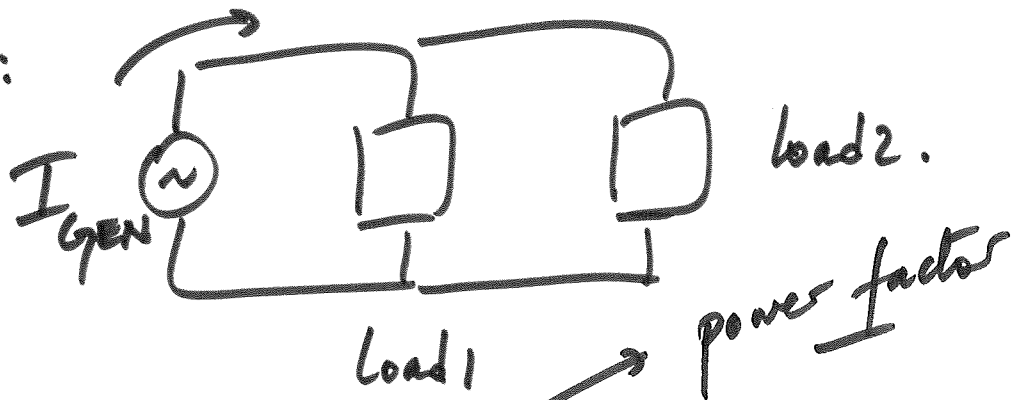


01/19/24

(1)

$$P = V_{rms} I_{rms} \cos(\theta_V - \theta_I).$$
$$Q = V_{rms} I_{rms} \sin(\theta_V - \theta_I).$$

Example:



load 1: $P_1 = 8 \text{ kW}$, $\text{pf} = 0.8$ leading.

load 2: $|\bar{S}_2| = 20 \text{ kVA}$, $\text{pf} = \underline{0.6}$ lagging.

$$V_{rms} = 120 \text{ V (AC)}$$

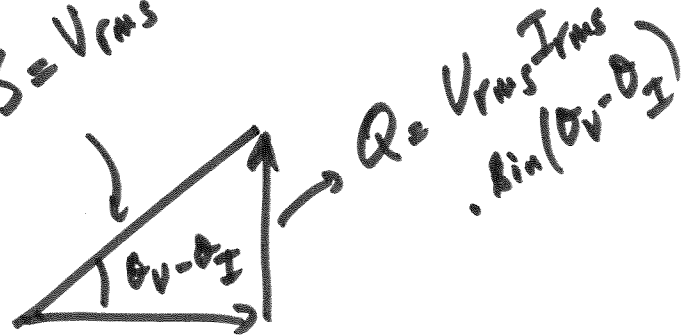
Q: Calculate I_{GEN}

Review:

$$S = P + jQ$$

$$S = V_{rms} \cdot I_{rms} \quad (2)$$

$Q > 0$, $\theta_V - \theta_I > 0$
current is lagging
the voltage.



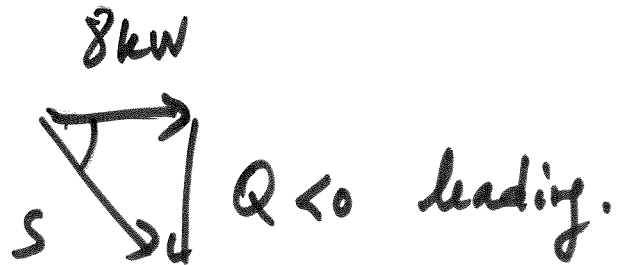
$$P = V_{rms} I_{rms} \cos(\theta_V - \theta_I)$$

$$\text{Pf} = \cos(\theta_V - \theta_I)$$

$Q < 0$, $\theta_V - \theta_I < 0 \Rightarrow$ current is leading
the voltage.

Solution 1:

Load 1



$$\cos^{-1}(0.8) = -36.87^\circ$$

$$S_1 = \frac{8 \text{ kW}}{0.8} = 10 \text{ kVA}$$

$$Q_1 = -\sqrt{S_1^2 - P_1^2} = -6 \text{ kVAR.}$$

(3)

Load 2: $\cos^{-1}(0.6) = \underline{53.13^\circ}$

$$P_2 = S_2 \cos(53.13^\circ)$$

$$= (20 \text{ kVA}) 0.6 = \underline{12 \text{ kW}}$$

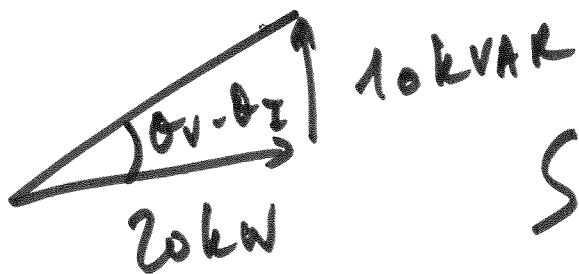
$$Q_2 = \sqrt{S_2^2 - P_2^2} = 16 \text{ kVAR}$$

The total: $\frac{P_T}{T} = P_1 + P_2 = 8 \text{ kW} + 12 \text{ kW}$

$$= 20 \text{ kW}$$

$$Q_T = Q_1 + Q_2 = -6 \text{ kVAR} + 16 \text{ kVAR}$$

$$= 10 \text{ kVAR}$$



$$S_{\text{total}} = V_{\text{GEN}} \bar{I}_{\text{GEN}}^*$$

$$\bar{I}_{\text{GEN}} = \left(\frac{S_{\text{total}}}{V_{\text{GEN}}} \right)^* = \left(\frac{22.36 \text{ kVA} \angle 26.56^\circ}{120 \angle 0^\circ} \right)^*$$

$$= \underline{186.3 \angle -26.56^\circ \text{ A}}$$