

Problem 5-24

(a) Volt-radian Area $A_u = \omega L_s I_d$

Assume $\frac{d V_{comm}}{d(\omega t)} \approx \sqrt{2} V_{LL}$

or $V_{comm} = (\sqrt{2} V_{LL}) \omega t$

$$A_u = \omega L_s I_d = \int_0^u \frac{V_{comm}}{2} \cdot d(\omega t)$$

$$= \frac{\sqrt{2} V_{LL}}{2} \int_0^u \omega t \cdot d(\omega t)$$

$$= \frac{\sqrt{2} V_{LL}}{2 \times 2} (\omega t)^2 \Big|_0^u = \frac{V_{LL}}{2\sqrt{2}} u^2$$

$$\therefore u = \left(\frac{2\sqrt{2} \omega L_s I_d}{V_{LL}} \right)^{1/2}$$

(b) Substituting values, $u = 18.35^\circ$