\omega) = ?$

$$1 \quad Z = R + \frac{jX_L - jX_C}{jX_L - jX_C} = R + \frac{X_L X_C}{j(X_L - X_C)} = R - j \frac{X_L X_C}{X_L - X_C} =$$

$$= R - j \frac{\omega L \cdot \frac{1}{\omega C}}{\omega L - \frac{1}{\omega C}} = R - j \frac{\frac{\omega L}{\omega C}}{\frac{\omega^2 LC - 1}{\omega C}} = R - j \frac{\omega L}{\omega^2 LC - 1} = 0 \quad ???$$

Malo smo zapeli pa idemo probati preko admitancije Y, pritom promatramo problem kao da je paralela L i C spojena na realni naponski izvor (unutarnji otpor R).

$$Y_{PM} = \frac{1}{j\omega L} + \frac{1}{j\omega C} = j \left( \frac{1}{\omega L} + j \omega C \right) = j \left( \frac{\omega^2 LC - 1}{\omega L} \right)$$

$$\ln(Y) = 0$$

$$\text{PAKET: } \omega^2 LC = 1$$

$$\omega = \frac{1}{\sqrt{LC}}$$

$$f = \frac{1}{2\pi\sqrt{LC}} = 79,57747 \text{ Hz}$$

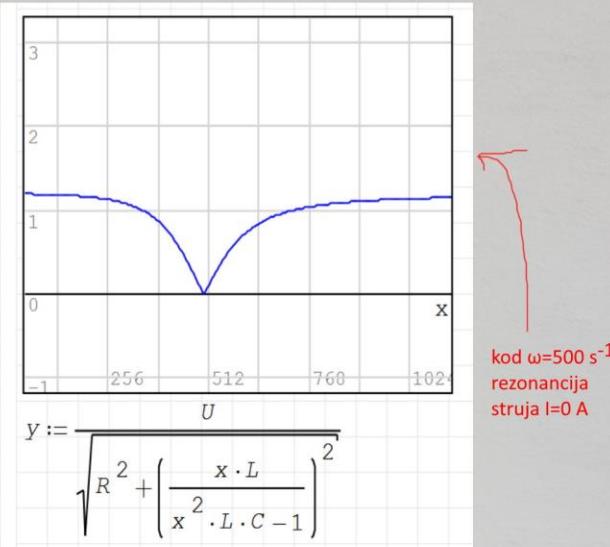
Došli smo ovako do rješenja, do rezonantne frekvencije:

$$I = \frac{U}{Z} \Rightarrow I = \frac{U}{Z} = \frac{U}{\sqrt{R^2 + \frac{\omega^2 L^2}{(\omega^2 L C - 1)^2}}}$$

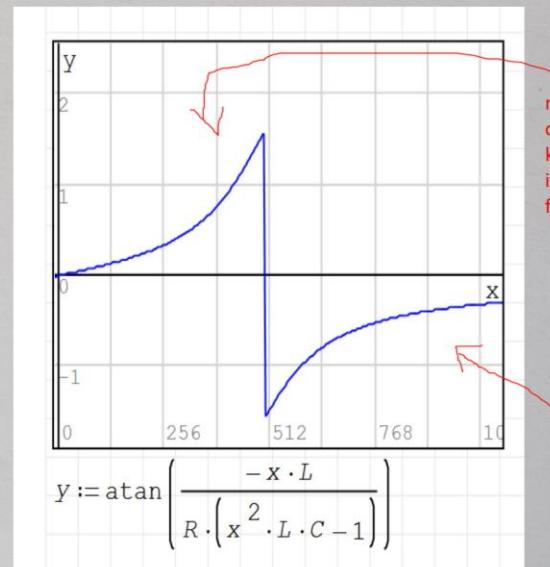
PM  $\omega_0 = \frac{1}{\sqrt{L C}}$  ISPAŠA DA JE  $I = 0$  A

$$Y = \text{arctan} \left( \frac{\omega L}{\omega^2 L C - 1} \right) = \text{arctan} \left( \frac{-\omega L}{R(\omega^2 L C - 1)} \right)$$

graf za struju izvora I (y: struja I, x: kružna frekvencija  $\omega$ )



graf za kut impedancije spoja fi (y: kut fi, x: kružna frekvencija  $\omega$ )



$$\omega_0 := \frac{1}{\sqrt{L \cdot C}}$$

$$\omega_0 = 500 \text{ s}^{-1}$$

kod rezonantne frekvencije Y paralele L i C je 0,  
impedancija paralele je beskonačna!  
zato je struja izvora jednaka  $I = 0 \text{ A}$  i nema pada napona  
na otporniku:  
 $UR = 0 \text{ V}$   
a što se događa na paraleli LC?  
ona je na naponu praznog hoda - naponu izvora  $U = 120 \text{ V}$ !

kroz tu kombinaciju LC cijelo vrijeme teče struja i  
naizmjence se izmjenjuje energija električnog polja  
spremljenog u C i energija magnetskog polja spremnjena  
u L

# ZBIORKA 1. DIO

VII-2-9

$Z_{UL}$  kod  $\omega = 0 \text{ s}^{-1}$  (stabilność)  
wynosi  $5\Omega$

$Z_{UL}$  kod  $\omega_0$  (resonans) wynosi  $2,5\Omega$

$X_C = ?$  (na resonansie prądu wejściowego)

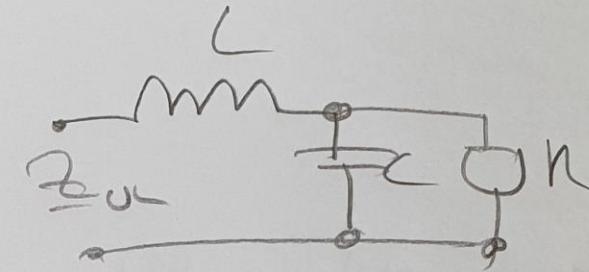
$$X_C^2 = 25$$

$$X_C = \sqrt{25} = 5\Omega$$

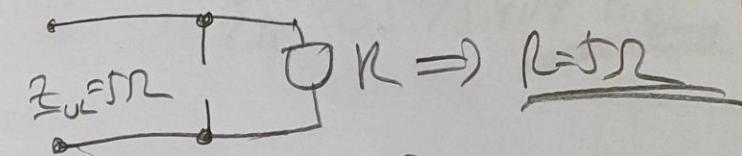
KOJUJE

$$\text{z } \lim_{\omega \rightarrow 0} Z = 0 \text{ dla } \omega = \omega_0:$$

$$X_L = \frac{X_C R^2}{R^2 + X_C^2} = \frac{5 \cdot 5^2}{5^2 + 5^2} = \frac{125}{50} = 2,5\Omega$$



$Z_A \quad \omega = 0 \text{ s}^{-1}$



$Z_A \quad \omega = \omega_0$  (resonans)

$$Z_{UL} = jX_C + \frac{-jX_C \cdot R}{R - jX_C} \cdot \frac{R + jX_C}{R + jX_C} =$$

$$= jX_C + \frac{-jX_C R^2 + X_C^2 R}{R^2 + X_C^2} =$$

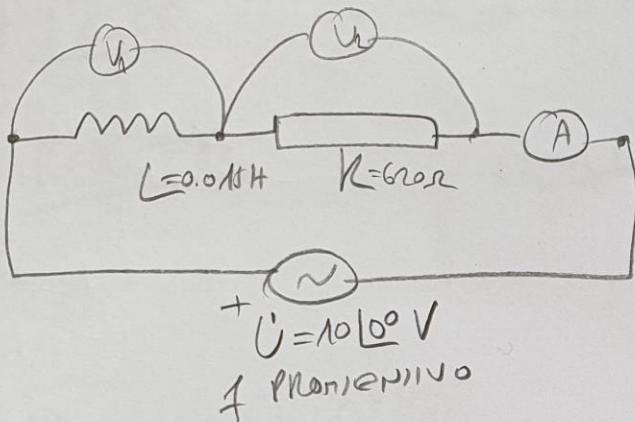
$$= \underbrace{\frac{X_C^2 R}{R^2 + X_C^2}}_{= 2,5} + j \left( X_C - \underbrace{\frac{X_C R^2}{R^2 + X_C^2}}_{= 0} \right)$$

$$2,5 = \frac{X_C^2 \cdot 5}{25 + X_C^2} \Rightarrow 62,5 + 2,5 X_C^2 = X_C^2 \cdot 5$$

$$2,5 X_C^2 = 62,5$$

ZADIRKA 1. VGO

VII-2-10



$U_1, U_2$  Ako

$$X_L = R$$

$$\omega L = R$$

$$\omega = \frac{R}{L} = \frac{620}{0.015} = 41333,333 \text{ s}^{-1}$$

$$\omega = 2\pi f \quad f = \frac{\omega}{2\pi} = 6578.404 \text{ Hz}$$

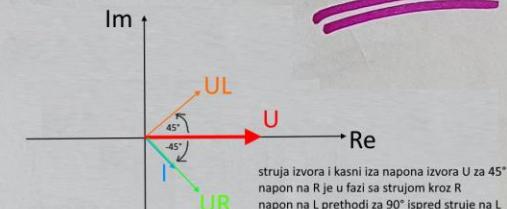
Kakvu jezonu  $U_{V1}$  ili  $U_{V2}$ ?

$$U_{V1} = \left| U \frac{jX_L}{R + jX_L} \right| = 10 \frac{620}{\sqrt{620^2 + 620^2}} = 10 \cdot \frac{620}{620\sqrt{2}} = \frac{10}{\sqrt{2}} = 7.07 \text{ V}$$

$$I = \frac{U}{Z} = \frac{U}{\sqrt{R^2 + X_L^2}} = \frac{10}{\sqrt{620^2 + 620^2}} = \frac{10}{620\sqrt{2}} = 0.0114049481 \text{ A} \approx 1 \text{ mA}$$

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{620^2 + 620^2} = 620\sqrt{2} \approx 876.81 \Omega$$

$$Z = R + jX_L \Rightarrow \varphi = \arctan \frac{X_L}{R} = \arctan \frac{620}{620} = \arctan 1 = 45^\circ$$



struja izvora i kasni za napona izvora  $U$  za  $45^\circ$   
napon na  $R$  je u fazi sa strujom kroz  $R$   
napon na  $L$  prethodi za  $90^\circ$  ispred struje na  $L$

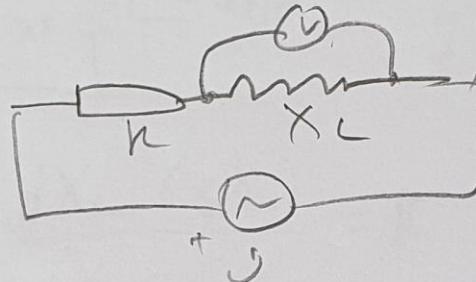
ZBIRKA

1. DIO

VII-2-7 TEST

$$R=X_L=X_C$$

ZATVORENA SICORA  $\rightarrow$  KURATOSPOD. C:  
 $U_{VH}=10V$



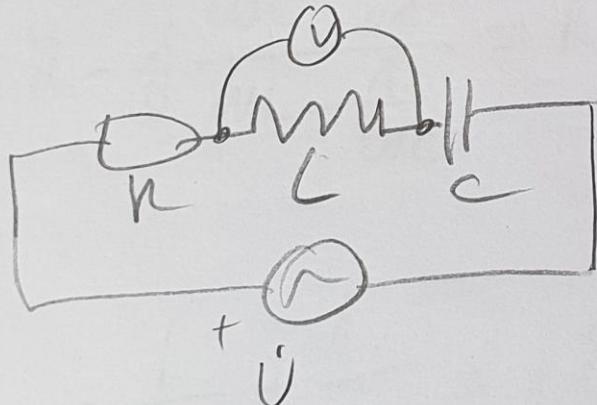
$$U = U_L = 10V$$

$$i_L = \frac{jX_L}{R+jX_L} = \frac{jX_L}{R+jX_L} \Rightarrow$$

$$U_L = U_R = U \frac{R}{\sqrt{R^2+X_L^2}} = U \frac{R}{R\sqrt{1+\frac{X_L^2}{R^2}}} = \frac{U}{\sqrt{1+\frac{X_L^2}{R^2}}} = \frac{U}{\sqrt{1+1}} = \frac{U}{\sqrt{2}}$$

$$\text{OPDA } U = U_V \cdot \sqrt{2} = 14.1V$$

OPNOMNO SILCOPKO:



SATA JE  
ZBOG

$$R=X_L=X_C$$

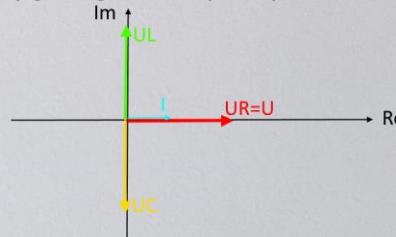
KMC V NEZAMANCI

ZBOG  $R=X_L=X_C \rightarrow$  NARON NA  $U_R=U=14.1V$

OPDA INA  $U_L=14.1V$

INA  $U_C=14.1V$

ovdje je  $R=X_L=X_C$  pa se fazori  $U_L$  i  $U_C$  ponište (razmislite kako bi vektorski dijagram izgledao da vrijedi da je  $X_L=R$ , a  $X_C=2R$ )



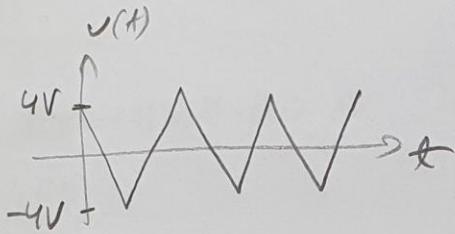
FAZORI SE PONISTE!

ZBINA 2.10

XII.2-1

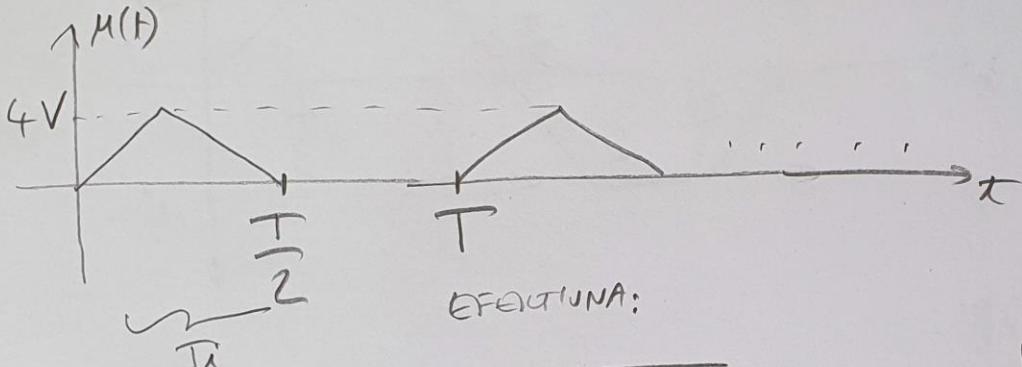
$$U_{RP} = 8V, T=0K, U_{SR}=0V$$

EFAKTUJNA!



$$U_{RP} = 8V \quad U_{SR} = 0V$$

$$U_f = \frac{U_m}{\sqrt{3}} = \frac{4}{\sqrt{3}}$$

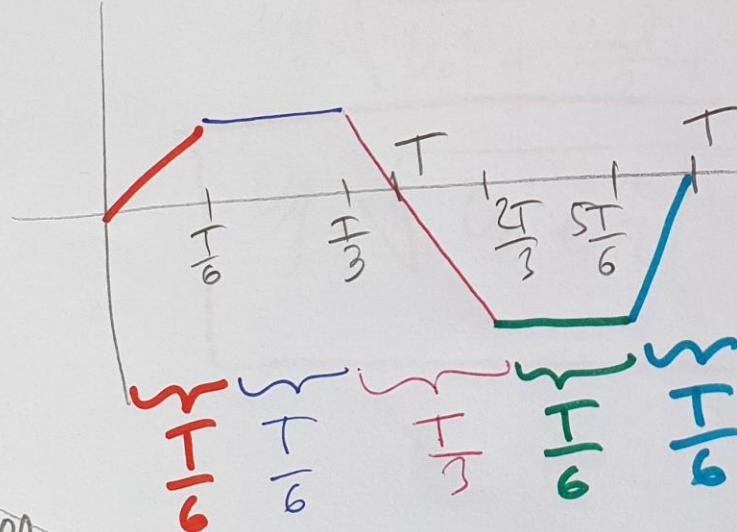
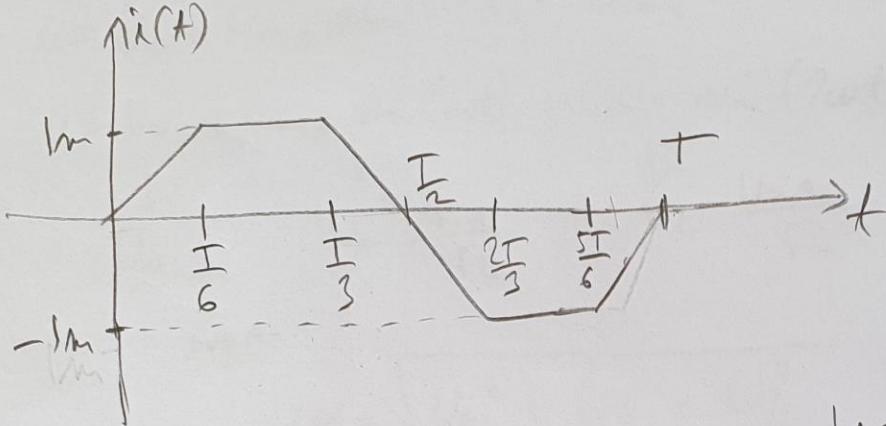


EFAKTUJNA:

$$U_f = \frac{U_m}{\sqrt{3}} \cdot \sqrt{\frac{T_1}{T}} = \frac{U_m}{\sqrt{3}} \cdot \sqrt{\frac{T/2}{T}} = \frac{U_m}{\sqrt{6}}$$

ZADIRKA 2. V10.

XII-2-4 EFECTUA UNA ACO ZE  $I_m = 10A$



ACO ZE  $I_m = 10A$   
ONDA  
 $I_{eff} \approx 7.5A$

EF. VULCANOV  
SE NE VLEVA S PROSTRANJENI T!

$$I_f = \sqrt{I_{f_1}^2 + I_{f_2}^2 + I_{f_3}^2 + I_{f_4}^2 + I_{f_5}^2}$$

$$I_f = \sqrt{\frac{I_m^2}{18} + \frac{I_m^2}{6} + \frac{I_m^2}{9} + \frac{I_m^2}{6} + \frac{I_m^2}{18}}$$

$$I_f = \sqrt{\frac{I_m^2 + 3I_m^2 + 2I_m^2 + 3I_m^2 + I_m^2}{18}}$$

$$I_f = \sqrt{\frac{10I_m^2}{18}}$$

$$I_{f_1} = \frac{I_m}{\sqrt{3}} \sqrt{\frac{I}{T}} = \frac{I_m}{\sqrt{18}}$$

$$I_{f_2} = I_m \sqrt{\frac{I}{T}} = \frac{I_m}{\sqrt{6}}$$

$$I_{f_3} = \frac{I_m}{\sqrt{3}} \sqrt{\frac{I}{T}} = \frac{I_m}{\sqrt{3}}$$

$$I_{f_4} = I_m \sqrt{\frac{I}{T}} = \frac{I_m}{\sqrt{6}}$$

$$I_{f_5} = \frac{I_m}{\sqrt{3}} \sqrt{\frac{I}{T}} = \frac{I_m}{\sqrt{18}}$$

$$I_f = I_m \sqrt{\frac{10}{18g}}$$

$$I_f = I_m \frac{\sqrt{5}}{3}$$

$$I_f = 10 \cdot \frac{\sqrt{5}}{3} A$$

$$I_f = 7.45356 A$$

$$I_f \approx 7.5 A$$

ZBIRKA 2. Dio

XIII-1

$$R=1\Omega$$

$$i(t) = 1 + 2 \sin(\omega t)$$

$$I_0=1A \quad I_1=\frac{2}{\sqrt{2}}=\sqrt{2}A$$

$$I_{eff}=\sqrt{I_0^2+I_1^2}=\sqrt{1+2}=\sqrt{3}A$$

SLUĐUĆA SNAGA = ?  
(RADNA SNAGA)

$$P=I_{eff}^2 \cdot R$$

RADA

$$P=I_{eff}^2 \cdot R = 3 \cdot 1 = 3W$$

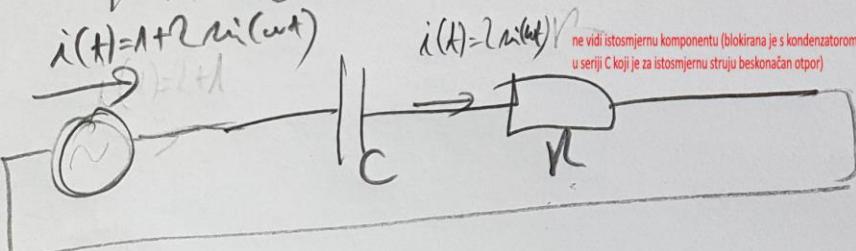
Ako je samo:

$$i(t) = 2 \sin(\omega t)$$

$$I_{eff}=\frac{2}{\sqrt{2}}=\sqrt{2}A$$

$$P=I_{eff}^2 \cdot R = 2 \cdot 1 = 2W$$

(O) I dešavat "ZASPUTVA" ISTOSMERNU komponentu struje?



ZASJO?  
jer za ISTOSMERNU komponentu  $\omega=0 \text{ rad/s}$   
KONDENZATOR C JE  $\infty$  OTOPOZ!

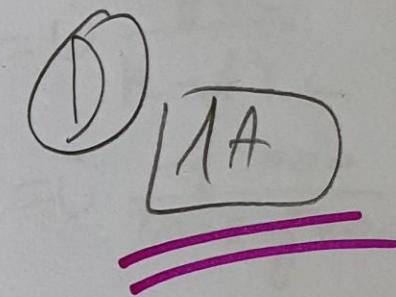
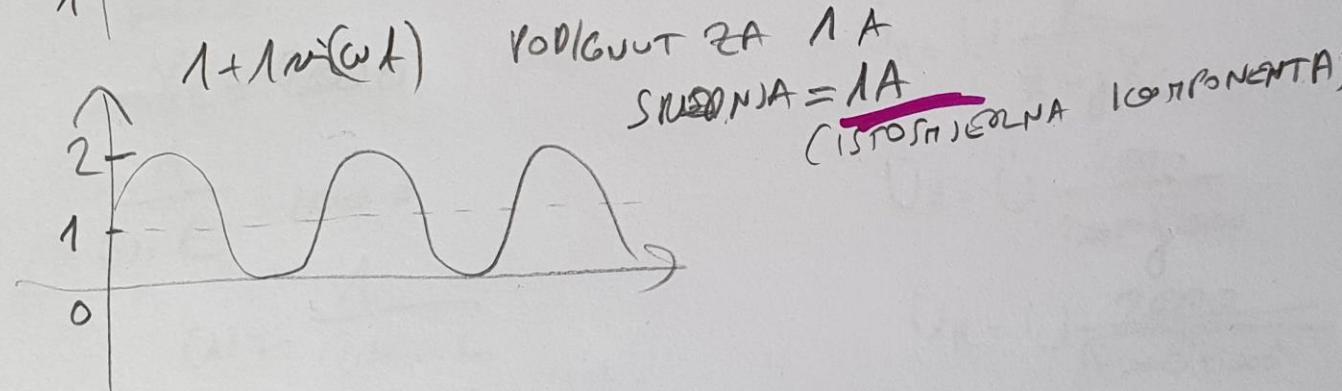
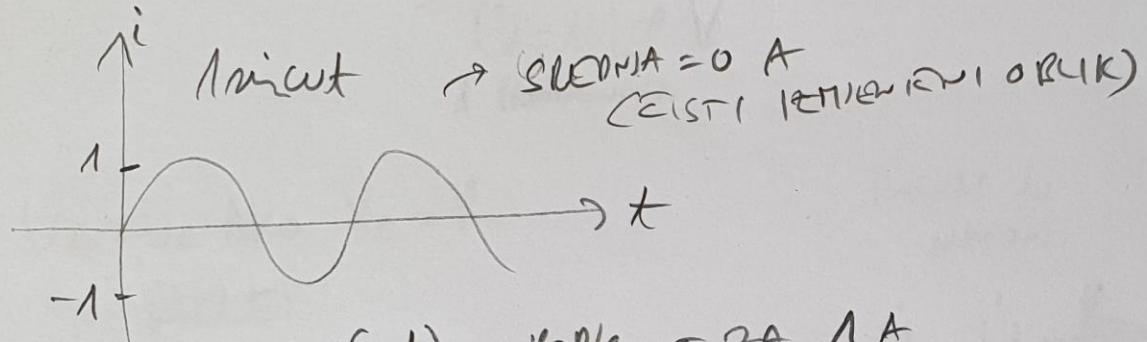
$$\frac{1}{\omega C} \Rightarrow \frac{1}{0 \cdot C} \Rightarrow \infty$$

ZBIRKA Z. VIO

XIII - TEST 3

$$i(t) = 1 + 1 \sin(\omega t)$$

SREDNJA VRHEDNOST ?



ZBRINKA 2. DÍLO

XII - TEST 8:

$$u = U_0 + U_{m1} \sin(\omega t) - U_{m2} \sin(3\omega t)$$

$$u = U_0 + U_{m1} \sin(\omega t) + U_{m2} \sin(2\omega t + \pi)$$

$$\downarrow \\ U_0$$

$$\downarrow \\ U_1 = \frac{U_{m1}}{\sqrt{2}}$$

$$\downarrow \\ U_2 = \frac{U_{m2}}{\sqrt{2}}$$

VÝSLEDKI

O VDA:

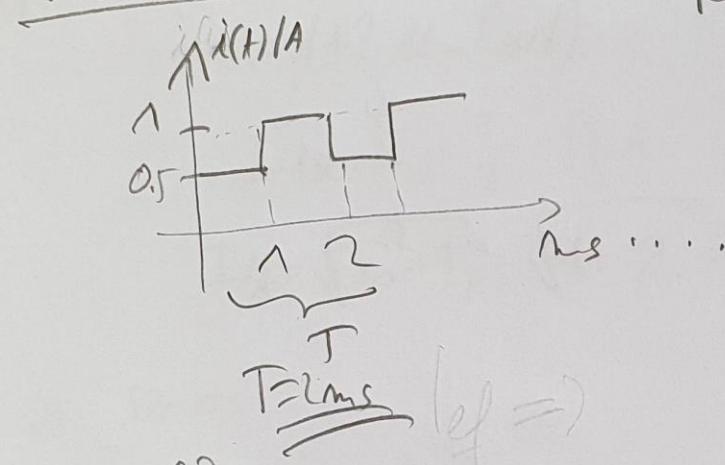
$$U_{ef} = \sqrt{U_0^2 + U_1^2 + U_2^2}$$

$$U_{ef} = \sqrt{U_0^2 + \frac{U_{m1}^2}{2} + \frac{U_{m2}^2}{2}}$$

$$U_{ef} = \sqrt{U_0^2 + \frac{1}{2} [U_{m1}^2 + U_{m2}^2]}$$

Zbirka 2. dio

XII - TEST 9



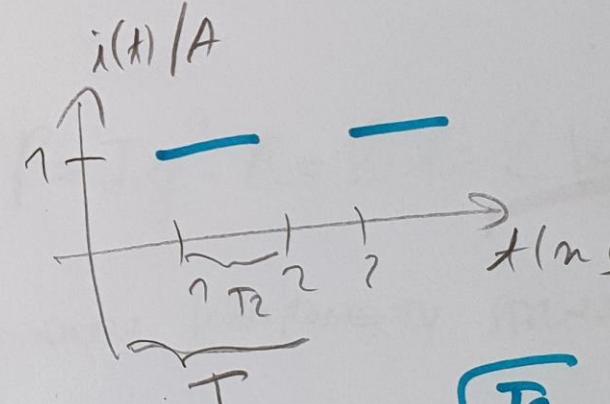
$$I_{eff} = I_m \sqrt{\frac{T_0}{T}} \quad \hookrightarrow \quad I_{eff} = 0.5 \sqrt{\frac{1}{2}} = \frac{1}{2\sqrt{2}} A$$

$$R = 1 \Omega$$

SREDNJA SNAGA NA OTROVNIKU

$$P_{sr} = P \rightarrow \underline{\text{RADNA SNAGA}}$$

$$P = I_{eff}^2 \cdot R$$



$$I_{eff} = I_m \sqrt{\frac{T_0}{T}} = 1 \cdot \sqrt{\frac{1}{2}} = \frac{1}{2\sqrt{2}} A$$

$$I_{eff} = \sqrt{I_{eff1}^2 + I_{eff2}^2} = \sqrt{\frac{1}{8} + \frac{1}{2}} = \sqrt{\frac{5}{8}} A$$

ODRAZ:

$$P = I_{eff}^2 \cdot R = \frac{5}{8} \cdot 1 = 0.625 W$$