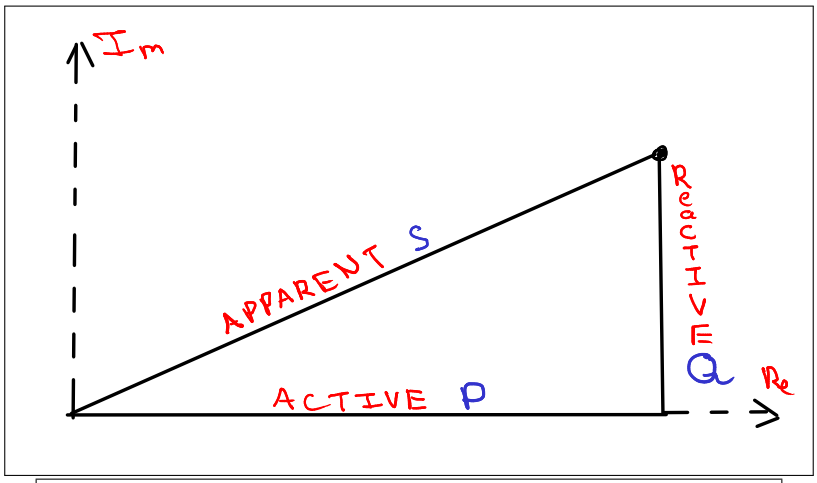
Formula Sheet EE2E11

MaybE_Tree

2022-09-07

1 Power



Name	Type	Symbol	Unit
Complex Power	Complex Value	S	VA
Active Power	$\mathrm{Re}(S)$	P	W
Reactive Power	$\mathrm{Im}(S)$	Q	VAr
Apparent Power	$\lvert S\rvert$	$\lvert S\rvert$	VA

1.1 Factors

$$\text{Power Factor} \quad \frac{\text{Active Power}}{\text{Apparent Power}} = \text{Distortion Factor} * \text{Displacement Factor}$$

$$\text{Distortion Factor} \quad \frac{\text{RMS of fundamental}}{\text{RMS of total}} = 1 \quad \text{(when no harmonics)}$$

$$\text{Displacement Factor} \quad \cos\phi, \text{ where } \phi \text{ is phase difference between voltage and current}$$

2 Three-phase

Property	**Y**	**Δ**
Voltage	$V_{LL} = \sqrt{3}V_\phi$	$V_{LL} = V_\phi$
Current	$I_L = I_\phi$	$I_L = \sqrt{3}I_\phi$
Phase	V_{ab} leads V_a by 30°	I_a lags I_{ab} by 30°
Active Power	$P = \sqrt{3}V_{LL}I_L \cos\phi$	
Reactive Power	$Q = \sqrt{3}V_{LL}I_L \sin\phi$	
Apparent Power	$\lvert S\rvert = \sqrt{3}V_\phi I_\phi$	

- All powers are given as total power ($3 *$ Power of single load/coil)
- V_ϕ is voltage across one coil.
- I_ϕ is current through one coil.
- ϕ is phase difference between voltage and current (conventionally, voltage has 0 phase offset).

3 AC Machines

Synchronous Speed	$n_s = \dfrac{120f}{P} = \dfrac{60f}{p}$	P is poles, $p = {}^{P}/_{2}$ is pole pairs.
Rotor Speed	$n_r = (1-s)n_s$	$0 \leq s \leq 1$ is slip.
Rotor Current Frequency	$f_r = sf_s$	

Parama's equation $P = \dfrac{V}{I}$ *V is voltage, I is current, P is power.*