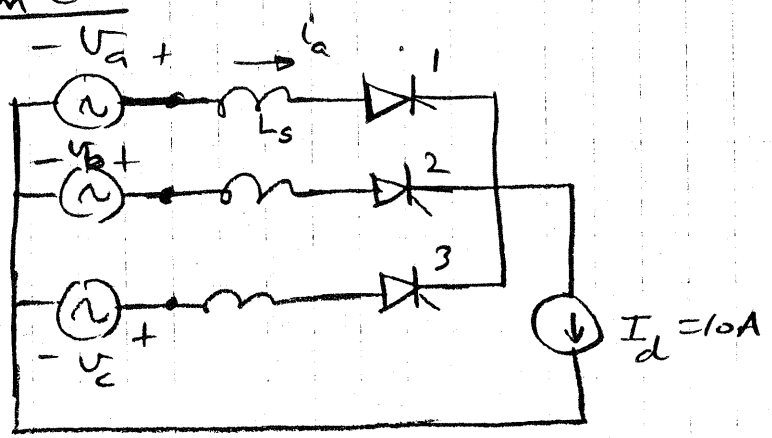
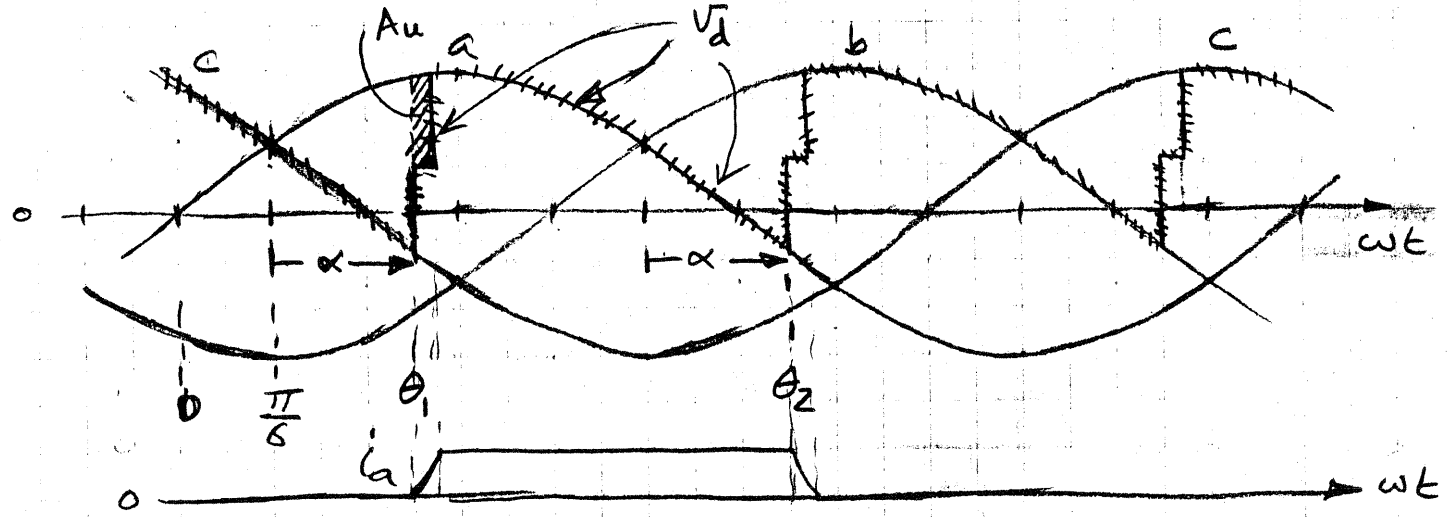
Problem 6-2





Procedure:

$$V_{d\alpha} = \left[\sqrt{2}\, V_s \int_{\theta_1}^{\theta_2} \sin\omega t \cdot d(\omega t)\right] \Big/ \left(\frac{2\pi}{3}\right) \quad (L_s = 0)$$

($\frac{2\pi}{3}$ ↑ 120°)

where $\theta_1 = (30^\circ + \alpha^\circ) \cdot \frac{\pi}{180}$ rad

and $\theta_2 = \theta_1 + \left(\frac{2\pi}{3}\right)$ rad

($\frac{2\pi}{3}$ ← 120°)

$A_u = \omega L_s \times [\text{Change in } i_a \text{ during commutation}] = \omega L_s I_d$

$$\therefore \quad V_d = V_{d\alpha} - \frac{A_u}{\frac{2\pi}{3}}$$

where

$$V_{d\alpha} = \frac{\sqrt{2}\,V_s}{\left(\frac{2\pi}{3}\right)} \left[\cos\theta_1 - \cos\theta_2\right]$$

from the 1st equation.

To calculate the procedure leading up to Eq. 6-62 in the text applies here as well. Therefore,

$$\cos(\alpha+u) = \cos\alpha - \frac{2\omega L_s}{\sqrt{2}\,V_{LL}}\, I_d$$

where V_{LL} = rms value of the line-line voltage

$$= \sqrt{3} \times V_{phase}(rms)$$

Substituting value

(a) at $\alpha = 45^\circ$, $u = 9.63^\circ$, $V_d = 99.24\ V$

(b) at $\alpha = 135^\circ$, $u = 11.65^\circ$, $V_d = -99.24\ V$