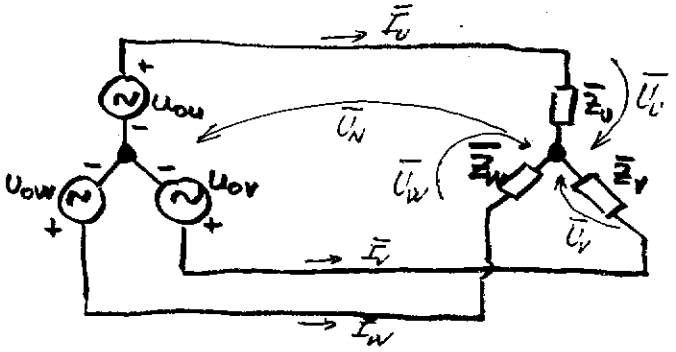
Trojfázové obvody

Př. 1. Stanovte proudy protékající fázemi souměrné 3f zátěže (zapojení Y) při napájení ze souměrného 3f zdroje Y. Dále stanovte výkon na zátěži



$\bar{U}_{0U} = 100\angle 0°\ V$

$\bar{U}_{0V} = 100\angle -120°\ V$

$\bar{U}_{0W} = 100\angle 120°\ V$

} fázory efektivních hodnot napětí (využito symbolicko-komplexní zobrazení)

a) $\bar{Z}_U = \bar{Z}_V = \bar{Z}_W = R = 50\,\Omega$

U souměrné soustavy $\bar{U}_N = 0 \Rightarrow \bar{U}_U = \bar{U}_{0U}$, $\bar{U}_V = \bar{U}_{0V}$, $\bar{U}_W = \bar{U}_{0W}$

$$\bar{I}_U = \frac{\bar{U}_U}{R} = \frac{100\angle 0°}{50} = \underline{\underline{2\angle 0°\ A}}$$

$$\bar{I}_V = \frac{\bar{U}_V}{R} = \frac{100\angle -120°}{50} = \underline{\underline{2\angle -120°\ A}}$$

$$\bar{I}_W = \frac{\bar{U}_W}{R} = \frac{100\angle 120°}{50} = \underline{\underline{2\angle 120°\ A}}$$

Proudy tvoří souměrnou soustavu

Platí 1. Kirchhoffův zákon: $\bar{I}_U + \bar{I}_V + \bar{I}_W = 2\angle 0° + 2\angle -120° + 2\angle 120° =$

$$= 2 + 2\left(-\tfrac{1}{2} - \tfrac{\sqrt{3}}{2}j\right) + 2\left(-\tfrac{1}{2} + \tfrac{\sqrt{3}}{2}j\right) = \underline{\underline{0}}$$

$\bar{S}_U = \bar{U}_U \cdot \bar{I}_U^* = 100 \cdot 2 = 200$ [W, VAr]

$\bar{S}_V = \bar{U}_V \cdot \bar{I}_V^* = 100\angle -120° \cdot 2\angle 120° = 200$ [W, VAr]

$\bar{S}_W = \bar{U}_W \cdot \bar{I}_W^* = 100\angle 120° \cdot 2\angle -120° = 200$ [W, VAr]

$\bar{S} = \bar{S}_U + \bar{S}_V + \bar{S}_W = 200 + 200 + 200 = 600 = P + jQ \Rightarrow$ $\underline{\underline{P = 600\ W}}$, $\underline{\underline{Q = 0\ VAr}}$

nebo

$P = 3UI\cos\varphi = 3 \cdot 100 \cdot 2 \cdot \cos 0° = \underline{\underline{600\ W}}$

$Q = 3UI\sin\varphi = 3 \cdot 100 \cdot 2 \cdot \sin 0° = \underline{\underline{0\ VAr}}$

$\varphi = \varphi_U = \varphi_V = \varphi_W = 0°$

$\varphi_U = \varphi_{U_U} - \varphi_{I_U} = 0° - 0° = 0°$

$\varphi_V = \varphi_{U_V} - \varphi_{I_V} = -120° - (-120°) = 0°$

$\varphi_W = \varphi_{U_W} - \varphi_{I_W} = 120° - 120° = 0°$

$\Rightarrow R = 20\,\Omega$

$X_L = 20\,\Omega$

$(\bar{Z} = R + jX_L)$

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b) $\bar{Z}_U = \bar{Z}_V = \bar{Z}_W = \bar{Z} = 20 + 20j\ \Omega = 20\sqrt{2}\angle 45°\ \Omega$

$$\bar{I}_U = \frac{\bar{U}_U}{\bar{Z}} = \frac{100\angle 0°}{20\sqrt{2}\angle 45°} = \frac{5}{\sqrt{2}}\angle -45° \doteq \underline{\underline{3{,}54\angle -45°\ A}}$$

$$\bar{I}_V = \frac{\bar{U}_V}{\bar{Z}} = \frac{100\angle -120°}{20\sqrt{2}\angle 45°} = \frac{5}{\sqrt{2}}\angle -165° \doteq \underline{\underline{3{,}54\angle -165°\ A}}$$

$$\bar{I}_W = \frac{\bar{U}_W}{\bar{Z}} = \frac{100\angle 120°}{20\sqrt{2}\angle 45°} = \frac{5}{\sqrt{2}}\angle 75° \doteq \underline{\underline{3{,}54\angle 75°\ A}}$$