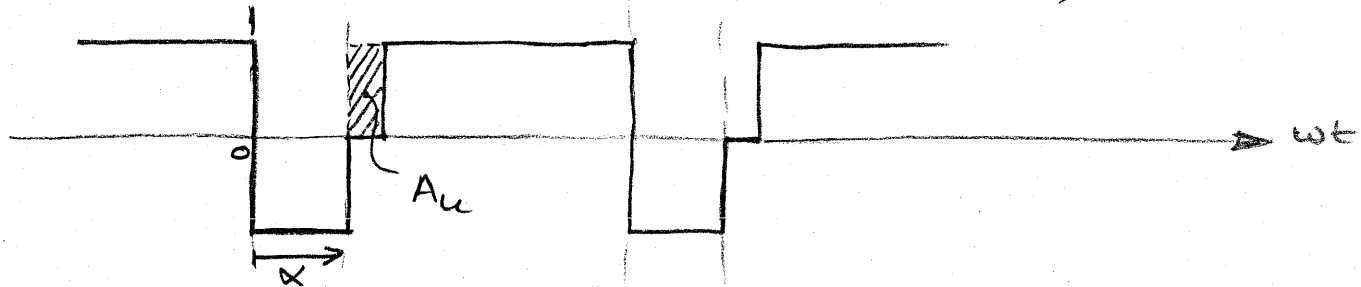
Problem 6-4

at $\alpha = 135°$, $V_{d\alpha} = -100\,V$

(a) In the above circuit in the presence of L_s,



$$A_u = \omega L_s [\, I_d - (-I_d)] = 2\omega L_s I_d$$

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

($V_{d\alpha}$ in Problem 6-3)

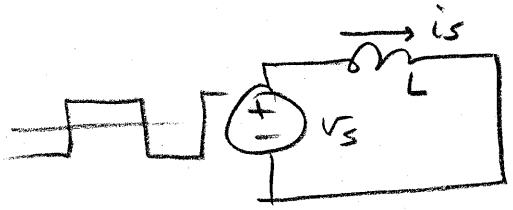
u is independent of α here because the commutation voltage is the same, independent of α.

$\therefore$

$$V_d = V_{ampl}\left(1 - \frac{2\alpha}{\pi}\right) - \frac{2\omega L_s}{\pi} I_d \cdot$$

(α in radians)

To calculate u:



Circuit during the commutation interval. $v_s = V_{ampl.}$

$$L_s \frac{di_s}{dt} = v_s$$

$$\therefore V_{ampl.} \int_{\alpha}^{\alpha+u} d(\omega t) = \omega L_s \int_{-I_d}^{I_d} di_s$$

$$\therefore V_{ampl}\left[(\alpha+u) - \alpha\right] = 2\omega L_s I_d$$

or $$u = \frac{2\omega L_s I_d}{V_{ampl.}}$$

(b)

Substituting values

$\alpha = 45^\circ$, $V_d = 92.8\,V$, $u = 6.48^\circ$

$\alpha = 135^\circ$, $V_d = -107.2\,V$, $u = 6.48^\circ$