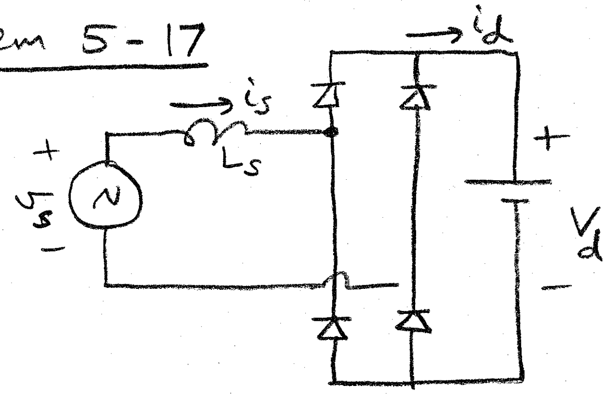
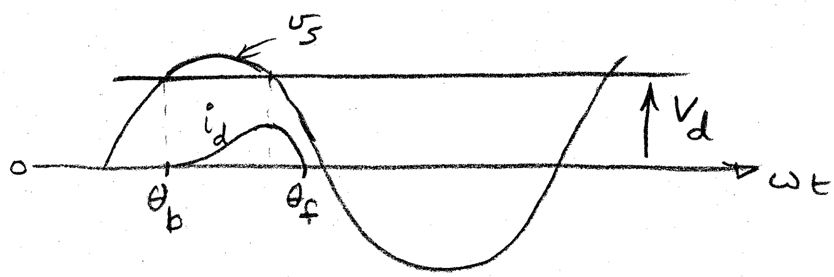
Problem 5-17





$$\theta_b < \theta < \theta_f$$

$$i_d(\theta) = \frac{1}{\omega L_s} \int_{\theta_b}^{\theta} \left[\sqrt{2}\, V_s \sin \omega t \cdot d(\omega t) - V_d\right] \cdot d(\omega t)$$

$$= \sqrt{2}\left(\frac{V_s}{\omega L_s}\right) \int_{\theta_b}^{\theta} \sin \omega t \cdot d(\omega t) - \frac{V_d}{V_s} \cdot \left(\frac{V_s}{\omega L_s}\right)(\theta - \theta_b)$$

$$\therefore \quad \frac{i_d(\theta)}{I_{\text{short circuit}}} = \sqrt{2}\left(\cos\theta_b - \cos\theta\right) - \frac{V_d}{V_s}(\theta - \theta_b)$$

where, $I_{\text{short circuit}} = \frac{V_s}{\omega L_s}$.

For a specific value of $\left(\frac{V_d}{V_s}\right)$, the following can be uniquely calculated:

θ_b, θ_f, and from the above equation

$\frac{i_d(\theta)}{I_{\text{short circuit}}}$ for $\theta_b < \theta < \theta_f$. Since $I_d = \left[\int_{\theta_b}^{\theta_f} i_d(\theta) \cdot d\theta\right] / \pi$,

$\frac{I_d}{I_{\text{short circuit}}}$ can also be uniquely calculated.

Since $i_d(\theta)$ is specified, PF, DPF, THD and CF can be uniquely obtained.