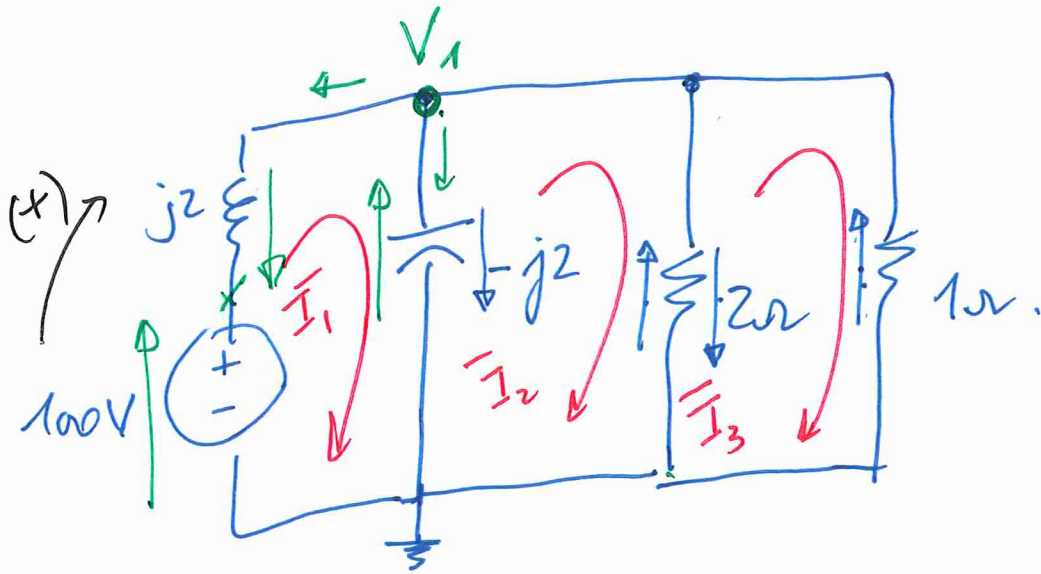


1

01/22/24.



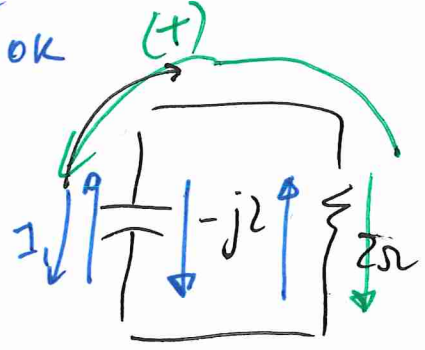
loop equations ✓

$$-(-j2)\bar{I}_1 + (-j2)\bar{I}_2$$

$$\left\{ \begin{aligned} 100 - j2\bar{I}_1 + j2(\bar{I}_1 - \bar{I}_2) &= 0 \quad \checkmark \text{ ok} \end{aligned} \right.$$

$$-j2(\bar{I}_2 - \bar{I}_1) + 2(\bar{I}_2 - \bar{I}_3) = 0 \quad \checkmark \text{ ok}$$

$$2(\bar{I}_3 - \bar{I}_2) + \bar{I}_3 = 0 \quad \checkmark \text{ ok.}$$



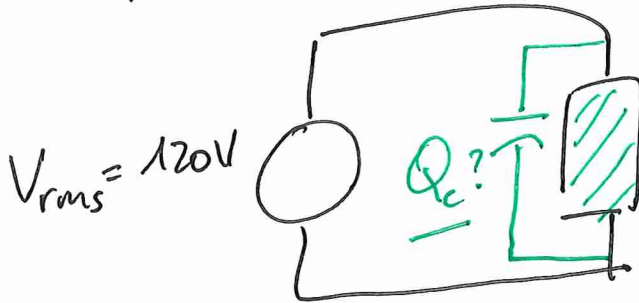
Node equations:

$$\frac{V_1 - 0}{-j2} + \frac{V_1 - 100}{j2} = 0 \Rightarrow \frac{V_1}{2} + \frac{V_1}{1} = 0$$

✓ ok.

2

Example:



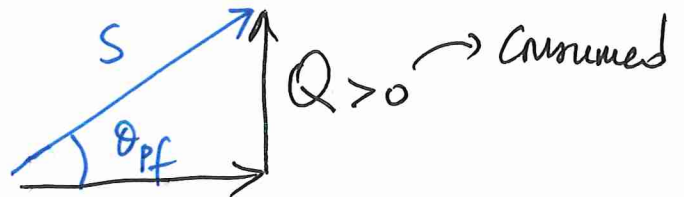
8kW at pf = 0.8 lagging.

power factor correction pf = 0.9 lagging.

Reactive  $Q_c?$

Solution:

$$\cos(\theta_{pf}) = 0.8 \checkmark$$

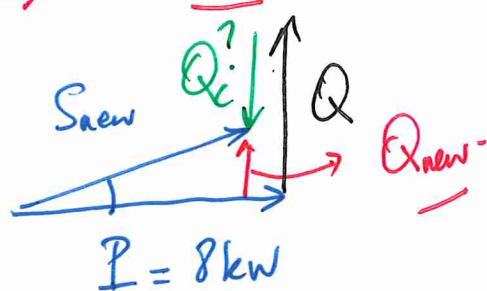


$$Q_{old} = P \tan(\cos^{-1}(0.8))$$

$$= 8kW \tan(\cos^{-1}(0.8)) = 6kVAR.$$

$$\cos \theta_{pf_{new}} = 0.9$$

$$\cos \theta_{pf_{new}} = \frac{P}{S_{new}} = \frac{8kW}{S_{new}} = 0.9$$



$$S_{new} = \frac{8kW}{0.9} = \frac{8000}{0.9} = 8888 \text{ kVA} \checkmark \text{ ok.}$$

$$Q_{\text{new}} = \sqrt{S_{\text{new}}^2 - I^2} = 3872 \text{ VAR.}$$

(3)

$$Q_c? \quad Q_{\text{old}} + Q_c = Q_{\text{new}}$$

$$Q_c = Q_{\text{new}} - Q_{\text{old}}$$

$$= 3872 \text{ VAR} - 6000 \text{ VAR.}$$

$$Q_c = -2128 \text{ VAR}$$

↳ supplied reactive power.

$$\cancel{Q_c} = \frac{-j}{\omega C} \cancel{X}$$

$$X_c = \frac{1}{\omega C}$$

$$Q = X |I|^2 = \frac{|V|^2}{X}$$

$$Q_c = \frac{|V|^2}{X_c} = \frac{|V|^2}{\left(\frac{1}{\omega C}\right)} = \omega C |V|^2$$

$$C = \left( \frac{|V|^2 \omega}{Q_c} \right)^{-1} = \frac{Q_c}{|V|^2 \omega} = \frac{2128}{(120)^2 2\pi \cdot 60}$$

$$C = 392 \mu\text{F} \quad \checkmark \text{ ok.}$$

④.

Root Mean Square.

$f_{RMS}$  of  $f(t)$

$$f_{RMS} = \sqrt{\frac{1}{T} \int_0^T f^2(t) dt}$$

↪ period of the  
function

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