Problem 5.7

Consider a continuous-time signal defined by

$$g(t) = \frac{\sin(\pi t)}{\pi t}$$

The signal $g(t)$ is uniformly sampled to produce the infinite sequence $\{g(nT_s)\}_{n=-\infty}^{\infty}$. Determine the condition which the sampling period T_s must satisfy so that the signal $g(t)$ is uniquely recovered from the sequence $\{g(nT_s)\}$.

Solution

The signal

$$g(t) = \frac{\sin(\pi t)}{\pi t} = \text{sinc}(t)$$

is limited to the band $-0.5 < f < 0.5$ Hz. The Nyquist rate for this signal must therefore exceed $2 \times 0.5 = 1$ Hz. Correspondingly, the permissible sampling interval must satisfy the condition $T_s < 1$s.