Problem 8-9

With the time origin shown in Fig. 8-34a, the waveform has an odd quarter-wave symmetry: $f(-t) = -f(t)$ and $f(t) = -f(t + \frac{T}{2})$

$$\omega = \omega_1 = \frac{2\pi}{T}$$

$$\therefore\ f(t) = \sum_{n=1}^{\infty} b_{2n-1} \sin[(2n-1)\omega t] \qquad n = 1,2,3,\ldots$$

$$b_{2n-1} = \frac{8}{T} \int_0^{T/4} f(t) \cdot \sin[(2n-1)\omega t] \cdot dt$$

$$= \frac{4}{\pi} \int_0^{\pi/2} f(\theta) \cdot \sin[h\theta] d\theta \qquad \text{where } \theta = \omega t \text{ and } h = 2n-1$$

From Fig. 8-34a

$$\frac{(\hat{V}_{A0})_h}{\frac{V_d}{2}} = \frac{4}{\pi}\left[\int_0^{\alpha_1} 1 \bullet \sin h\theta \bullet d\theta + \int_{\alpha_1}^{\alpha_2} (-1) \bullet \sin h\theta \bullet d\theta + \int_{\alpha_2}^{\alpha_3} 1 \bullet \sin h\theta \bullet d\theta\right.$$

$$\left. + \int_{\alpha_3}^{90^\circ} (-1) \bullet \sin h\theta \bullet d\theta\right]$$

$$= \frac{4}{h\pi}[1 - 2\cos h\alpha_1 + 2\cos h\alpha_2 - 2\cos h\alpha_3]$$

For $\alpha_1 = 0$, $\alpha_2 = 16.24^\circ$ and $\alpha_3 = 22.06^\circ$,

$$\therefore \frac{(\hat{V}_{A0})_1}{\frac{V_d}{2}} = 1.188 \qquad \text{(same as Eq. 8-78)}$$

and, $(\hat{V}_{A0})_5 = (\hat{V}_{A0})_7 = 0$