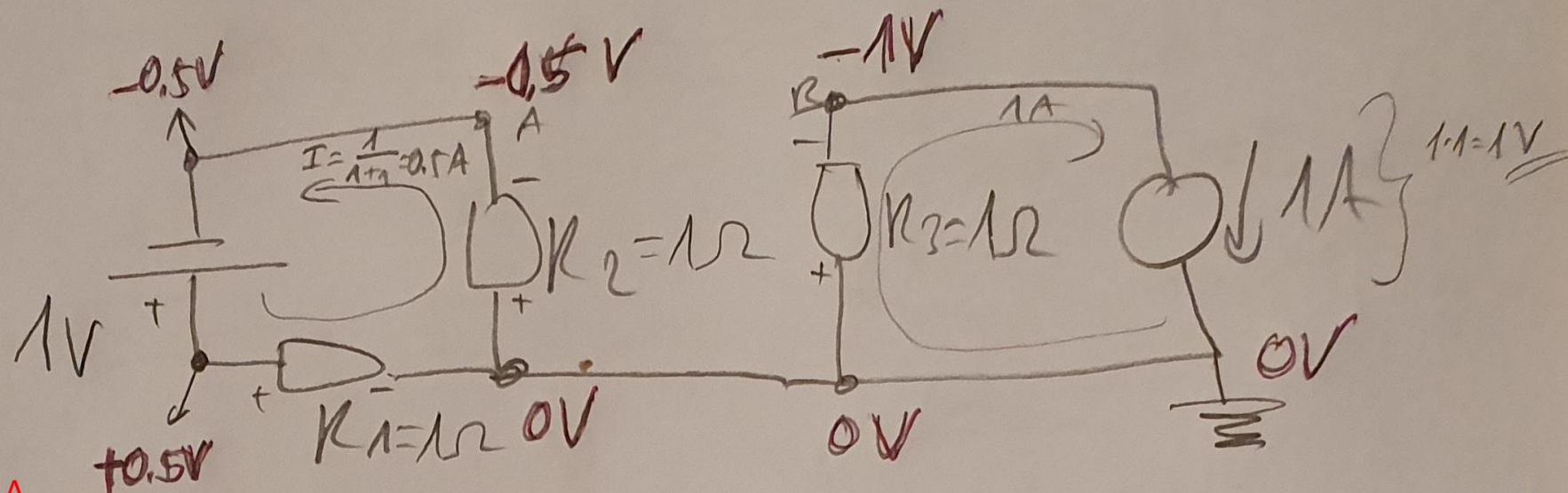


OE - konzultacije

22. svibnja 2020.

PAVIĆ - FELJA
2.010

X-TEST 11



ucrtamo ref. smjer struje kroz
lijevu petlju iznosa $1/(1+1) = 0.5$ A
i prema tome polaritete napona
na otpornicima

u desnoj petlji struju diktira strujni
izvor i samo prema tome ucrtamo
polaritete napona na otporniku R3

na R2 je iznos pada napona $1 \cdot 0.5 = 0.5$ V
na R1 je iznos pada napona $1 \cdot 0.5 = 0.5$ V
na R3 je iznos pada napona $1 \cdot 1 = 1$ V

dalje prolazimo od referentne točke (uzemljenja) do
A, odnosno B i pratimo što se događa s potencijalom

$$U_{AB} = \varphi_A - \varphi_B = -0.5 - (-1) = -0.5 + 1 = \underline{\underline{0.5V}}$$

(B)

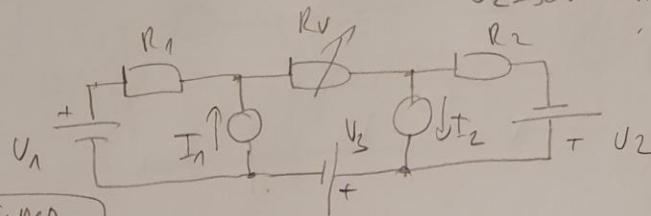
0.5V, + NA A

PAVIC - FELJA
2.010

X-9

$$R_1 = 20\Omega \quad R_2 = 10\Omega \quad U_1 = U_3 = 20V$$

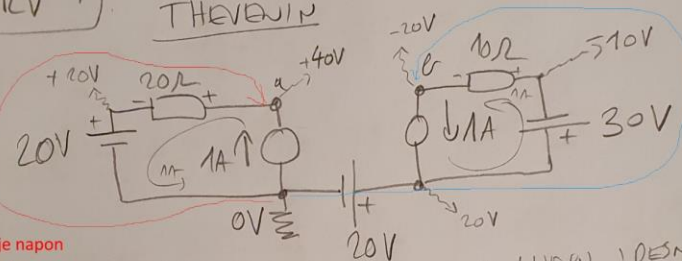
$$U_2 = 30V \quad I_1 = I_2 = 1A$$



MAX. SNAGA?
NA R_V

THEVENIN

obilazak od
mase do
točke a dužim
putem
(ne znamo koliki je napon
na strujnom izvoru,
trebali bi ga
izračunati...)



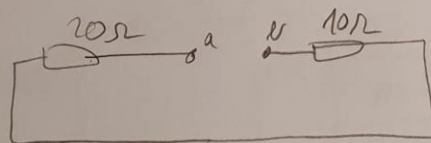
obilazak od
mase do točke b
dužim putem

STRUJNI IZVORI PIKTIRAJU STRUJU U UJEDNO I DESNO KONTURI!

$$\varphi_a = 40V \quad \varphi_b = -20V$$

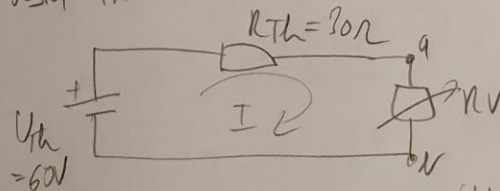
$$U_{th} = U_{ab} = \varphi_a - \varphi_b = 40 - (-20) = 60V$$

R_{th} (STRUJNE ODSTAVIMO, NAPONIKE ZAMENIMO S KRATKIM SPOJOM)



$$R_{th} = R_{ab} = 20 + 10 = 30\Omega$$

NAPON JE NI THEVENINOV IZVOR:



MAX SNAGA
NA TERETU
KADA JE
 $R_V = R_{th} = 30\Omega$

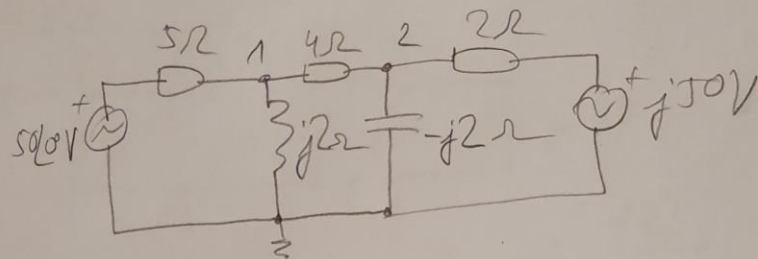
$$P_{max} = I^2 \cdot R_V = \left(\frac{U_{th}}{R_V + R_{th}} \right)^2 \cdot R_V = \left(\frac{60}{60} \right)^2 \cdot 30 \Rightarrow$$

$$P_{max} = 30W$$

PAULI-TEMA
2.010

X-17

$R=4\Omega$



a) NAPONI IZVOROVA

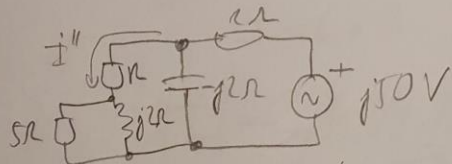
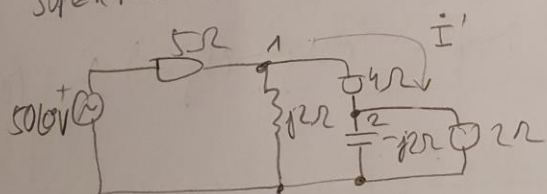
$$\dot{I}_1 \left(\frac{1}{5} + \frac{1}{j2} + \frac{1}{4} \right) - \dot{I}_2 \left(\frac{1}{4} \right) = \frac{50}{5}$$

$$-\dot{I}_1 \left(\frac{1}{4} \right) + \dot{I}_2 \left(\frac{1}{4} + \frac{1}{-j2} + \frac{1}{2} \right) = \frac{j50}{2}$$

$$\dot{I}_1 = \frac{400}{53} + j \frac{1250}{53} \quad \dot{I}_2 = \frac{1100}{53} + j \frac{1450}{53}$$

$$|\dot{I}| = \frac{|\dot{I}_1 - \dot{I}_2|}{R} = \frac{|-\frac{700}{53} - j \frac{200}{53}|}{4} = 3.434 A$$

b) SUPERPOZICIJA

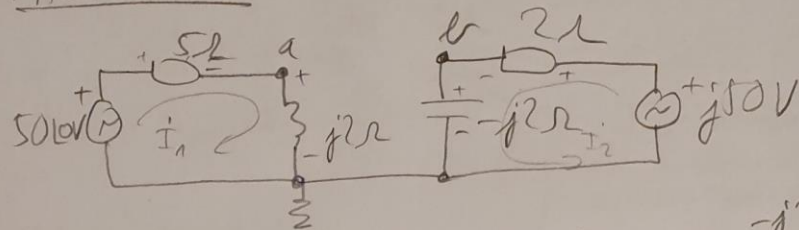


$$\dot{I} = \dot{I}' - \dot{I}''$$

PROBATE SAMI...

zbog suprotnih smjerova u prvom slučaju (referentan) i u drugom slučaju

c) THEVENIN



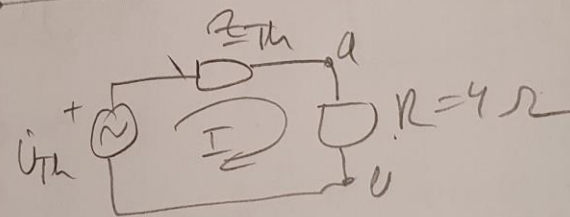
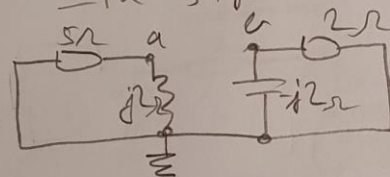
$$\dot{U}_a = 50 \frac{j2}{5+j2} \quad \dot{U}_b = j50 \frac{-j2}{2-j2}$$

$$\dot{U}_a = \frac{200}{29} + j \frac{500}{29} V \quad \dot{U}_b = 25 + j25 V$$

$$\dot{U}_{Th} = \dot{U}_a - \dot{U}_b = -\frac{525}{29} - j \frac{225}{29} V$$

$$\underline{Z}_{Th} = \frac{5 \cdot j2}{5+j2} + \frac{2 \cdot (-j2)}{2-j2} = \frac{49}{29} + j \frac{21}{29}$$

NAPONSKE
IZVORE
ZAMJENIMO
S KRAKIM
SPOJEM

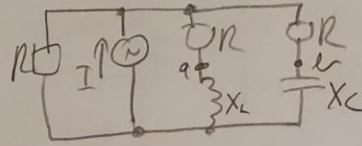


$$\dot{I} = \frac{\dot{U}_{Th}}{\underline{Z}_{Th} + R}$$

$$|\dot{I}| = 3.434 A$$

PAVIĆ - FELJA 2.010

X-22



$$R = X_L = X_C$$

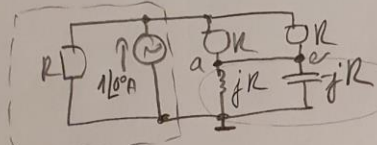
$$I = 1A$$

I_N između a i b

[KAO DA JE IZMEĐU a i b BILO
SPOJENO NEKO TROJILIO I GDE SMO HAVADIU]

NORTONOVA STRUJA

↳ KROZ KRATKI SPOJ a-b



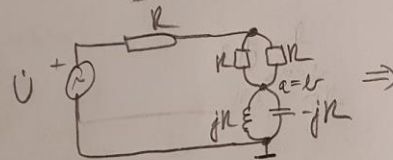
→ OVO JE ∞ OTPOR

$$\frac{jR \cdot (-jR)}{jR - jR} = \frac{R^2}{0} \Rightarrow \infty$$

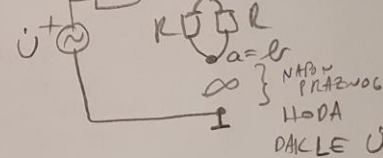
REAKTNI STRUJNI IZVOR

↓
REAKTNI NAPONSKI IZVOR

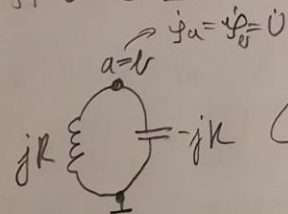
$$U = I \cdot R$$



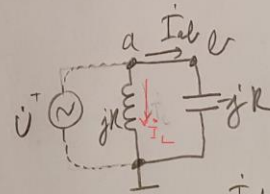
IZVOR I OSTATAK KRUGA
VIDE OVAKVO SITUACIJU:
→ NETAČE
STRUJA



A ŠTO JE S LC PARALELOM



$$j_a = j_b = U$$



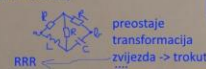
(KAO DA JE PARALELA
SPOJENA NA
IZVOR U)

$$I_{ab} = \frac{U}{-jK} \Rightarrow I_{ab} = \frac{U}{R}$$

$$I_{ab} = \frac{I \cdot R}{R} = I = 1A$$

druga opcija rješenja (duža)
Theveninov napon između a i b
Theveninova impedancija između a i b
i onda
je Nortonova struja jednaka
 $I_N = U_{th}/Z_{th}$

mali problem je Theveninova
impedancija (dobije se mosni spoj koji
nije u ravnoteži...)



paralela:
 $U = U_L = U_C$
 $U = I_L \cdot jX_L = I_C \cdot -jX_C$

$$I_L = U/jX_L = -jU/X_L$$

$$I_C = U/-jX_C = jU/X_C$$

po KZS za točku a ispada:

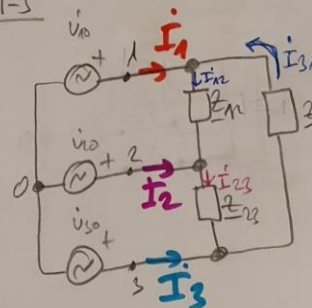
$0 = I_L + I_C$ odnosno zbroj I_L i I_C je nula (zato u ostatku kruga

ne teče struja)

odnosno $I_L = -I_C$ → kako se i vidi iz računa gore jer ovdje $X_L = X_C = R$!

PAUIC
FELJA
2.9.10

X1-5



$$Z_{12} = 20 \angle 60^\circ \Omega$$

$$Z_{23} = 20 \angle -60^\circ \Omega$$

$$Z_{31} = 10 \angle 0^\circ \Omega$$

$$\text{K7S: } \dot{I}_1 + \dot{I}_{31} = \dot{I}_{12}$$

$$\dot{I}_1 = \dot{I}_{12} - \dot{I}_{31}$$

$$\dot{I}_2 + \dot{I}_{12} = \dot{I}_{23}$$

$$\dot{I}_2 = \dot{I}_{23} - \dot{I}_{12}$$

$$\dot{I}_3 + \dot{I}_{23} = \dot{I}_{31}$$

$$\dot{I}_3 = \dot{I}_{31} - \dot{I}_{23}$$

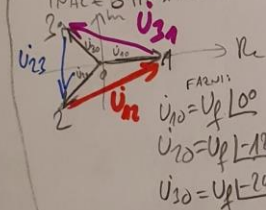
$$\dot{U}_{12} = 190 \angle 0^\circ \text{ V}$$

ONDA VRJEDNOSTI

$$\dot{U}_{23} = 190 \angle -120^\circ \text{ V (KASNI 120^\circ)}$$

$$\dot{U}_{31} = 190 \angle -240^\circ \text{ V (KASNI 120^\circ)}$$

IMAE STAJARNO:



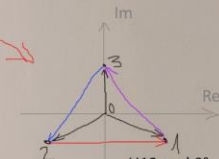
LIMISKE

$$\dot{U}_{12} = \dot{U}_{10} - \dot{U}_{20} = \sqrt{3} \dot{U}_p \angle 30^\circ$$

$$\dot{U}_{23} = \dot{U}_{20} - \dot{U}_{30} = \sqrt{3} \dot{U}_p \angle 150^\circ$$

$$\dot{U}_{31} = \dot{U}_{30} - \dot{U}_{10} = \sqrt{3} \dot{U}_p \angle 150^\circ$$

DAKLE
OVDE JE
SVE ZAKONITOSTI
U DEJNO ZA
300



U12 pod 0°
U23 pod -120°
U31 pod 120°

fazni:
U10 pod -30°
U20 pod -150°
U30 pod 90°

FARJE STAJE TROJICA

$$\dot{I}_{12} = \frac{\dot{U}_{12}}{Z_{12}} = \frac{190 \angle 0^\circ}{20 \angle 60^\circ} = 9.5 \angle -60^\circ \text{ A}$$

$$\dot{I}_{23} = \frac{\dot{U}_{23}}{Z_{23}} = \frac{190 \angle -120^\circ}{20 \angle -60^\circ} = 9.5 \angle -60^\circ \text{ A}$$

$$\dot{I}_{31} = \frac{\dot{U}_{31}}{Z_{31}} = \frac{190 \angle -240^\circ}{10 \angle 0^\circ} = 19 \angle -240^\circ \text{ A}$$

ONDA:

$$|\dot{I}_1| = |\dot{I}_{12} - \dot{I}_{31}|$$

$$|\dot{I}_1| = 28.5 \text{ A} \checkmark$$

$$|\dot{I}_2| = |\dot{I}_{23} - \dot{I}_{12}|$$

$$|\dot{I}_2| = 0 \text{ A} \checkmark$$

$$|\dot{I}_3| = |\dot{I}_{31} - \dot{I}_{23}|$$

$$|\dot{I}_3| = 28.5 \text{ A} \checkmark$$

PRAVE GREŠKA U
PRAVILNOSTI U ZBIRCI
I1 I I2 ZATVORENI!

PAVIC-TELBA
2. Dio
X1-11

$$\cos \varphi = 1$$

↓

EISTO KADNO
TROJILA
 $\varphi = 0^\circ$

NA SVETILI
FAZE TROJILA
JE FAZNI NAPON VEKORA
(U_f)

[JER JE SPOJAN
NULVOVIČ]

$$U_e = 350 \text{ V}$$

ONDA:

$$U_f = \frac{U_e}{\sqrt{3}}$$

$$U_f = \frac{350}{\sqrt{3}}$$

$$\dot{U}_{f0} = U_f \angle 0^\circ \text{ V} = U_f$$

$$\dot{U}_{f120} = U_f \angle 120^\circ \text{ V} = U_f \left[\frac{1}{2} + j\frac{\sqrt{3}}{2} \right]$$

$$\dot{U}_{f240} = U_f \angle 240^\circ \text{ V} = U_f \left[\frac{1}{2} + j\frac{\sqrt{3}}{2} \right]$$

NA 1. FAZI TROJILA

$$P_1 = P$$

$$P_1 = \frac{U_f^2}{R_1}$$

$$380 = \frac{U_f^2}{R_1}$$

$$R_1 = \frac{380^2}{3}$$

$$R_1 = \frac{380}{3} \Omega$$

$$\dot{I}_1 = \frac{\dot{U}_{f0}}{R_1}$$

NA 2. FAZI TROJILA

$$P_2 = 2P$$

$$P_2 = \frac{U_f^2}{R_2}$$

$$760 = \frac{U_f^2}{R_2}$$

$$R_2 = \frac{380^2}{2 \cdot 380}$$

$$R_2 = \frac{380}{6} \Omega$$

$$\dot{I}_2 = \frac{\dot{U}_{f120}}{R_2}$$

NA 3. FAZI TROJILA

$$P_3 = 3P$$

$$P_3 = \frac{U_f^2}{R_3}$$

$$1140 = \frac{U_f^2}{R_3}$$

$$R_3 = \frac{380^2}{3 \cdot 380}$$

$$R_3 = \frac{380}{9} \Omega$$

$$\dot{I}_3 = \frac{\dot{U}_{f240}}{R_3}$$

$$\dot{I}_0 = \dot{I}_1 + \dot{I}_2 + \dot{I}_3$$

$$\dot{I}_0 = \frac{U_f}{\frac{380}{3}} + \frac{U_f \left(-\frac{1}{2} - j\frac{\sqrt{3}}{2} \right)}{\frac{380}{6}} + \frac{U_f \left(-\frac{1}{2} + j\frac{\sqrt{3}}{2} \right)}{\frac{380}{9}}$$

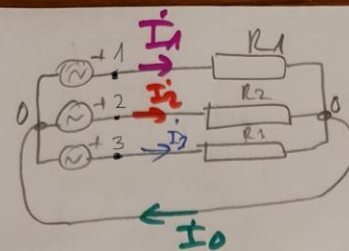
$$\dot{I}_0 = \frac{U_f}{380} \left[3 + 6 \left(-\frac{1}{2} - j\frac{\sqrt{3}}{2} \right) + 9 \left(-\frac{1}{2} + j\frac{\sqrt{3}}{2} \right) \right]$$

$$\dot{I}_0 = \frac{380}{380} \left[3 - 3 - j3\sqrt{3} - 4.5 + j4.5\sqrt{3} \right]$$

$$\dot{I}_0 = \frac{1}{\sqrt{3}} \left[-4.5 + j1.5\sqrt{3} \right]$$

$$\dot{I}_0 = \frac{1.5}{\sqrt{3}} \left[-3 + j\sqrt{3} \right] \Rightarrow \dot{I}_0 = \frac{1.5}{\sqrt{3}} \sqrt{9+3} \Rightarrow$$

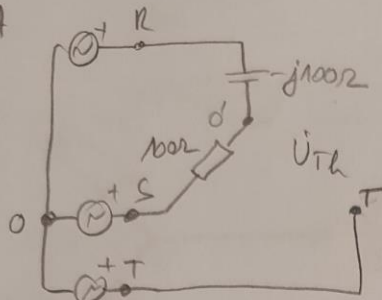
$$\dot{I}_0 = \frac{1.5}{\sqrt{3}} \cdot 2\sqrt{3} = \underline{\underline{3 \text{ A}}}$$



PAKLE:
 $R_1 \neq R_2 \neq R_3$
NESIMETRIČNO
TROJILA
KZS:
 $\dot{I}_0 = \dot{I}_1 + \dot{I}_2 + \dot{I}_3$

X1-13

Überschied

$$U_f = 220V$$


$$\dot{U}_H = \dot{U}_{to}$$

$$\dot{U}_{Th} = \dot{U}_{T_0} - \dot{U}_{0'0}$$

$$V_{d0} = \frac{\frac{V_{100}}{-j100} + \frac{V_{50}}{100}}{\frac{1}{-j100} + \frac{1}{100}}$$

$$U_{O_2} = \frac{U_1}{100} \left[\frac{1}{-j} - \frac{1}{2} - j \frac{\sqrt{3}}{2} \right]$$

$$\frac{1}{100} \left[-\frac{1}{j} + 1 \right]$$

$$U_{00} = U_f \frac{-\frac{1}{2} + j(1 - \frac{\sqrt{3}}{2})}{1 + j}$$

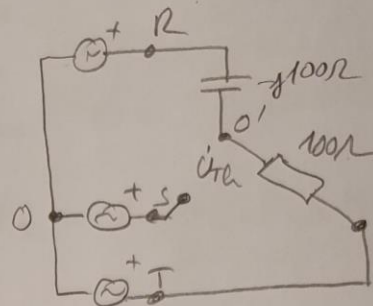
$$V_{02} = 220 \frac{0.5176380302 \angle 165^\circ}{\sqrt{2} \angle 45^\circ}$$

$$U_{00} = 80.52558883 \text{ } | 1200$$

$$V_{Th} = V_{TO} - V_{O/O}$$

$$U_{Th} = 139.4744 \text{ V}$$

$$|V_{th}| \approx 140V$$



$$\dot{\theta}_{T_h} = \dot{\theta}_{S_0'}$$

$$\dot{U}_D = \dot{U}_{C_2} - \dot{U}_{O'0}$$

$$U_{D0} = \frac{U_{D0}}{100} + \frac{U_{D0}}{100}$$

$$V_o = \frac{\frac{V_i}{100} \left[j + \left(-\frac{1}{2} + j\frac{\sqrt{3}}{2} \right) \right]}{\frac{1}{100} \left(\frac{1}{-j} + 1 \right)}$$

$$U_{o'o} = U_f \frac{-\frac{1}{2} + j(1 + \frac{\sqrt{3}}{2})}{1 + j}$$

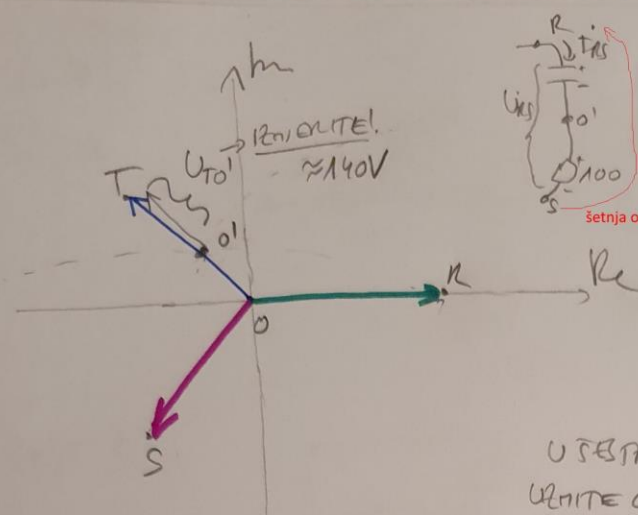
$$U_0 = 220 \frac{1,931851653 \sqrt{145^\circ}}{\sqrt{2} \sqrt{145^\circ}}$$


$$U_{d'0} = 300.525888 \angle 60^\circ \text{ V}$$

$$\dot{U}_{Th} = \dot{U}_{S0} - \dot{U}_{0'0}$$

$$\vec{U}_{Th} = 520,525888 \angle -120^\circ V$$

$$|U_{Th}| \approx 520V$$





$$|I_{RS}| = \frac{|U_{RS}|}{100 - j100}$$

$$I_{RS} = \frac{220\sqrt{3}}{100\sqrt{2}} = 2.2 \frac{\sqrt{3}}{\sqrt{2}} A$$

šetnja od S preko O' do F

$$U_{o's} = 220 \frac{\sqrt{2}}{\sqrt{2}} V$$

$$|U_{R0}| = |I_{Rd}| \cdot |-j100|$$

$$U_{K0'} = 220 \frac{\sqrt{3}}{\sqrt{2}} V$$

U 5 E 3 T A N

12.

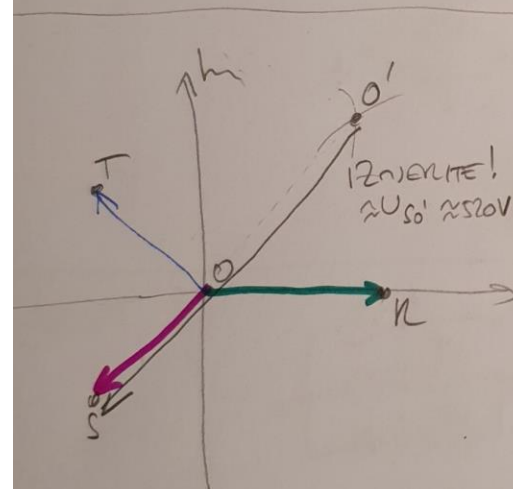
WHITE OVI

1000 - 1111

JEVAN V R H

A DWG 1

CHINESE



$$|I_{TR}| = \frac{|U_{TR}|}{100 - j100}$$

$$I_{TK} = \frac{220\sqrt{3}}{100\sqrt{2}} = 2.2 \frac{\sqrt{3}}{\sqrt{2}} A$$

$$|U_{O'n}| = |I_{Tn}| \cdot | -j100 |$$

$$V_{0'n} = 220 \frac{\sqrt{2}}{\sqrt{2}}$$

$$(\dot{U}_{T0})' = (\dot{I}_{TK}) \cdot |100|$$

$$U_{T01} = 220 \frac{\sqrt{2}}{\sqrt{2}} V$$

po iznosu
isto kao U_{01T}

OPET U ŠESTAR

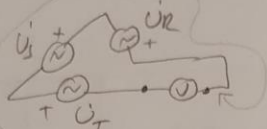
Power is $R \lambda T$

ONE SE SUAW TU JEO'

PRIK - FELJA
2. DIO

XI-TEST 4

podrazumijeva se
da su U_S , U_R i U_T razmaknuti za 120°
i da im je redoslijed $U_R \rightarrow U_S \rightarrow U_T$
npr kao standardno U_R pod 0° , U_S pod -120° ,
 U_T pod -240°



C

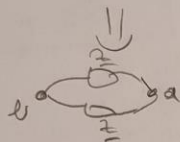
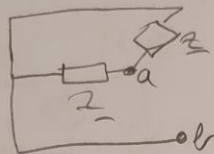
$$U_V = |U_T + U_S + U_R|$$

$$U_V = |U_0(-\frac{1}{2} + j\frac{\sqrt{3}}{2}) + U_0(-\frac{1}{2} - j\frac{\sqrt{3}}{2}) + U_0|$$

$$U_V = 0 \text{ V}$$

XI-TEST 5

Z_{th} s air?



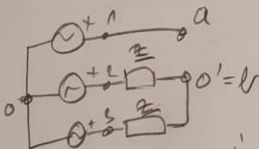
D

NAPONSKI IZVORI
NAPONIŠTEPI S
KRATKIM SPOJEN
ONDA:

$$Z_{th} = Z \parallel Z = \frac{Z \cdot Z}{Z + Z} = \frac{Z}{2}$$

$$Z_{th} = \frac{Z}{2}$$

XI-TEST 8



$$U_{0b} = \frac{U_{0a}}{\frac{1}{Z} + \frac{1}{Z}} = \frac{U_{0a}}{\frac{2}{Z}} = \frac{U_{0a} \cdot Z}{2}$$

ONDA:

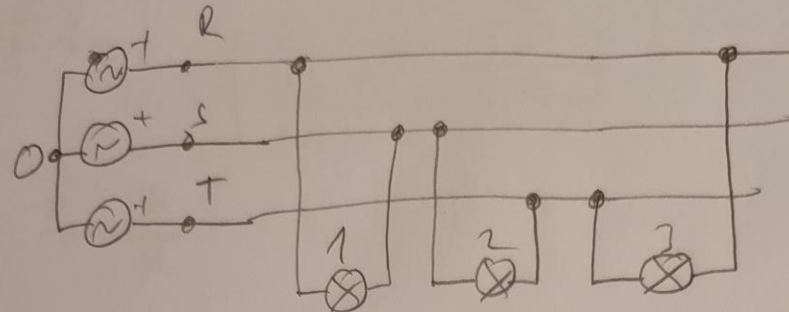
$$\dot{U}_a = \dot{U}_{10} = 220 \angle 0^\circ = 220 \text{ V}$$

ONDA:

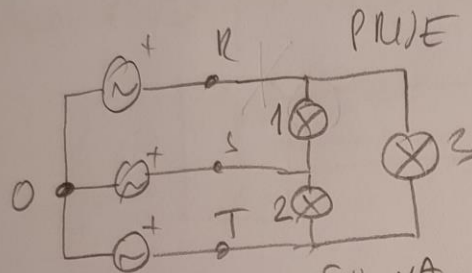
$$\dot{U}_{ab} = \dot{U}_{th} = \dot{U}_a - \dot{U}_b = 220 - (-110) = 330 \text{ V}$$

D

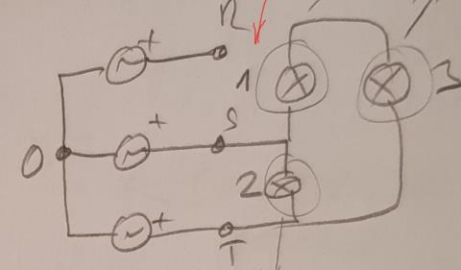
PRIK - FELJA 2. DIO XI-TEST 9



pukao osigurač - ne teče struja kroz ovu liniju!



SUI NA
LIMISKOM
NAPONU



NA LIMISKOM

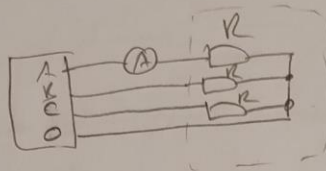
NA PO POLA
LIMISKOG

2 ISO SVIJETLI
1,3 SVIJETLE SLABE

E

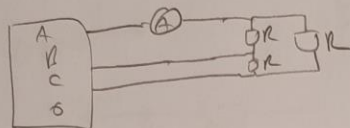
PAVLO-FEJSA
2.0/0

XI-TEST 12



$$I_A = \frac{U_f}{R}$$

Ako PRESPOJIMO TROKUT (i ODSPOJIMO NUL-VODIČ)



RESIMETRIČNO
TROJLO
O TROKUTU

PA JE

$$I_L = \sqrt{3} \cdot I_{\text{faza}}(A)$$

↓

$$I_{\text{faza}} = \frac{U_{\text{LINIJSKO}}}{R}$$

$$I_L = \sqrt{3} \cdot \frac{\sqrt{3} \cdot U_f}{R} = 3 \frac{U_f}{R}$$

DAKLE:

$$I_A = I_L = 3 \frac{U_f}{R}$$

STAVJA POKASNE
3 PUTA!

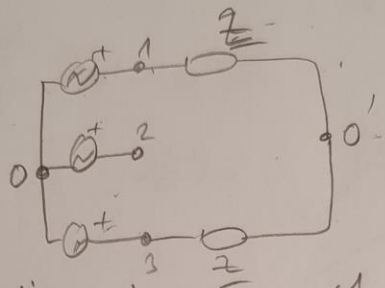
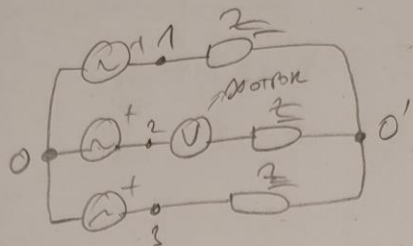
A

PAVLE - FELJA
2.010

XI-TEST 10

$$U_V = 220V$$

$$U_V = |U_{20}|$$



$$\dot{U}_{00} = \frac{\dot{U}_{10}}{\frac{1}{Z} + \frac{1}{Z}} + \frac{\dot{U}_{20}}{\frac{1}{Z} + \frac{1}{Z}} = \frac{U_f + U_f(-\frac{1}{2} + j\frac{\sqrt{3}}{2})}{\frac{2}{Z}} = \frac{U_f}{2} \left[\frac{1}{2} + j\frac{\sqrt{3}}{2} \right]$$

$$\dot{U}_{00} = \frac{U_f}{2} \left[\frac{1}{2} + j\frac{\sqrt{3}}{2} \right]$$

$$\dot{U}_{00} = \frac{U_f}{4} (1 + j\sqrt{3})$$

$$|\dot{U}_{20}| = |\dot{U}_{20} - \dot{U}_{00}|$$

$$220 = \left| U_f \left(-\frac{1}{2} - j\frac{\sqrt{3}}{2} \right) - \frac{U_f}{4} (1 + j\sqrt{3}) \right|$$

$$220 = \frac{U_f}{2} \left| -1 - j\sqrt{3} - \frac{1}{2} - j\frac{\sqrt{3}}{2} \right|$$

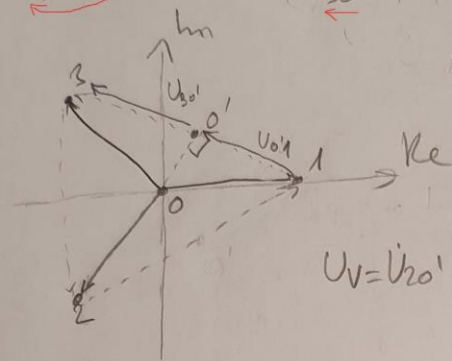
$$220 = \frac{U_f}{2} \left| -1.5 - j1.5\sqrt{3} \right| = \frac{U_f}{2} \cdot 1.5 \sqrt{1 + 3}$$

$$220 = \frac{U_f \cdot 1.5}{2} \sqrt{1 + 3} \Rightarrow U_f = \frac{220}{1.5} = 146.667V$$

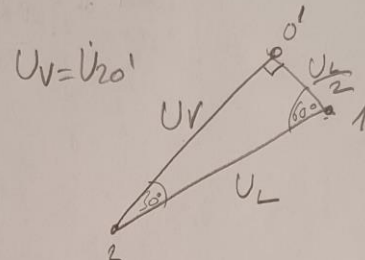
$$\dot{U}_{31} = U_f \sqrt{3} \angle 150^\circ$$

$$\dot{U}_{01} = \dot{I}_{31} \cdot Z = \frac{\dot{U}_{31}}{2Z}, Z = \frac{U_f \sqrt{3}}{2} \angle 150^\circ$$

$$\dot{U}_{30} = \dot{I}_{31} \cdot Z = \frac{\dot{U}_{31}}{2Z} \cdot Z = \frac{U_f \sqrt{3}}{2} \angle 150^\circ$$



U_{30} i U_{01} su po pola
od LINJSKOG NAPONA



$$U_L^2 = U_V^2 + \left(\frac{U_L}{2} \right)^2$$

$$U_L^2 = 220^2 + \frac{U_L^2}{4}$$

$$\frac{3U_L^2}{4} = 220^2$$

$$U_L^2 = \frac{4}{3} 220^2$$

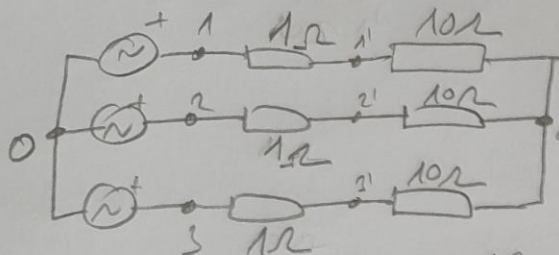
$$U_L = \frac{2}{\sqrt{3}} 220$$

ONDA:

$$U_f = \frac{U_L}{\sqrt{3}} = \frac{2}{3} \cdot 220 = \frac{440}{3} = 146.667V$$

PAVE-FELJA 2. DIO

X1-14



$\Rightarrow \dot{U}_{0'0} = 0V$ JER JE TRASILO SIMETRIZNO [$\dot{\varphi}_{0'} = \dot{\varphi}_0$]
(PROVJERITE PREKO MILIHANA)

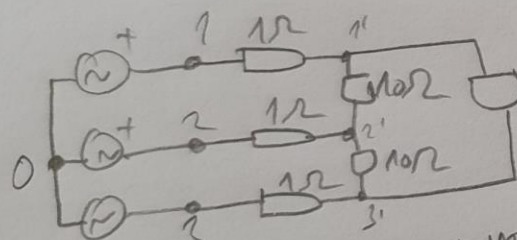
OPRA JE FAZNI NAPON TRASILICA U 1. FAZI:

PRVO RACUNAMO: $\dot{U}_{1'0'} = \dot{U}_{1'0} = 220 \angle 0^\circ V$ ONDA PO NAPONSKOM DIJELU
DIO NAPONA KOJI I OTPADA NA OTTORNIK 10Ω :

$$\dot{U}_{1'0'} = \dot{U}_{1'0} \frac{10}{10+1} = 220 \angle 0^\circ \frac{10}{11} = \underline{\underline{200 \angle 0^\circ V}}$$

$$|\dot{U}_{1'0'}| = 200V$$

AAKO TRASILICA
PREPOJIMO U TROKUT:



KONPLICIRANO ZA IZRACUNATI
ZBOG 1Ω OTPORA LIMIJA
I A TRANSFORMIRANO SU

$$R_D = 10 + 10 + 10 = 30\Omega$$

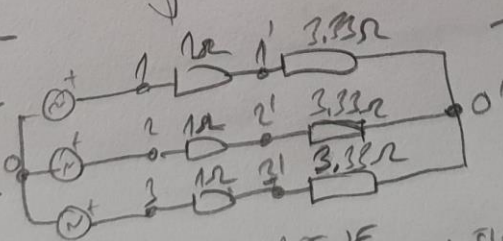
$$R_{1'0'} = \frac{10 \cdot 10}{R_D} = 3.33\Omega$$

$$R_{2'0'} = \frac{10 \cdot 10}{R_D} = 3.33\Omega$$

$$R_{3'0'} = \frac{10 \cdot 10}{R_D} = 3.33\Omega$$

TRAZI SE
FAZNI NAPON TRASILICA NPL:
 $|\dot{U}_{1'2'}|$

EKVIVALENTNI
SPOJEVI
1', 2', 3' NA ISTIN
POTENCIJALIMA!



OPET JE
SIMETRIZNO TRASILO
I A $\dot{U}_{0'0} = 0V$
 $\dot{\varphi}_{0'} = \dot{\varphi}_0$

$$\dot{U}_{1'0'} = \dot{U}_{1'0} - \dot{U}_{0'0} = \dot{U}_{1'0}$$

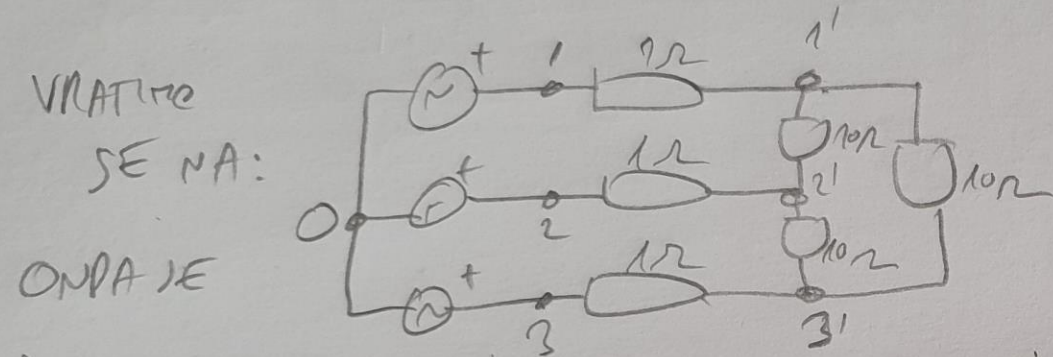
OPRA: $\dot{U}_{1'0'} = \dot{U}_{1'0} \frac{3.33}{3.33+1} = \frac{2200}{13} \angle 0^\circ V$

$$\dot{U}_{2'0'} = \dot{U}_{2'0} - \dot{U}_{0'0} = \dot{U}_{2'0}$$

OPRA: $\dot{U}_{2'0'} = \dot{U}_{2'0} \frac{3.33}{3.33+1} = \frac{2200}{13} \angle -120^\circ V$

$$\dot{\varphi}_0' = \dot{\varphi}_0 \rightarrow 1A \quad \dot{U}_{1'0} = \dot{U}_{1'0'} = \frac{2200}{13} \angle 0^\circ$$

$$\dot{U}_{10} = \dot{U}_{20'} = \frac{2200}{13} \angle -120^\circ = \frac{2200}{13} \left(-\frac{1}{2} - j\frac{\sqrt{3}}{2} \right) = -\frac{1100}{13} - j\frac{1100\sqrt{3}}{13} V$$

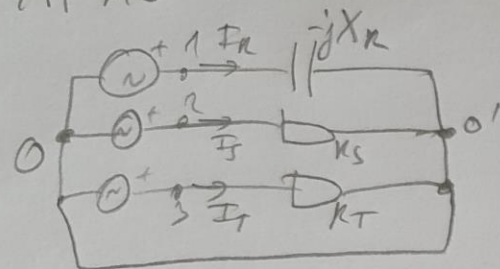


$$|\dot{U}_{1'2'}| = |\dot{\varphi}_{1'} - \dot{\varphi}_{2'}| = |\dot{U}_{1'0} - \dot{U}_{2'0}| = \left| \frac{2200}{13} + \frac{1100}{13} + j\frac{1100\sqrt{3}}{13} \right| = \left| \frac{3300}{13} + j\frac{1100\sqrt{3}}{13} \right| =$$

$$= \frac{1100}{13} |3 + j\sqrt{3}| = \frac{1100}{13} \cdot \sqrt{9+3} = \frac{1100}{13} \cdot 2\sqrt{3} =$$

$$= \frac{2200\sqrt{3}}{13} = 293.1162905 V$$

X1-16



$\dot{U}_{0'0} = 0V \rightarrow$ zbog NUL-VODICA! \rightarrow

$$I_R = I_S = I_T = 5A$$

$$I_R = \frac{|\dot{U}_{10}|}{|1-jX_R|} \quad I_S = \frac{|\dot{U}_{20}|}{R_S} \quad I_T = \frac{|\dot{U}_{30}|}{R_T}$$



ODNA VRIJED!

$$X_R = R_S = R_T = R$$

AKO JE NESIMETRNO
TROŠILO ZBOG NULVODICA JE
NA SVE TRI FAZE
TROŠILA FAZNI NAPON
IZVORA

NA jX_R JE \dot{U}_{10}

NA R_S JE \dot{U}_{20}

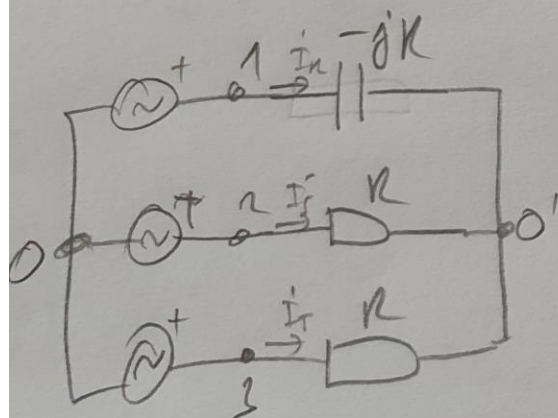
NA R_T JE \dot{U}_{30}

$|\dot{U}_{10}| = |\dot{U}_{20}| = |\dot{U}_{30}| = U_f$
SIMETRAN NAPON!
(KAO I OBIČNO)

AKO SE PREKINE NUL-VODICA
SADA' NAPONI NA SVE
TRI FAZE TROŠILA NISU ISTI!
(NESIMETRNO TROŠILO!)

PAKLE?

$$\frac{U_f}{R} = 5A$$



$$\dot{U}_{0'0} = \frac{\frac{\dot{U}_{10}}{-jK} + \frac{\dot{U}_{20}}{R} + \frac{\dot{U}_{30}}{R}}{\frac{1}{-jK} + \frac{1}{R} + \frac{1}{R}} = \frac{j\dot{U}_{10} + \dot{U}_{20} + \dot{U}_{30}}{2+j}$$

$$= U_f \frac{-1+j}{2+j} = U_f \frac{-1+j}{2+j} \cdot \frac{2-j}{2-j} = \frac{U_f}{5} (-2+j+2j+1) = \frac{U_f}{5} (-1+j3)$$

$$\dot{U}_{N0} = \dot{U}_{10} - \dot{U}_{00} = U_f - \frac{U_f}{5}(-1+j3) = U_f \left(\frac{6}{5} - j\frac{3}{5} \right) = \frac{3}{5} U_f (2-j)$$

$$I_N = \left| \frac{\dot{U}_{N0}}{-jR} \right| = \frac{\frac{3}{5} U_f \sqrt{5}}{R=5} = \frac{3}{5} \cdot 5 \cdot \sqrt{5} = 3\sqrt{5} = \underline{\underline{6.708 A}}$$

$$\dot{U}_{20}' = \dot{U}_{20} - \dot{U}_{00} = U_f \left(-\frac{1}{2} - j\frac{\sqrt{3}}{2} \right) - \frac{U_f}{5}(-1+j3) = U_f \left(-\frac{3}{10} - j\left(\frac{\sqrt{3}}{2} + \frac{3}{5}\right) \right)$$

$$I_S = \left| \frac{\dot{U}_{20}'}{R} \right| = \frac{U_f \cdot 1.496405856}{R=5} = \underline{\underline{7.48203 A}}$$

$$\dot{U}_{30}' = \dot{U}_{30} - \dot{U}_{00} = U_f \left(-\frac{1}{2} + j\frac{\sqrt{3}}{2} \right) - \frac{U_f}{5}(-1+j3) = U_f \left(-\frac{3}{10} + j\left(\frac{\sqrt{3}}{2} - \frac{3}{5}\right) \right)$$

$$I_T = \left| \frac{\dot{U}_{30}'}{R} \right| = \frac{U_f \cdot 0.4009607405}{R=5} = \underline{\underline{2.0048 A}}$$