1.6.2 Time Slicing

Slicing the signal into discrete points in time is termed *time sampling* or simply *sampling*. Time slicing samples the continuous waveform, $x(t)$, at discrete points in time, $1T_s$, $2T_s$, $3T_s$,..., nT_s, where T_s is the sample interval. Since the purpose of sampling is to produce an acceptable (for all practical purposes) copy of the original waveform, the critical issue is how well does this copy represent the original? Stated in another way, can the original be reconstructed from the digitized copy? If so, then the copy is clearly adequate. The answer to this question depends on the frequency at which the analog waveform is sampled relative to the frequencies that it contains.

The question of what sampling frequency should be used can best be addressed using a simple waveform, a single sinusoid.* In Chapter 3, we show that all finite, continuous waveforms

Table 1.3 Results from Example 1.2 Comparing the Noise Variance Predicted by Equation 1.10 with Those Determined by Digitizing a Sine Wave Signal and Finding the Digitization Error

Bits	Empirical	Theoretical
6	1.878702e-005	2.099605e-005

* A sinusoid has a straightforward frequency domain representation: it is defined only by a single magnitude and phase (or a single complex point) at the frequency of the sinusoid. The classical methods of frequency analysis described in Chapter 3 make use of this fact.