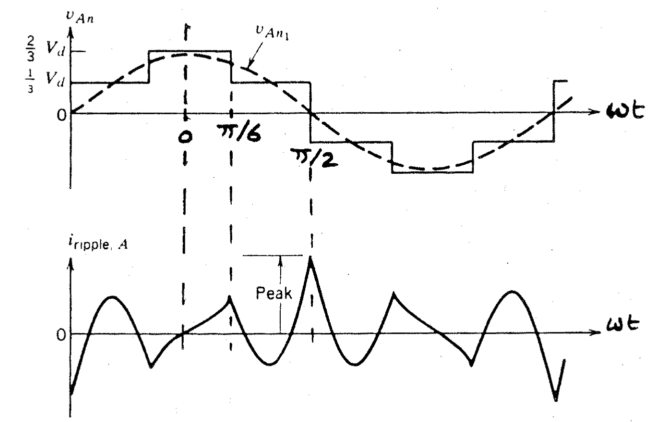
Problem 8-7

Using Eq. 8-58

$$V_d = \frac{\pi}{\sqrt{6}} V_{LL_1}(\text{rms}) = \frac{200}{0.78} = 256.51\text{V}$$



From Eq. 8-58,

$$\hat{V}_{An_1} = \frac{\sqrt{6}}{\pi} \times \frac{\sqrt{2}}{\sqrt{3}} V_d = \frac{2}{\pi} \cdot V_d = 163.3\text{ V}$$

$$\therefore \; v_{An_1} = 163.3 \cos \omega t$$

$$i_{L,ripple} = \frac{1}{L}\int_0^t (v_{An} - v_{An_1})\cdot dt = \frac{1}{\omega L}\int_0^{\omega t} (v_{An} - v_{An_1})\cdot d(\omega t)$$

As shown in the figure, the peak ripple current occurs at $\omega t = \pi/2$.

[Note that the ripple current at $\omega t = 0$ is zero in the figure above]

$$\therefore\ i_{L,ripple}(\omega t = \frac{\pi}{2}) = \frac{1}{\omega L}\left[\int_0^{\pi/6} (2\cdot\frac{V_d}{3} - \hat{V}_{An_1}\cos\omega t)\cdot d\omega t\right.$$

$$\left. + \int_{\pi/6}^{\pi/2} (\frac{V_d}{3} - \hat{V}_{An_1}\cos\omega t)\cdot d\omega t\right]$$

$$= \frac{1}{\omega L}\left[2\cdot\frac{V_d}{3}\cdot\frac{\pi}{6} + \frac{V_d}{3}(\frac{\pi}{2} - \frac{\pi}{6}) - \hat{V}_{An_1}\sin\omega t\,\Big|_0^{\pi/2}\right]$$

$$= \frac{1}{\omega L}\left[\frac{2}{9}\pi\ V_d - \hat{V}_{An_1}\right] = 0.483\text{A (peak ripple current)}$$