15.12 Find the trigonometric Fourier series coefficients for the waveform in Fig. P15.12.

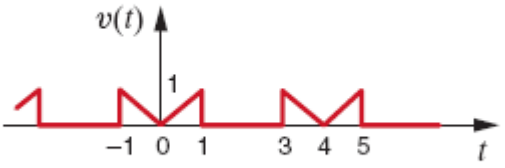

Figure P15.12

SOLUTION:

$$T_0 = 4s \quad , \quad \omega_0 = \frac{\pi}{2}$$

$$a_0 = \frac{1}{T_0}\int_0^{T_0} v(t)\,dt$$

$$a_0 = \frac{1}{4}\left[\frac{1}{2}(1)(1) + \frac{1}{2}(1)(1)\right]$$

$$a_0 = \frac{1}{4}$$

Even symmetry exists

$$b_n = 0$$

$$a_n = \frac{4}{T_0}\int_0^{T_0/2} v(t)\cos n\omega_0 t\,dt$$

$$a_n = \int_0^1 t\cos n\omega_0 t\,dt$$

$$a_n = \frac{1}{(n\omega_0)^2}\cos n\omega_0 t + \frac{t}{n\omega_0}\sin n\omega_0 t \Big]_0^1$$

$$a_n = \frac{4}{n^2\pi^2}\left[\cos n\pi/2 - 1\right] + \frac{2}{n\pi}\sin n\pi/2$$

$$a_0 = 1/4 \qquad b_n = 0$$

$$a_n = \frac{4}{n^2\pi^2}\left[\cos n\pi/2 - 1\right] + \frac{2}{n\pi}\sin n\pi/2$$