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

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

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

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