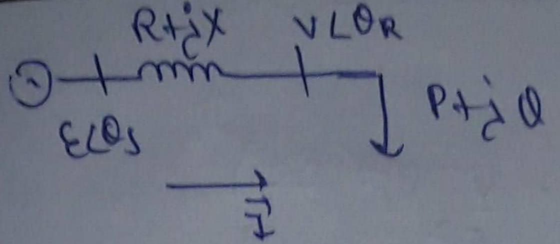


Abhishek Saini
abhisheksaini.eed@gmail
Mtech Power system

$$\vec{I} = \frac{\vec{E} - \vec{V}}{R + jX} = \frac{E\angle\theta_s - V\angle\theta_R}{R + jX}$$

$$\vec{I} = \frac{E\angle\theta_s - V\angle\theta_R}{|Z|\angle\theta_I} \qquad \theta_I = \tan^{-1}\left(\frac{X}{R}\right)$$

$$\vec{I} = \frac{E}{Z}\angle\theta_s - \theta_I - \frac{V}{Z}\angle\theta_R - \theta_I$$

$$\vec{S}_R = \vec{V}(\vec{I})^*$$

$$= V\angle\theta_R\left[\frac{E}{Z}\angle\theta_s - \theta_I - \frac{V}{Z}\angle\theta_R - \theta_I\right]^*$$

$$= V\angle\theta_R\left[\frac{E}{Z}\angle\theta_I - \theta_s - \frac{V}{Z}\angle\theta_I - \theta_R\right]$$

$$\vec{S}_R = \frac{EV}{Z}\angle\theta_R + \theta_I - \theta_s - \frac{V^2}{Z}\angle\theta_I$$

$$P_R = \frac{EV}{Z}\cos\angle\theta_R + \theta_I - \theta_s - \frac{V^2}{Z}\cos(\theta_I)$$

$$P_R = \frac{EV}{Z}\cos(\theta_I - \delta) - \frac{V^2}{Z}\cos(\theta_I)$$

$$Q_R = \frac{EV}{Z}\sin(\theta_I - \delta) - \frac{V^2}{Z}\sin(\theta_I)$$

Ideas, Questions & Summary:

$$v = \frac{V}{E}, \quad p = \frac{P \cdot z}{E^2}$$

$$q = \frac{Q z}{E^2}$$

$$\frac{P_R \cdot z}{E^2} = \frac{EV}{E^2} \cos(\theta_z - \delta) - \frac{V^2}{E^2} \cos(\theta_z)$$

$$p = v\cos(\theta_z - \delta) - v^2 \cos(\theta_z) \quad — (1)$$

$$\frac{Q_R \cdot z}{E^2} = \frac{EV}{E^2} \sin(\theta_z - \delta) - \frac{V^2}{E^2} \sin(\theta_z)$$

$$q = v \sin(\theta_z - \delta) - v^2 \sin(\theta_z) \quad — (2)$$

from (1) & (2)

$$\cos(\theta_z - \delta) = \frac{p}{v} + \frac{v^2 \cos(\theta_z)}{v}$$

$$\cos(\theta_z - \delta) = p/v + v\cos(\theta_z)$$

$$\sin(\theta_z - \delta) = q/v + v\sin(\theta_z)$$

squaring eq$^n$ (1) & (2)

$$p^2 = v^2 \cos^2(\theta_z - \delta) + v^4 \cos^2(\theta_z) - 2v^3 \cos(\theta_z) \cos(\theta_z - \delta)$$

$$q^2 = v^2 \sin^2(\theta_z - \delta) + v^4 \sin^2(\theta_z) - 2v^3 \sin(\theta_z) \sin(\theta_z - \delta)$$

$$p^2 + q^2 = v^2 + v^4 - 2v^3 [\cos(\theta_z)\cos(\theta_z - \delta) + \sin(\theta_z)\sin(\theta_z - \delta)] \quad — (3)$$

| Unit No. | Lecture No. | Faculty | Subject Name | Subject Code | Main Topics:- |
| --- | --- | --- | --- | --- | --- |
| | | | | | |

$$p^2+q^2 = v^2+v^4-2v^3[\cos(\theta_I-(\theta_I-\delta))]$$

$$p^2+q^2 = v^2+v^4-2v^3\cos\delta$$

$$v^4+v^2-2\cos\delta\, v^3-(p^2+q^2)=0$$

target eqn

from eqn (3)

$$p^2+q^2 = v^4+v^2-2v^3\left[\cos(\theta_I)\cos(\theta_I-\delta) + \sin(\theta_I)\sin(\theta_I-\delta)\right]$$

putting values of

$\cos(\theta_I-\delta)$ & $\sin(\theta_I-\delta)$

take

$$\frac{q}{p}=K$$

$$p^2+q^2 = v^4+v^2-2v^3\left[\cos(\theta_I)\left[\frac{p}{v}+v\cos\theta_I\right] + \sin(\theta_I)\left[\frac{q}{v}+v\sin(\theta_I)\right]\right]$$

$$p^2+q^2 = v^4+v^2-2v^3\left[\frac{p}{v}\cos\theta_I + v\cos^2(\theta_I) + \frac{q}{v}\sin(\theta_I) + v\sin^2(\theta_I)\right]$$

$$p^2+q^2 = v^4+v^2-2v^3\left[\cos(\theta_I)\cos(\theta_I-\delta) + \sin(\theta_I)\sin(\theta_I-\delta)\right]$$

$$p^2+q^2 = v^4+v^2-2v^3\left[\cos(\theta_I)\left[\frac{p}{v}+v\cos(\theta_I)\right] + \sin(\theta_I)\left[\frac{q}{v}+v\sin(\theta_I)\right]\right]$$

$q = kp$

$$p^2+q^2 = v^4+v^2-2v^3\left[\frac{p}{v}\cos\theta_I + v\cos^2(\theta_I) + \frac{q}{v}\sin(\theta_I) + v\sin^2(\theta_I)\right]$$

$$p^2+q^2 = v^4+v^2-2v^3\left[\frac{p}{v}\cos\theta_I + \frac{q}{v}\sin(\theta_I) + v\right]$$

$$p^2+q^2 = v^4+v^2-2v^3\left[\frac{p\cos\theta_I + q\sin(\theta_I) + v^2}{v}\right]$$

$$p^2+q^2 = v^4+v^2-2v^2\left[v^2 + p\cos\theta_I + q\sin\theta_I\right]$$

$$p^2+q^2 = v^4+v^2-2v^4-2v^2\left[p\cos\theta_I + kp\sin\theta_I\right]$$

$$p^2+q^2 = -v^4+v^2-2v^2p\left[\cos\theta_I + k\sin\theta_I\right]$$

$$p^2+q^2 = -v^4+v^2\left(1-2p\left[\cos\theta_I + k\sin\theta_I\right]\right)$$

$$V = \sqrt{\frac{-(1-2p(\cos\theta_z + k\sin\theta_z)) \pm \sqrt{(k')^2 - 4(1+k^2)p^2}}{2}}$$

$$k' = 1-2p(\cos\theta_z + k\sin\theta_z)$$

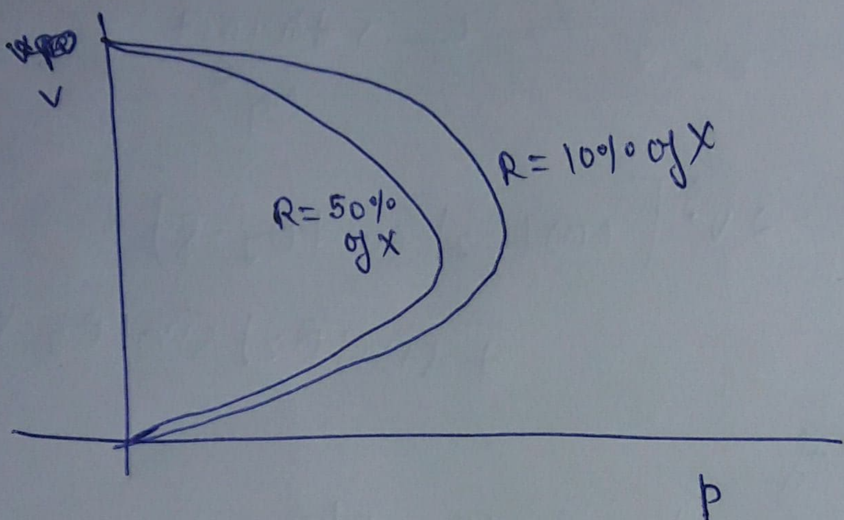


Figure 1
File Edit View Insert Tools Desktop Window Help
voltage at bus 2
active power
R=0.5
R=0.1
R=0
0
0.05
0.1
0.15
0.2
0.25
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Type here to search
31°C
ENG
16:22
20-09-2021