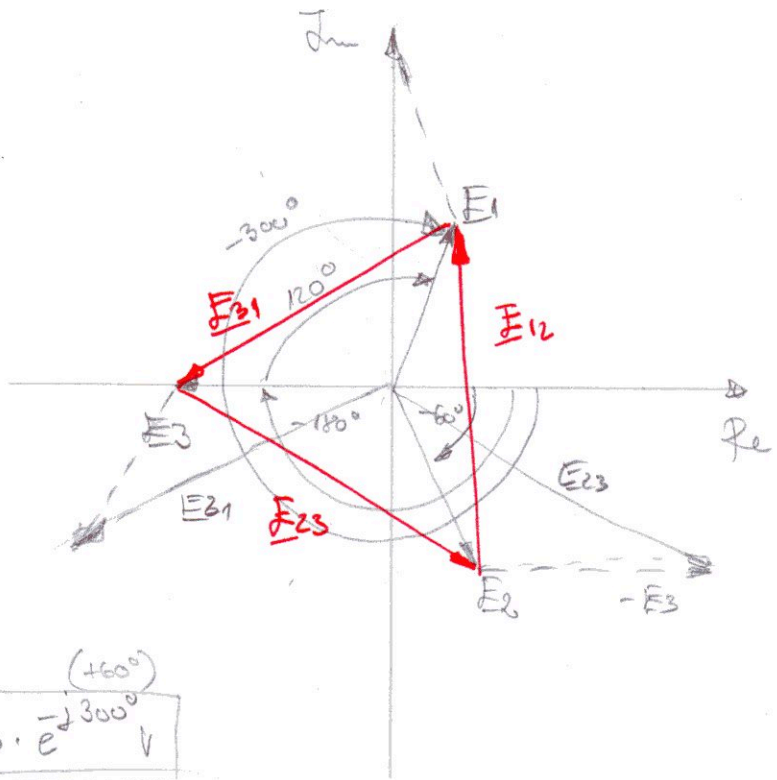
3- fazni sistem

$m = 3$

$\underline{E}_2 = 200 \cdot e^{-j60°}\ V$

$\alpha = \frac{2\pi}{m} = \frac{2\pi}{3} = 120°$



$\underline{E}_3 = \underline{E}_2 \cdot e^{j120°} \overset{(+180°)}{=} \boxed{200 \cdot e^{-j180°}\ V}$

$\underline{E}_1 = \underline{E}_3 \cdot e^{-j120°} \overset{(+60°)}{=} \boxed{200 \cdot e^{-j300°}\ V}$

$\underline{E}_{12} = \underline{E}_1 - \underline{E}_2 = 200 \cdot e^{j60°} - 200 \cdot e^{j-60°}$

$= 200 \cdot \frac{1}{2} + j200 \cdot \frac{\sqrt{3}}{2} - \left(200 \frac{1}{2} - j200 \cdot \frac{\sqrt{3}}{2}\right)$

$= j100\sqrt{3} + j100\sqrt{3} = \boxed{200\sqrt{3} \cdot e^{j90°}\ V}$

$\underline{E}_{23} = \underline{E}_2 - \underline{E}_3 = \underline{E}_2 \cdot \sqrt{3} \cdot e^{j30°} = 200 \cdot \sqrt{3} \cdot e^{-j60°} \cdot e^{j30°} = \boxed{200\sqrt{3} \cdot e^{-j30°}\ V}$

$\underline{E}_{31} = \underline{E}_3 - \underline{E}_1 = \underline{E}_3 \cdot \sqrt{3} \cdot e^{j30°} = 200 \cdot \sqrt{3} \cdot e^{-j180°} \cdot e^{j30°} = \boxed{200 \cdot e^{-j150°}\ V}$

$m = 6$

$\alpha = \pm k \frac{2\pi}{m}$

$\alpha = \pm k \frac{2\pi}{6} = \pm k \frac{\pi}{3} = \pm k\, 60°$ za ta lot zaostaja, vsaka naslednja napetost za E_1.
(matematično negativna smer, je smer urinega kazalca)

$\underline{E_1} = 100 \cdot e^{j30°}\ V$

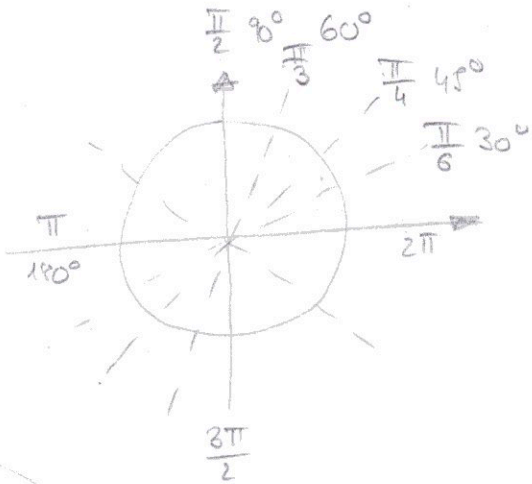
$\underline{E_2} = \underline{E_1} \cdot e^{-j60°} = 100 \cdot e^{j30°}\ V$

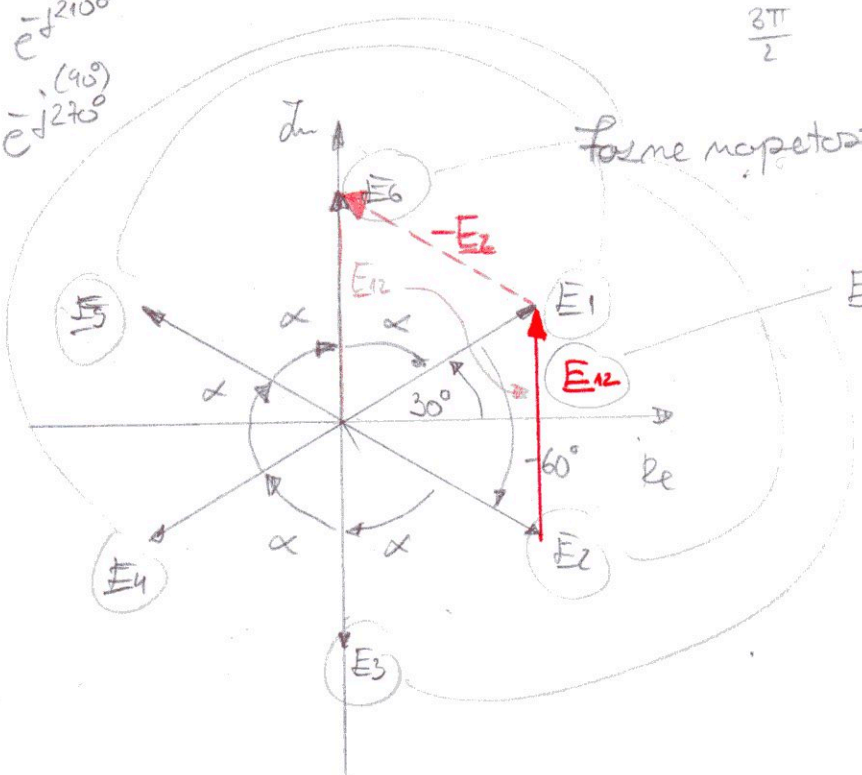
$\underline{E_3} = 100 \cdot e^{-j90°}$

$\underline{E_4} = 100 \cdot e^{-j180°}$ (ali $e^{j180°}$)

$\underline{E_5} = 100 \cdot e^{-j210°}$ (ali $e^{j(-30°)}$)

$\underline{E_6} = 100 \cdot e^{-j270°}$ (ali $e^{j90°}$)





fazne napetosti

$\underline{E_{12}} = \underline{E_1} - \underline{E_2}$

$(\underline{E_1} + (-\underline{E_2}))$

$m = 3$

$$\alpha = \pm k \frac{2\pi}{m} \Rightarrow \alpha = \frac{2\pi}{3} = 120°$$

$$\underline{E}_{12} = 400 \cdot e^{-j150°}\ V$$

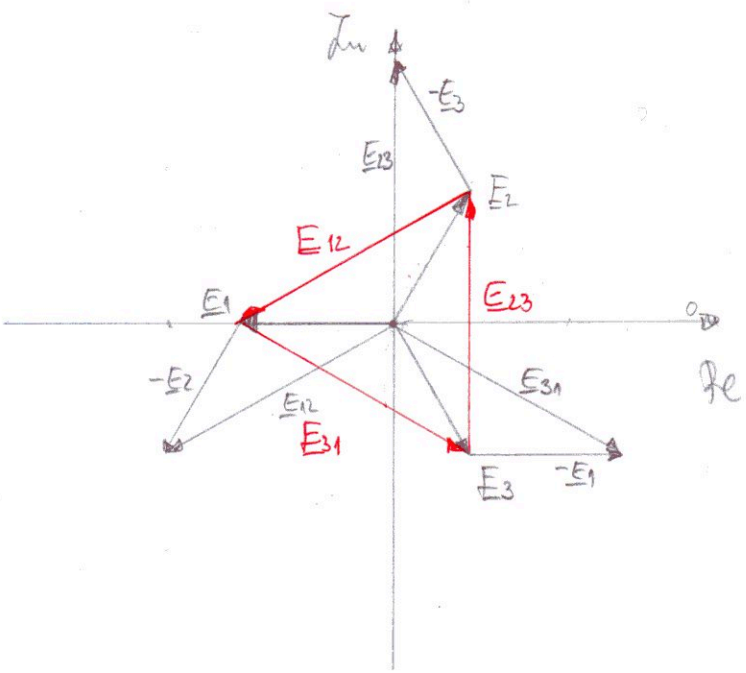
$$\underline{E}_{12} = \underline{E}_1 \cdot \sqrt{3} \cdot e^{j30°} \rightarrow \underline{E}_1 = \frac{\underline{E}_{12}}{\sqrt{3} \cdot e^{j30°}} = \frac{400}{\sqrt{3}} \cdot e^{-j180°}\ V$$

$$\underline{E}_{23} = \underline{E}_2 \cdot \sqrt{3} \cdot e^{j30} = \underline{E}_1 \cdot \sqrt{3} \cdot e^{j90} = 400 \cdot e^{-j270°}\ V$$

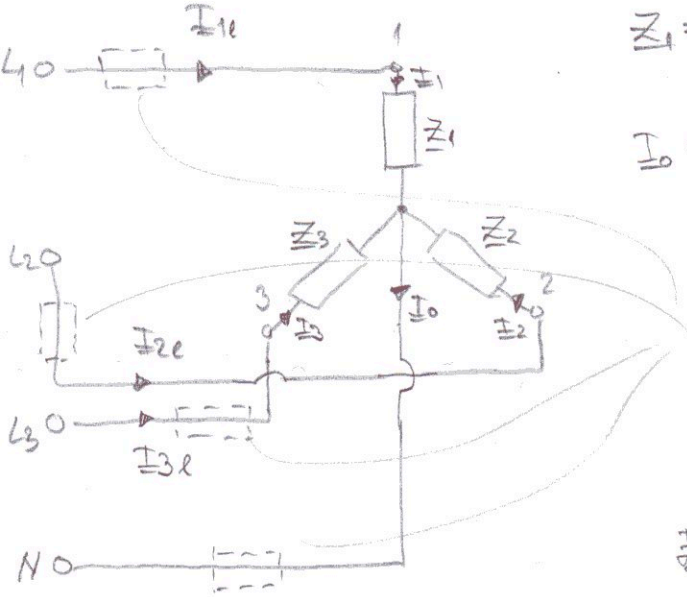
$$\underline{E}_2 = \underline{E}_1 \cdot e^{-j120°} = \frac{400}{\sqrt{3}} \cdot e^{-j300°\,(+60°)}\ V$$

$$\underline{E}_3 = \underline{E}_2 \cdot e^{-j120°} = \frac{400}{\sqrt{3}} \cdot e^{j60°}\ V$$

$$\underline{E}_{31} = \underline{E}_3 \cdot \sqrt{3} \cdot e^{j30°} = 400 \cdot e^{-j30°}\ V$$



- **URAVNOTEŽEN SISTEM** (Bueno to enako)



$\underline{Z}_1 = \underline{Z}_2 = \underline{Z}_3$

$\underline{I}_0 = \underline{I}_1 + \underline{I}_2 + \underline{I}_3 = 0$ ~ če je bueno simetrično

Možno so impedance različne!

$\underline{E}_1 = 100\,V$

$\underline{Z}_1 = \underline{Z}_2 = \underline{Z}_3 = 10 + j10\,\Omega$

$\underline{I}_1, \underline{I}_2, \underline{I}_3 = ?$

$$\underline{I}_1 = \frac{\underline{E}_1}{\underline{Z}_1} = \frac{100}{10+j10} = \frac{100}{10\sqrt{2}\cdot e^{j45^\circ}} = \boxed{5\cdot\sqrt{2}\cdot e^{-j45^\circ}\,A}$$

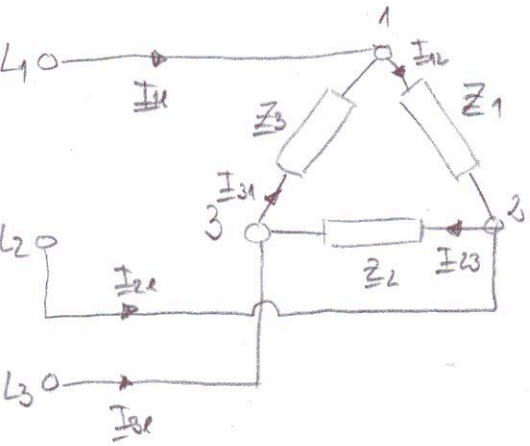
$\sqrt{10^2+10^2} = \sqrt{200} = 10\sqrt{2}$

$\operatorname{tg}\varphi = \frac{10}{10} = 1 \quad \varphi = 45^\circ$

$$\underline{I}_2 = \frac{\underline{E}_2}{\underline{Z}_2} = \frac{E_1\cdot e^{-j120^\circ}}{10\sqrt{2}\cdot e^{j45^\circ}} = \boxed{5\cdot\sqrt{2}\cdot e^{-j165^\circ}\,A}$$

$$\underline{I}_3 = \frac{\underline{E}_3}{\underline{Z}_3} = \frac{100\cdot e^{-j240^\circ}}{10\sqrt{2}\cdot e^{j45^\circ}} = 5\cdot\sqrt{2}\cdot e^{-j285^\circ} = \boxed{5\cdot\sqrt{2}\cdot e^{j75^\circ}\,A}$$

• NESIMETRIČNA OBREMENITEV



$$\underline{I}_1 = \frac{\underline{E}_1}{\underline{Z}_1} = \frac{\underline{E}_2}{\underline{Z}_2} = \dots$$

$\underline{U}_0$ – premik nevtralne točke

Brez N vodila, neodvisni na bremenu

$$\underline{U}_1 = \underline{E}_1 - \underline{U}_0,$$

$$\underline{U}_2 = \underline{E}_2 - \underline{U}_0, \dots$$

RAČUNAMO LAHKO LE! $\Delta - \Delta$! $\lambda - \lambda$.

$\underline{Z}_{12} = 10\,\Omega$
$\underline{Z}_{23} = j10\,\Omega$
$\underline{Z}_{31} = -j10\,\Omega$
} nesimetrično

$\underline{E}_1 = 100 \cdot e^{j60°}\,V$ – fazorji → premaknjeno v kvadrant!

$m = 3$

$\alpha = \frac{2\pi}{m} = 120°$

$\underline{I}_1, \underline{I}_2, \underline{I}_3 = ?$

$$\underline{E}_{12} = \underline{E}_1 \cdot \sqrt{3} \cdot e^{j30°} = \boxed{100\sqrt{3} \cdot e^{j90°}\,V}$$

$$\underline{E}_{23} = \underline{E}_{12} \cdot e^{-j120°} = \boxed{100\sqrt{3} \cdot e^{-j30°}\,V}$$

$$\underline{E}_{31} = \underline{E}_{23} \cdot e^{-j120°} = \boxed{100\sqrt{3} \cdot e^{-j150°}\,V}$$

$$\underline{I}_{12} = \frac{\underline{E}_{12}}{\underline{Z}_{12}} = \frac{100\sqrt{3} \cdot e^{j90°}}{10\,\Omega} = \boxed{10\sqrt{3} \cdot e^{j90°}\,A}$$

$$\underline{I}_{23} = \frac{\underline{E}_{23}}{\underline{Z}_{23}} = \frac{100\sqrt{3} \cdot e^{-j30°}}{j10} = \frac{100\sqrt{3} \cdot e^{-j30°}}{10 \cdot e^{j90°}} = \boxed{10\sqrt{3} \cdot e^{-j120°}\,A}$$

$$\underline{I}_{31} = \frac{\underline{E}_{31}}{\underline{Z}_{31}} = \frac{100\sqrt{3} \cdot e^{-j150°}}{10 \cdot e^{-j90°}} = \boxed{10\sqrt{3} \cdot e^{-j60°}\,A}$$

$\underline{I}_1, \underline{I}_2, \underline{I}_3$ → Kirchhoff

$$\underline{I}_1 = \underline{I}_{12} - \underline{I}_{31} = -8{,}66 + j\,32{,}32\,A$$

$$\underline{I}_2 = \underline{I}_{23} - \underline{I}_{12} = -8{,}66 - j\,32{,}32\,A$$

$$\underline{I}_3 = \underline{I}_{31} - \underline{I}_{23} = 17{,}32\,A$$

$\Sigma = 0$ Brez N.

• MNOGOKOTNI JKA VEZAVA (Δ)

$\underline{E}_{12} = 300 \cdot e^{j90°}\,V$

$Z_{12} = j20\,\Omega$

$Z_{23} = 20\,\Omega$

$Z_{31} = -j20\,\Omega$

$I_1, I_2, I_3 = ?$

$$\underline{I}_{12} = \frac{\underline{E}_{12}}{\underline{Z}_{12}} = \frac{300 \cdot e^{j90°}}{20 \cdot e^{j90°}} = \boxed{15\,A}$$

$\underline{E}_{12} \cdot e^{-j120°}$

$$\underline{I}_{23} = \frac{\underline{E}_{23}}{\underline{Z}_{23}} = \frac{300 \cdot e^{j30°}}{20} = \boxed{15 \cdot e^{j30°}\,A}$$

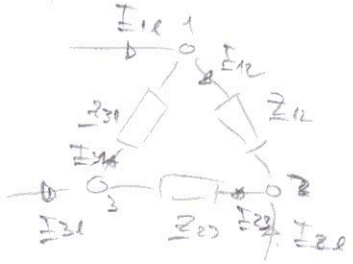
$$\underline{I}_{31} = \frac{\underline{E}_{31}}{\underline{Z}_{31}} = \frac{300 \cdot e^{j150°}}{20 \cdot e^{-j90°}} = \boxed{15 \cdot e^{j60°}}$$

$$\underline{I}_1 = \underline{I}_{12} - \underline{I}_{31} = \boxed{7{,}5 + j12{,}99\,A}$$

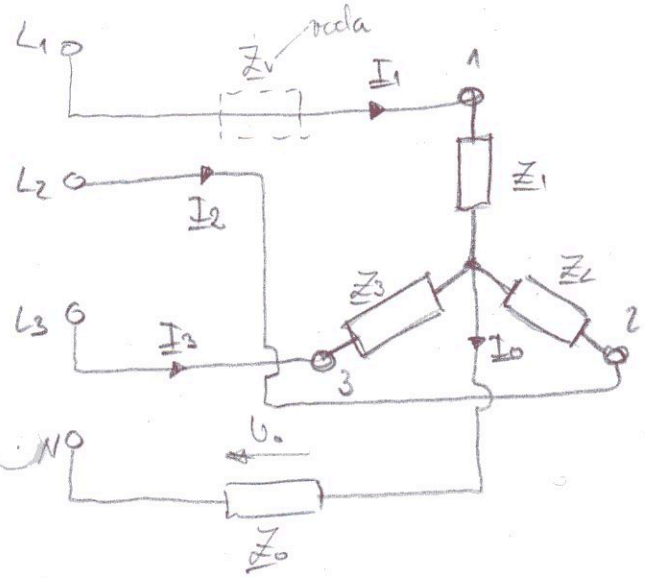
$$\underline{I}_2 = \underline{I}_{23} - \underline{I}_{12} = \boxed{-2{,}01 - j7{,}5\,A}$$

$$\underline{I}_3 = \underline{I}_{31} - \underline{I}_{23} = \boxed{-5{,}49 - j5{,}49\,A}$$

$\Sigma = 0$ ✓



• VEČKRATNA VEZAVA (λ)



$\underline{I}_{linijskega} = \underline{I}_{bremenskega}$

– Če je bremenska ničnotočka $\underline{U}_0$ zančena saj je $\underline{I}_0 = 0$.

$\underline{Z}_1 = \underline{Z}_2 = \underline{Z}_3$

$\underline{I}_0 = \underline{I}_1 + \underline{I}_2 + \underline{I}_3 = 0$

$\underline{U}_0$ – zančena

$\underline{U}_1 = \underline{E}_1$

---

nesimetrični sistem

– brez N:

$-\ \underline{E}_1 = \underline{U}_1 + \underline{U}_0$

$\Rightarrow \underline{U}_1 = \underline{E}_1 - \underline{U}_0$

$$\underbrace{\underline{U}_0 \underline{Y}_0}_{\underline{I}_0} = \underbrace{(\underline{E}_1 - \underline{U}_0)\cdot \underline{Y}_1}_{\underline{I}_1} + \underbrace{(\underline{E}_2 - \underline{U}_0)\underline{Y}_2}_{\underline{I}_2} + \dots + \underbrace{(\underline{E}_n - \underline{U}_0)\underline{Y}_n}_{\underline{I}_n}$$

$\underline{U}_1$, $\underline{U}_2$, $\underline{U}_n$

$-\ \underline{I}_0 = \underline{I}_1 + \underline{I}_2 + \underline{I}_3 + \dots + \underline{I}_n$

$-\ \underline{U}_0 = \underline{I}_0 \cdot \underline{Z}_0$

$-\ \underline{I}_1 = \underline{U}_1 \cdot \underline{Y}_1$

$\underline{I}_n = \underline{U}_n \cdot \underline{Y}_n$

$$\Rightarrow \underline{U}_0 = \frac{\underline{E}_1\underline{Y}_1 + \underline{E}_2\underline{Y}_2 + \dots + \underline{E}_n\underline{Y}_n}{(\underline{Y}_0) + \underline{Y}_1 + \underline{Y}_2 + \dots + \underline{Y}_n}$$

• NEURAVNOTEŽEN SISTEM Z N.

1

$\underline{E}_1 = 200 \cdot e^{j30°}\ V$

$\underline{Z}_1 = j20\,\Omega$

$\underline{Z}_2 = 20\,\Omega$

$\underline{Z}_3 = -j20\,\Omega$

$\underline{E}_1 = \underline{U}_1$

$\underline{E}_2 = \underline{U}_2$

$\underline{E}_3 = \underline{U}_3$

$\underline{I}_1 = \frac{\underline{U}_1}{\underline{Z}_1} = \frac{200 \cdot e^{j30°}}{20 \cdot e^{j90°}} = \boxed{10 \cdot e^{-j60°}\ A}$

$\underline{I}_2 = \frac{\underline{U}_2}{\underline{Z}_2} = \frac{200 \cdot e^{-j90°}}{20} = \boxed{10 \cdot e^{-j90°}\ A}$

$\underline{I}_3 = \frac{\underline{U}_3}{\underline{Z}_3} = \frac{200 \cdot e^{j210°}}{20 \cdot e^{-j90°}} \overset{(+180°)}{=} \boxed{10 \cdot e^{j120°}\ A}$

linijski tuki?

$\underline{I}_0 = \underline{I}_1 + \underline{I}_2 + \underline{I}_3 = \boxed{-j27{,}32\ A}$

• BREZ N

- premaknitev $\underline{U}_0$

$$\underline{U}_0 = \frac{\underline{E}_1\underline{Y}_1 + \underline{E}_2\underline{Y}_2 + \underline{E}_3\underline{Y}_3}{\underline{Y}_1 + \underline{Y}_2 + \underline{Y}_3} = \frac{\overbrace{\underline{E}_1\underline{Y}_1 + \underline{E}_2\underline{Y}_2 + \underline{E}_3\underline{Y}_3}^{\underline{I}_0}}{\underline{Y}_1 + \underline{Y}_2 + \underline{Y}_3} = \frac{\underline{I}_0}{\underline{Y}_1 + \underline{Y}_2 + \underline{Y}_3} = \frac{-j27{,}32}{0{,}05} = \boxed{-546{,}41\ V}$$

$\underline{U}_1 = \underline{E}_1 - \underline{U}_0$

$\underline{U}_2 = \underline{E}_2 - \underline{U}_0$

$\underline{U}_3 = \underline{E}_3 - \underline{U}_0$

$\underline{I}_1 = \frac{\underline{U}_1}{\underline{Z}_1} = \frac{669{,}213 \cdot e^{j75°}}{20 \cdot e^{j90°}} = \boxed{32{,}32 - j8{,}66\ A}$

$\underline{U}_1 = 200 \cdot e^{j30°} + 546{,}41\ V = 173{,}21 + j546{,}4\ V = 669{,}213 \cdot e^{j75°}$

$\underline{I}_2 = \frac{346{,}41 \cdot e^{j90°}}{20} = \boxed{j17{,}32\ A}$

$\underline{I}_3 = \frac{669{,}213 \cdot e^{j105°}}{20 \cdot e^{j90°}} = \boxed{-32{,}32 - j8{,}66\ A}$

• MOĆI V 3-f SISTEMIH

$\underline{S}$ - vektor kompleksne!

vezava Y:

$\underline{S}_m = \underline{U}_m \cdot \underline{I}_m^*$ IZVORI: $\underline{S}'_m = \underline{E}_m \cdot \underline{I}_m^*$

$\underline{S}_m = \underline{S}'_m$

$\underline{S}_m$ → ponorniki, $\underline{S}'_m$ → vir

- Skupna delovna moč P

$$P = P_1 + P_2 + P_3 \dots$$
$$= U_1 I_1 \cos\varphi_1 + U_2 I_2 \cos\varphi_2 + U_3 I_3 \cos\varphi_3 + \dots$$
$$= I_1^2 R_1 \cdot \cos\varphi_1 + I_2^2 R_2 \cdot \cos\varphi_2 + \dots$$

$$Q = Q_1 + Q_2 + Q_3 \dots$$
$$= U_1 I_1 \cdot \sin\varphi_1 + U_2 I_2 \cdot \sin\varphi_2 + \dots$$

Uravnotežen sistem

$E = \sqrt{3} \cdot E_f$ (modificirana napetost) $\quad I = I_f = I_\ell \quad \varphi_1 = \varphi_2 = \varphi_3$

$$S = 3S_1 = 3E_1 I_1 = \sqrt{3} E I$$ (linijski tok)

vezava Δ

$$\underline{S} = \underline{S}_{12} + \underline{S}_{23} + \underline{S}_{31} = \underline{E}_{12} \cdot \underline{I}_{12}^* + \underline{E}_{23} \cdot \underline{I}_{23}^* + \underline{E}_{31} \underline{I}_{31}^* + \dots = P + jQ$$

$$P = E_{12} \cdot I_{12} \cdot \cos\varphi_{12} + E_{23} I_{23} \cdot \cos\varphi_{23} + \dots$$

$$Q = E_{12} I_{12} \cdot \sin\varphi_{12} + \dots$$

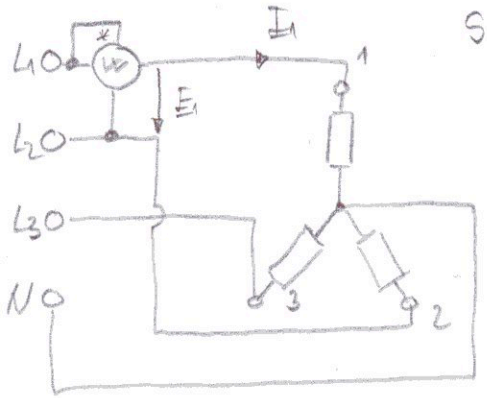
Uravnotežen sistem

$E_{\Delta} = E \quad I = \sqrt{3} I_f \quad \varphi_1 = \varphi_2 = \varphi_3$

$$S = 3 E_{12} I_{12} = \sqrt{3} E I$$

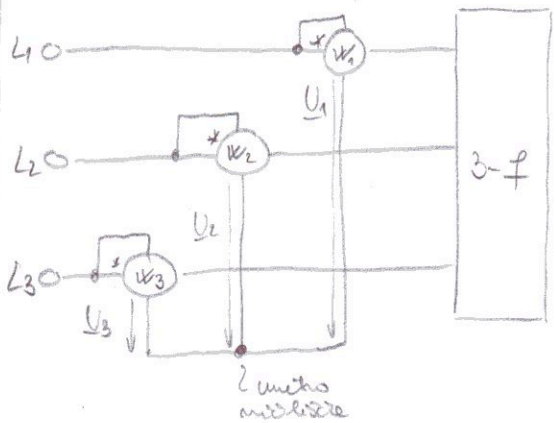
• MERITEV IN IZRAČUN MOČI V 3-f

- Uravnotežen sistem



$$S = 3S_1 = 3 \cdot E_1 \cdot I_1^*$$

- Neuravnotežen sistem (brez N)



$$U_1 = E_1 - U_0, \quad U_2 = E_2 - U_0, \quad U_3 = E_3 - U_0$$

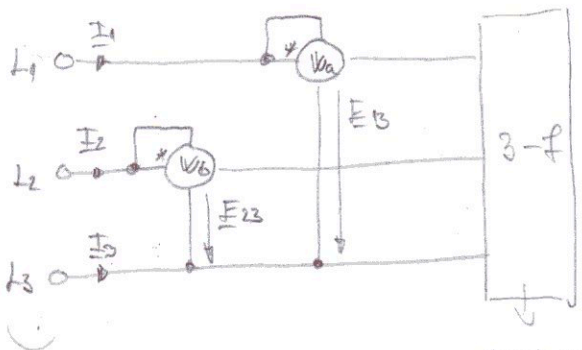
$$S = U \cdot I_1^* + U_2 I_2^* + U_3 I_3^*$$

$$= (E_1 - U_0) \cdot I_1^* + (E_2 - U_0) I_2^* + (E_3 - U_0) \cdot I_3^*$$

$U_0 = 0$

$$= E_1 I_1^* + E_2 I_2^* + E_3 I_3^*$$

- Merilec moči z 2 wattmetroma



$$S_a = E_{13} \cdot I_1^* = (E_1 - E_3) I_1^* = E_1 I_1^* - E_3 I_1^*$$

$$S_b = E_{23} I_2^* = (E_2 - E_3) I_2^* = E_2 I_2^* - E_3 I_3^*$$

$$S_a + S_b = E_1 I_1^* + E_2 I_2^* - E_3 (I_1^* + I_2^*)$$

$$= E_1 I_1^* + E_2 I_2^* + E_3 I_3^*$$

$I_1 + I_2 + I_3 = 0$

$-I_3 = I_1 + I_2$

W-metra → <u>vsota del moči!</u>

VASE 25.05.2012 – primer

3-ф ⇒ $\alpha = 120°$

$\underline{E}_{23} = 100\sqrt{3}\ V$

$\underline{Z}_1 = 10\ \Omega$

$\underline{Z}_2 = j5\ \Omega$

$\underline{Z}_3 = -j25\ \Omega$ } ⅄

$\underline{I}_1, \underline{I}_2, \underline{I}_3 = ?$

$\underline{E}_{31} = \underline{E}_{23} \cdot e^{-j120°} = \boxed{100\sqrt{3} \cdot e^{j120°}\ V}$

$\underline{E}_{12} = \underline{E}_{31} \cdot e^{-j120°} = \boxed{100\sqrt{3} \cdot e^{j120°}\ V}$

→ Δ

→ transformisemo u Δ

Enačbe transformacij

⅄ → Δ

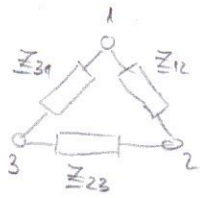
$\underline{Z} = \underline{Z}_1 + \underline{Z}_2 + \frac{\underline{Z}_1 \underline{Z}_2}{\underline{Z}_3}$

Δ → ⅄

$\underline{Z} = \frac{\underline{Z}_1 + \underline{Z}_2}{\underline{Z}_1 + \underline{Z}_2 + \underline{Z}_3}$

⅄ → Δ

$\underline{Z} = \underline{Z}_1 + \underline{Z}_2 + \frac{\underline{Z}_1 \underline{Z}_2}{\underline{Z}_3}$



$\underline{Z}_{12} = \underline{Z}_1 + \underline{Z}_2 + \frac{\underline{Z}_1 \underline{Z}_2}{\underline{Z}_3} = 10 + j5 - \frac{j50}{j25} = \boxed{8 + j5\ \Omega}$

$\underline{Z}_{23} = \underline{Z}_2 + \underline{Z}_3 + \frac{\underline{Z}_2 \underline{Z}_3}{\underline{Z}_1} = -j20 + \frac{125}{10} = \boxed{12{,}5 - j20\ \Omega}$

$\underline{Z}_{31} = \underline{Z}_3 + \underline{Z}_1 + \frac{\underline{Z}_3 \underline{Z}_1}{\underline{Z}_2} = 10 - j25 + \frac{-j250}{j5} = \boxed{40 - j25\ \Omega}$

$\underline{I}_{12} = \frac{\underline{E}_{12}}{\underline{Z}_{12}} = \frac{100\sqrt{3} \cdot e^{j120°}}{8 + j5} = \boxed{0{,}64 + j18{,}35\ A}$

$\underline{I}_{23} = \frac{\underline{E}_{23}}{\underline{Z}_{23}} = \frac{100\sqrt{3}}{12{,}5 - j20} = \boxed{3{,}89 + j6{,}23\ A}$

$\underline{I}_{31} = \frac{\underline{E}_{31}}{\underline{Z}_{31}} = \frac{100\sqrt{3} \cdot e^{-j120}}{40 - j25} = \boxed{3{,}24 - j1{,}72\ A}$

$\underline{I}_1, \underline{I}_2, \underline{I}_3$ ⇒ kirchoff

$\underline{I}_1 = \underline{I}_{12} - \underline{I}_{31} = \boxed{-2{,}5998 + j16{,}6249\ A}$

$\underline{I}_3 = \underline{I}_{31} - \underline{I}_{23} = \boxed{-0{,}6[illegible] + j4{,}5040\ A}$

$\underline{I}_2 = \underline{I}_{23} - \underline{I}_{12} = \boxed{3{,}2499 - j12{,}1209\ A}$ → $\Sigma = 0$ ✓

- primjer 2.

$\underline{E}_1 = 100 \cdot e^{-j60°}$ V

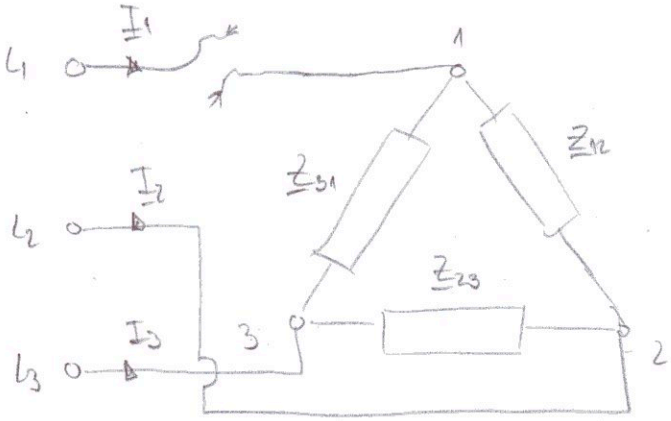
$\underline{Z}_{12} = -j5\,\Omega$

$\underline{Z}_{23} = 4 - j2\,\Omega$

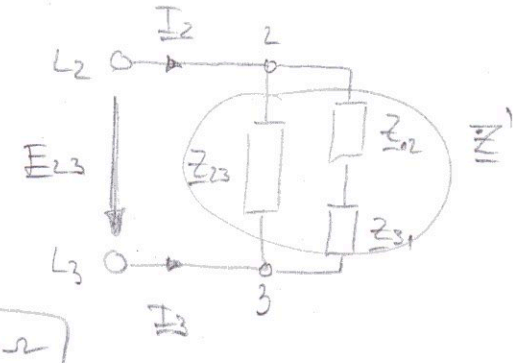
$\underline{Z}_{31} = 2 - j4\,\Omega$

primjer izvoda 1.

$\underline{I}_3$ po obvoni?



Po obvoni



$$\underline{Z}' = \frac{(\underline{Z}_{12}+\underline{Z}_{31})\cdot \underline{Z}_{23}}{\underline{Z}_{12}+\underline{Z}_{31}+\underline{Z}_{23}}$$

$$\underline{Z}' = \frac{(2-j9)\cdot(4-j2)}{6-j11} = \boxed{2{,}42 - j2{,}23\,\Omega}$$

$\underline{E}_1 \cdot e^{j120°}$

$$\underline{E}_{23} = E_2\sqrt{3}\cdot e^{j30°} = \boxed{100\sqrt{3}\cdot e^{j150°}\ \text{V}} \quad (+240)$$

$$\underline{I}_3 = -\underline{I}_2 = \frac{\underline{E}_{23}}{\underline{Z}'} = \boxed{-15{,}7 - 80{,}2\,\text{A}}$$

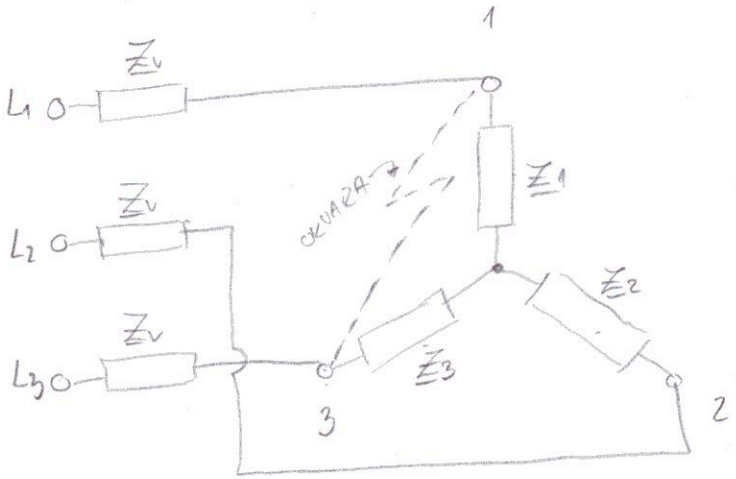
- nalogo 5.
- OKVARA

$\underline{E}_{12} = 100\sqrt{3} \cdot e^{j60°}\ V$

$\underline{Z}_1 = \underline{Z}_2 = \underline{Z}_3 = 8+j8\ \Omega$ (Δ)

$\underline{Z}_v = 2+j2\ \Omega$

$\underline{I}_1$, pred in po okvari!

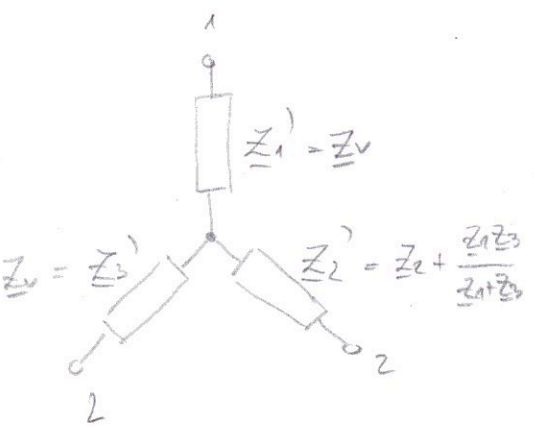


↓ Po okvari

Pred: 1

$\underline{E}_1 = \frac{\underline{E}_{12}}{\sqrt{3} \cdot e^{j30°}} = \boxed{100 \cdot e^{j30°}\ V}$

$\underline{I}_1 = \frac{\underline{E}_1}{\underline{Z}_{12}} = \frac{100 \cdot e^{j30°}}{10+j10} = \boxed{6,83 - j1,83\ A}$



Po okvari: 1

Premik nevtralne točke!

$\underline{U}_0 = \frac{\underline{E}_1 \underline{Y}_1 + \underline{E}_2 \underline{Y}_2 + \underline{E}_3 \underline{Y}_3}{\underline{Y}_1 + \underline{Y}_2 + \underline{Y}_3} = \frac{100 \cdot e^{j30°} \cdot \underline{Y}_1 + 100 \cdot e^{j90°} \cdot \underline{Y}_2 + 100 \cdot e^{j150°} \cdot \underline{Y}_3}{\underline{Y}_1 + \underline{Y}_2 + \underline{Y}_3}$

$\underline{U}_0 = \boxed{j40\ V}$

$\underline{Z}_2 = 8+j8 + \frac{(8+j8)(8+j8)}{16+j16} = \boxed{16+j16\ \Omega}$

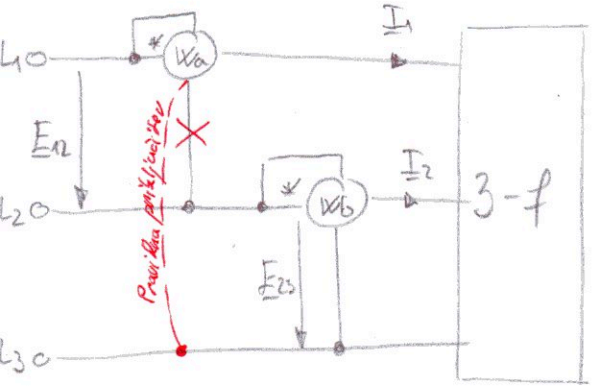
$\underline{E}_1 = \underline{E}_1' - \underline{U}_0$

$\underline{E}_1 = 100 \cdot e^{j30°} - 40 \cdot e^{j90°}$

$\underline{E}_1 = 87,18 \cdot e^{j6,59°}$

$\underline{I}_1 = \frac{\underline{E}_1}{\underline{Z}_1} = \frac{87,18 \cdot e^{j6,59°}}{2+j2} = \boxed{24,15 - j19,15\ A} = 30,82 \cdot e^{j38,41°}$

Moči - primer



$\underline{E}_1 = 100 \cdot e^{j60°}\ V$

$\underline{I}_1 = 2 - j3\ A$

$\underline{I}_2 = 3 + j4\ A$

$\underline{S}_a$, $\underline{S}_b$, moč bo rabila

napačno!

$\underline{E}_{12} = \underline{E}_1 \cdot \sqrt{3} \cdot e^{j30°} = \boxed{100\sqrt{3} \cdot e^{j30°}\ V}$ $\quad \underline{E}_{23} = \underline{E}_{12} \cdot e^{j120°} = 100\sqrt{3} \cdot e^{j210°}\ V$

$\underline{S}_a = \underline{E}_{12} \cdot \underline{I}_1^* = 100 \cdot \sqrt{3} \cdot e^{j30°} \cdot (2 + j3) = \boxed{559,81 + j\,276,8\ VA}$

P

$\underline{S}_b = \underline{E}_{23} \cdot \underline{I}_2^* = 100\sqrt{3} \cdot e^{j210°} \cdot (3 - j4)$

$= \boxed{-796,41 + j\,340,19\ VA}$

$W_b = \boxed{-796,41\ W}$

$\boxed{W_a = 559,81\ W}$

$P_{SISTEM} = W_a + W_b = \boxed{-236,6\ W}$

Pravilno!

W_b nam pravilno.

$\underline{S}_a = \underline{E}_{31} \cdot \underline{I}_1^*$

$\underline{E}_{31} = \underline{E}_{23} \cdot e^{j120°} = 100\sqrt{3} \cdot e^{j90°}$

$\underline{E}_{31} = -\underline{E}_{13} \Rightarrow \boxed{-100\sqrt{3} \cdot e^{j90°}\ V}$

$\underline{S}_a = -100\sqrt{3} \cdot e^{j90°} \cdot (2 + j3)$

$\underline{S}_a = \boxed{519,62 - j\,346,41\ VA}$

$P_{bat.} = \boxed{1079,42\ W}$