

$$\begin{aligned}
 Z_1 &= 1 \Omega \\
 Z_2 &= 2 \Omega \\
 Z_3 &= 3 \Omega \\
 Z_4 &= 4 \Omega
 \end{aligned}$$

$$\begin{aligned}
 \underline{U} &= U \cdot e^{j\varphi_u} \\
 \underline{I} &= I \cdot e^{j\varphi_i} \\
 \underline{Z} &= Z \cdot e^{j\varphi}
 \end{aligned}$$

$$\underline{I} = 5 \cdot e^{j\frac{\pi}{4}} \rightarrow \varphi_i = \frac{\pi}{4}$$

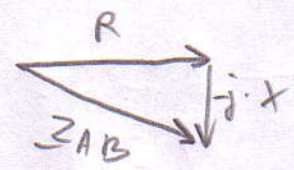
$$\begin{aligned}
 Y_3 &= \frac{1}{Z_3} = \frac{1}{-j \cdot 3} = j \cdot \frac{1}{3} \\
 Y_4 &= \frac{1}{Z_4} = \frac{1}{4}
 \end{aligned}$$

$$\begin{aligned}
 Y_{34} &= Y_3 + Y_4 = j \cdot \frac{1}{3} + \frac{1}{4} \\
 Z_{34} &= \frac{1}{Y_{34}} = \frac{1}{\frac{1}{4} + j \cdot \frac{1}{3}} = \frac{1}{\frac{1}{4} + j \cdot \frac{1}{3}} \cdot \frac{\frac{1}{4} - j \cdot \frac{1}{3}}{\frac{1}{4} - j \cdot \frac{1}{3}} = \frac{\frac{1}{4} - j \cdot \frac{1}{3}}{\frac{1}{16} + \frac{1}{9}} \\
 &= \frac{\frac{1}{4} - j \cdot \frac{1}{3}}{\frac{9}{16 \cdot 9} + \frac{16}{16 \cdot 9}} = \frac{\frac{1}{4} - j \cdot \frac{1}{3}}{\frac{25}{144}} = \frac{144}{25} \cdot \left( \frac{1}{4} - j \cdot \frac{1}{3} \right) \\
 &= \frac{144}{100} - j \frac{144}{75}
 \end{aligned}$$

$$Z_{AB} = Z_1 + Z_2 + Z_{34} = j + 2 + \frac{144}{100} - j \cdot \frac{144}{75} = \frac{346}{100} - j \cdot \frac{71}{75}$$

$$Z_{AB} \approx 3,46 - j \cdot 0,95$$

$$|Z_{AB}| = \sqrt{3,46^2 + 0,95^2} \approx 3,6 \text{ [}\Omega\text{]}$$



$$\varphi = \arctan \frac{X}{R} = \arctan \frac{0,95}{3,46} \approx 0,27 \text{ [rad]}$$

$$\underline{Z}_{AB} = 3,6 \cdot e^{-j0,27}$$

$$\underline{U} = \underline{Z} \cdot \underline{I} \rightarrow \underline{U}_{AB} = \underline{Z}_{AB} \underline{I} = 3,6 \cdot e^{-j0,27} \cdot 5 \cdot e^{j\frac{\pi}{4}} = 18 \cdot e^{j0,52}$$

$$\underline{S} = \underline{U} \cdot \underline{I}^* = 18 \cdot e^{j0,52} \cdot 5 \cdot e^{-j\frac{\pi}{4}}$$

$$\underline{I} = 5 \cdot e^{j\frac{\pi}{4}} = 5 \cdot \left( \cos \frac{\pi}{4} + j \sin \frac{\pi}{4} \right)$$

$$\underline{S} = 90 \cdot e^{j0,27} \rightarrow \underline{S} = S \cdot e^{j\varphi}$$

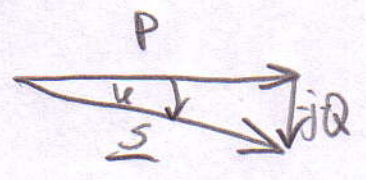
$$\underline{I}^* = 5 \cdot \left( \cos \frac{\pi}{4} - j \sin \frac{\pi}{4} \right)$$

$$\underline{S} = 90 \cdot \cos 0,27 - j \cdot 90 \cdot \sin 0,27$$

$$\underline{I}^* = 5 \cdot e^{-j\frac{\pi}{4}}$$

$$P = \text{Re } \underline{S} = 90 \cdot \cos 0,27 = 86,7 \text{ [W]}$$

$$Q = \text{Im } \underline{S} = 90 \cdot \sin 0,27 = -24 \text{ [var]}$$



$$\underline{S}^2 = P^2 + Q^2$$