Problem 5.6

Consider uniform sampling of the sinusoidal wave

$$g(t) = \cos(\pi t)$$

Determine the Fourier transform of the sampled waveform for the following sampling period:

(a) $T_s = 0.25$s

(b) $T_s = 1$s

(c) $T_s = 1.5$s

Solution

We are given

$$g(t) = \cos(\pi t)$$

the frequency of which is 0.5 Hz.

(a) For the sampling period $T_s = 0.25$, we have

$$g_\delta(t) = \sum_{n=-\infty}^{\infty} g(nT_s)\delta(t - nT_s)$$

$$= \sum_{n=-\infty}^{\infty} \cos\left(\frac{n\pi}{4}\right)\delta(t - nT_s)$$

(b) For $T_s = 1$s,

$$g_\delta(t) = \sum_{n=-\infty}^{\infty} \cos(n\pi)\delta(t - nT_s)$$

$$= \sum_{n=-\infty}^{\infty} (-1)^n \delta(t - nT_s)$$

(c) For $T_s = 1.5$,

$$g_\delta(t) = \sum_{n=-\infty}^{\infty} \cos(1.5n\pi)\delta(t - nT_s)$$