2018-08-27-1

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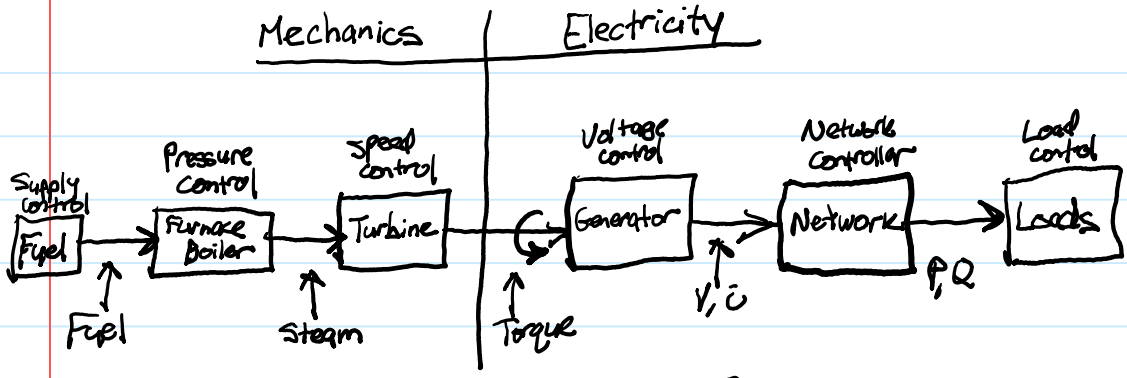
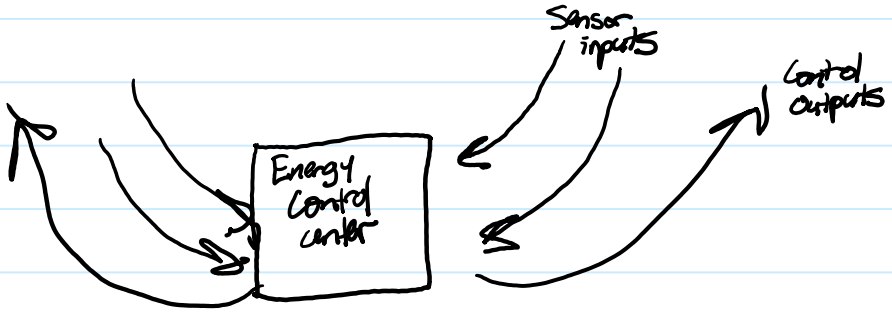




* Uses SCADA

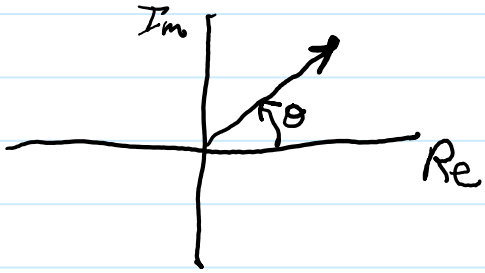
Supervisory
Control
And
Data
Acquisition

Review of phasors

$v(t) = V_m \cos(\omega t + \theta_v)$

$i(t) = I_m \cos(\omega t + \theta_i)$

$\omega = 2\pi f$



$z = x + jy$

$r = \sqrt{x^2 + y^2}$ $\quad \theta = \tan^{-1}\left(\frac{y}{x}\right)$

$z = r(\cos\theta + j\sin\theta)$

$e^{j\theta} = \cos\theta + j\sin\theta$

$z = re^{j\theta}$

Ex] point in the complex plane

$p = A\cos(\omega t + \theta)$

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$r = A$

$\theta' = \omega t + \theta$

Can't simply write $P = Ae^{j\theta'}$

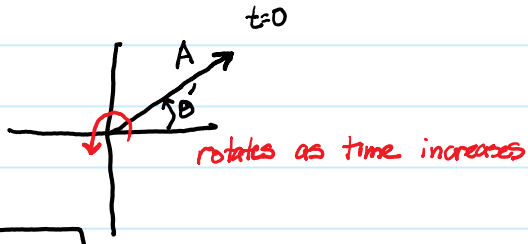
* Extra sine term would be introduced

$P = Re\{Ae^{j\theta'}\}$

$Ae^{j(\omega t+\theta)}$

$Ae^{j\omega t}e^{j\theta}$

$(Ae^{j\theta})e^{j\omega t}$



Phasor Notation

$A\cos(\omega t+\theta_v) \Rightarrow A\angle\theta_v$

* Note: Must be given as a cosine

$*\sin(A) = \cos(A-90^\circ)*$

$v(t) = V_m\cos(\omega t+\theta_v)$

$i(t) = I_m\cos(\omega t+\theta_i)$

* Don't write as peak values!! Instead use RMS:

$\bar{V} = V_{RMS}\angle\theta_v$

$\bar{I} = I_{rms}\angle\theta_i$

$$V_{RMS} = \sqrt{\frac{1}{T}\int_0^T v^2(t)dt} = \sqrt{\frac{1}{T}\int_0^T V_m^2\cos^2(\omega t+\theta_v)dt}$$

$$\cos^2 A = \frac{1+\cos(2A)}{2}$$

$$\Rightarrow \boxed{V_{RMS} = \frac{V_m}{\sqrt{2}}}$$

$$\boxed{I_{RMS} = \frac{I_m}{\sqrt{2}}}$$

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Ex 1

$$v(t) = \sqrt{2}(10)\cos(\omega t + 30^\circ)$$
$$i(t) = \sqrt{2}(5)\cos(\omega t - 20^\circ)$$

$$V_{RMS} = \frac{V_m}{\sqrt{2}} = \frac{\sqrt{2}(10)}{\sqrt{2}} = V_{RMS} = 10 \qquad \theta_v = 30^\circ$$

$$I_{RMS} = \frac{I_m}{\sqrt{2}} = \frac{\sqrt{2}(5)}{\sqrt{2}} = I_{RMS} = 5\,A \qquad \theta_i = -20^\circ$$

$$\bar{V} = 10\angle 30^\circ \; V$$
$$\bar{I} = 5\angle -20^\circ \; A$$