The Discrete Fourier Transforms

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What is the objective of DFT ?

Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals

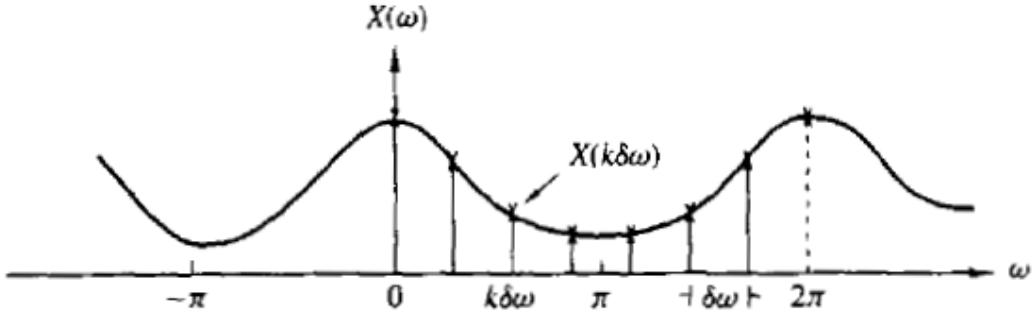


Figure 7.1.1 Frequency-domain sampling of the Fourier transform

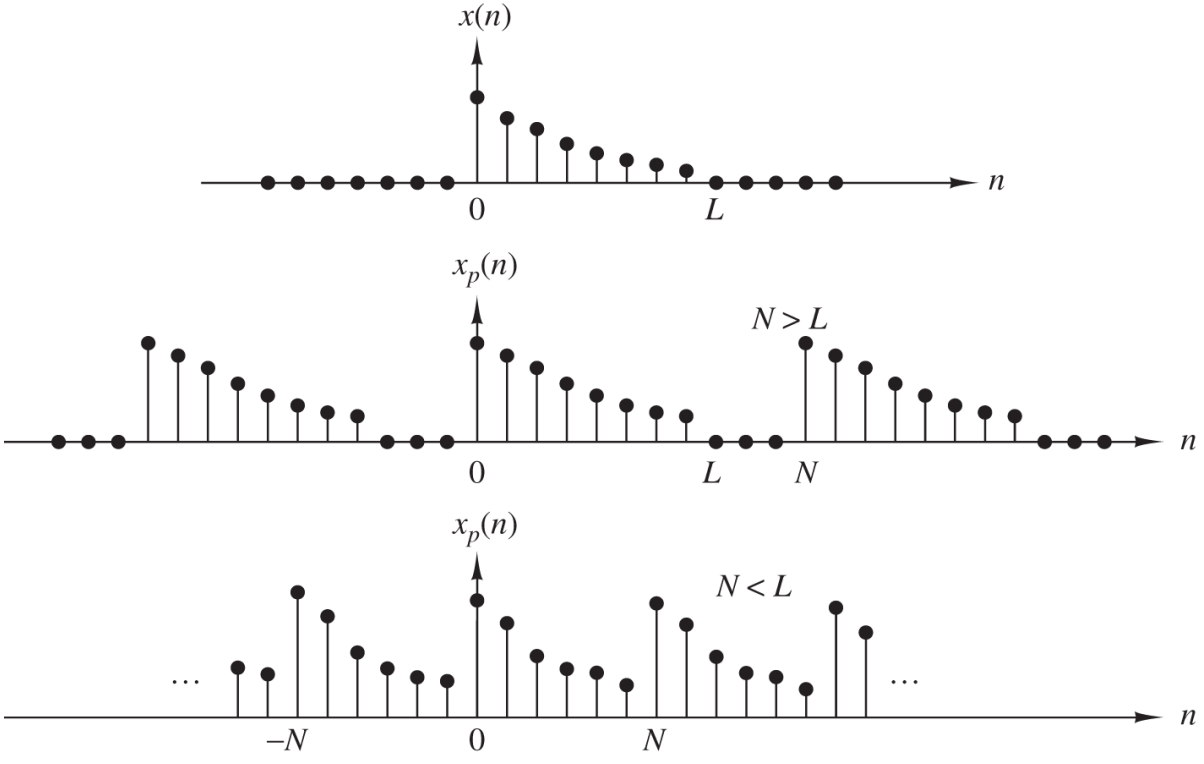


Figure 7.1.2 Aperiodic sequence $x(n)$ of length L and its periodic extension for $N \geq L$ (no aliasing) and $N < L$ (aliasing).

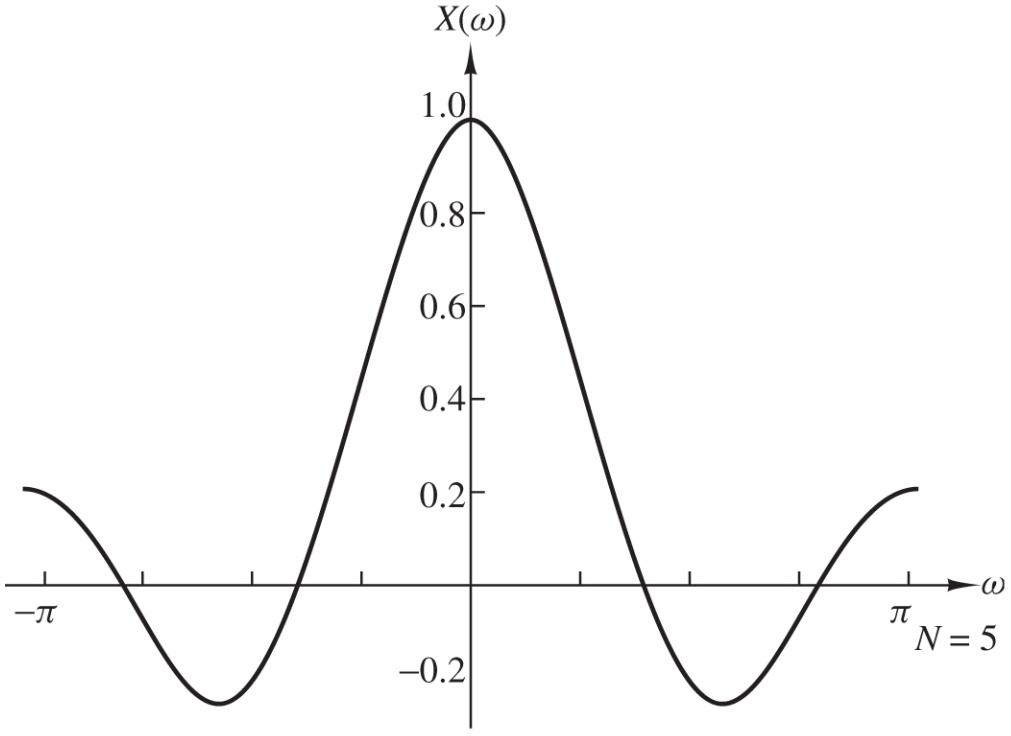


Figure 7.1.3 Plot of the function $[\sin(\omega N/2)]/[N \sin(\omega/2)]$.

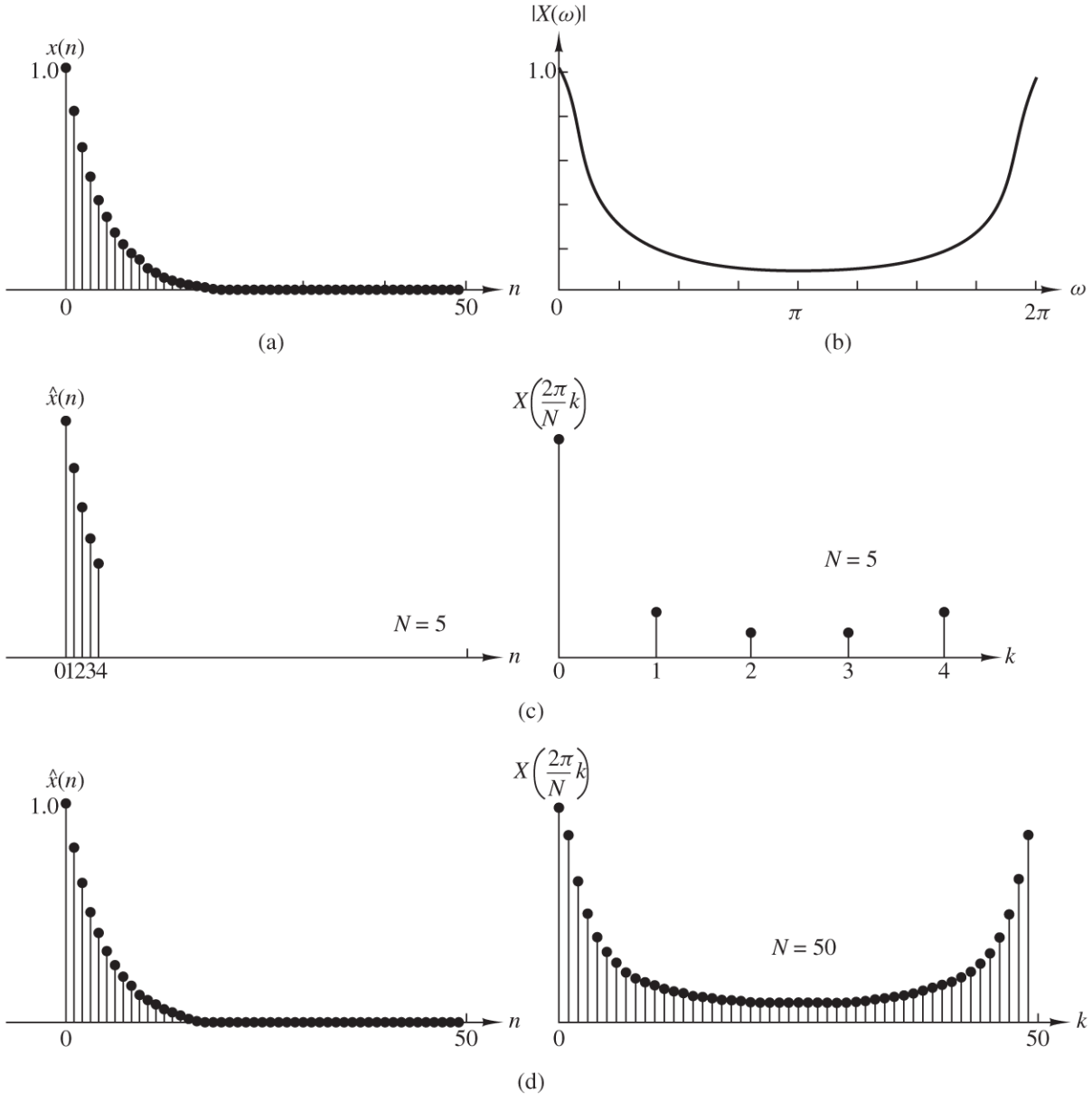


Figure 7.1.4 (a) Plot of sequence $x(n) = (0.8)^n u(n)$; (b) its Fourier transform (magnitude only); (c) effect of aliasing with $N = 5$; (d) reduced effect of aliasing with $N = 50$.

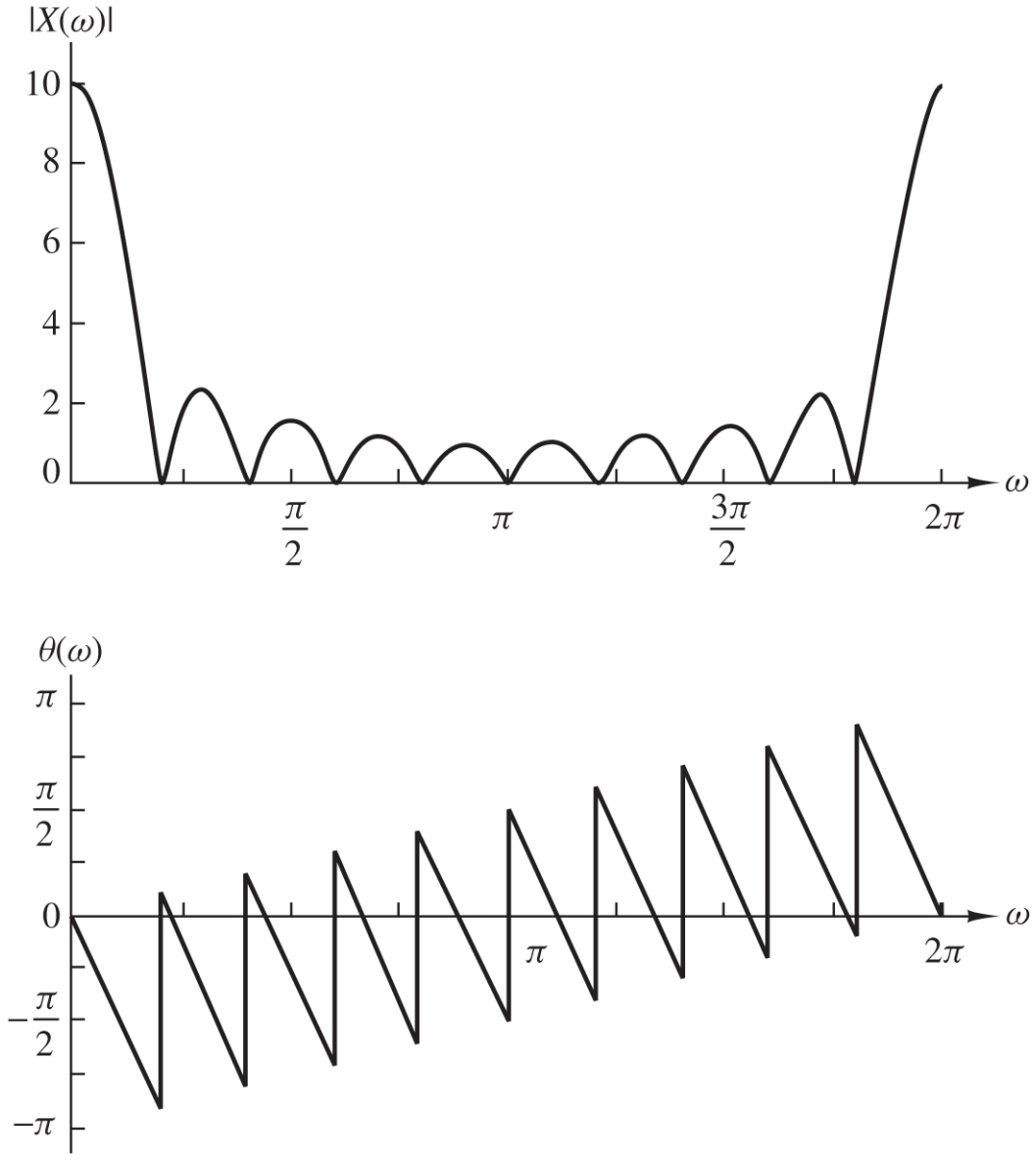


Figure 7.1.5 Magnitude and phase characteristics of the Fourier transform for signal in Example 7.1.2.

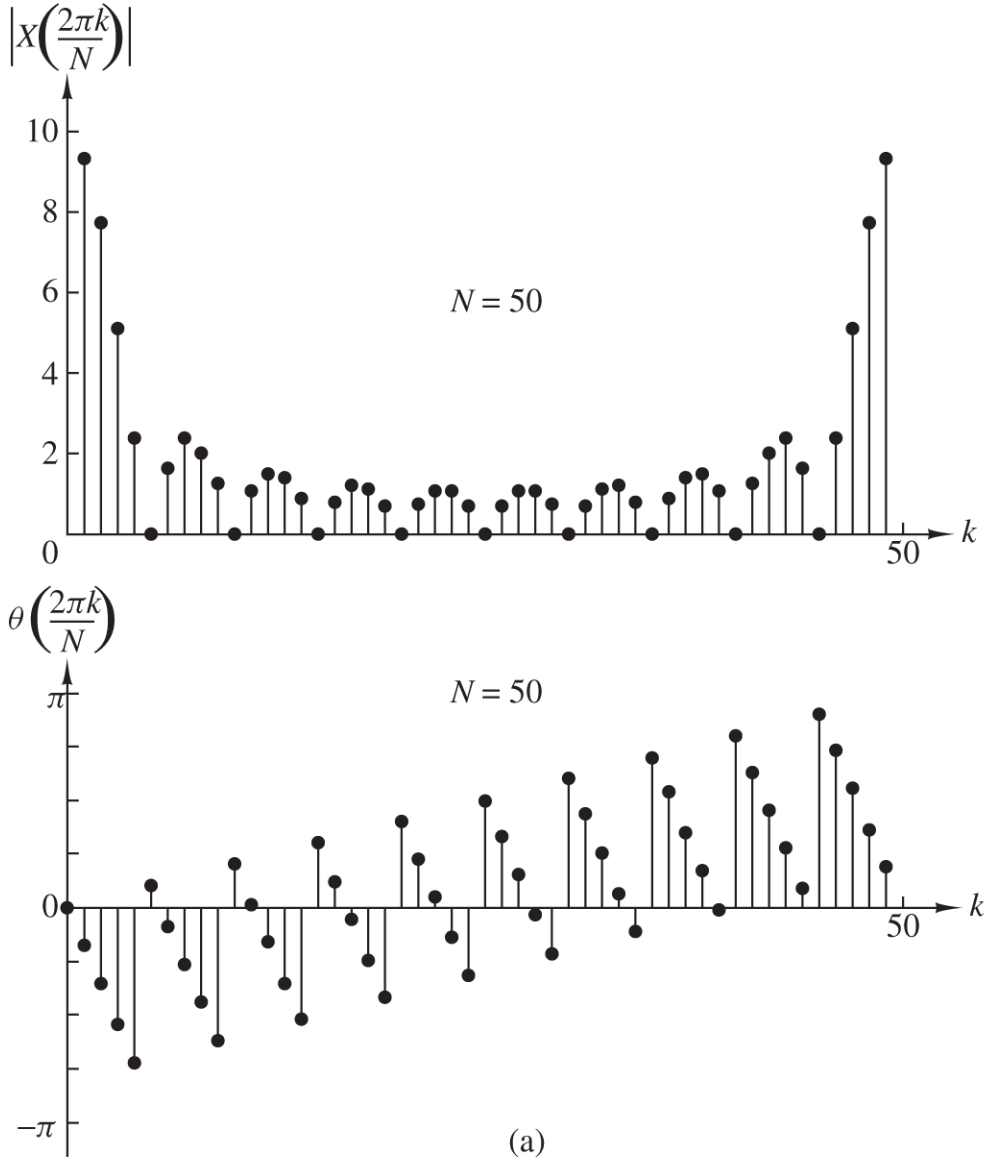


Figure 7.1.6 Magnitude and phase of an N-point DFT in Example 7.1.2; (a) $L = 10$, $N = 50$; (b) $L = 10$, $N = 100$.

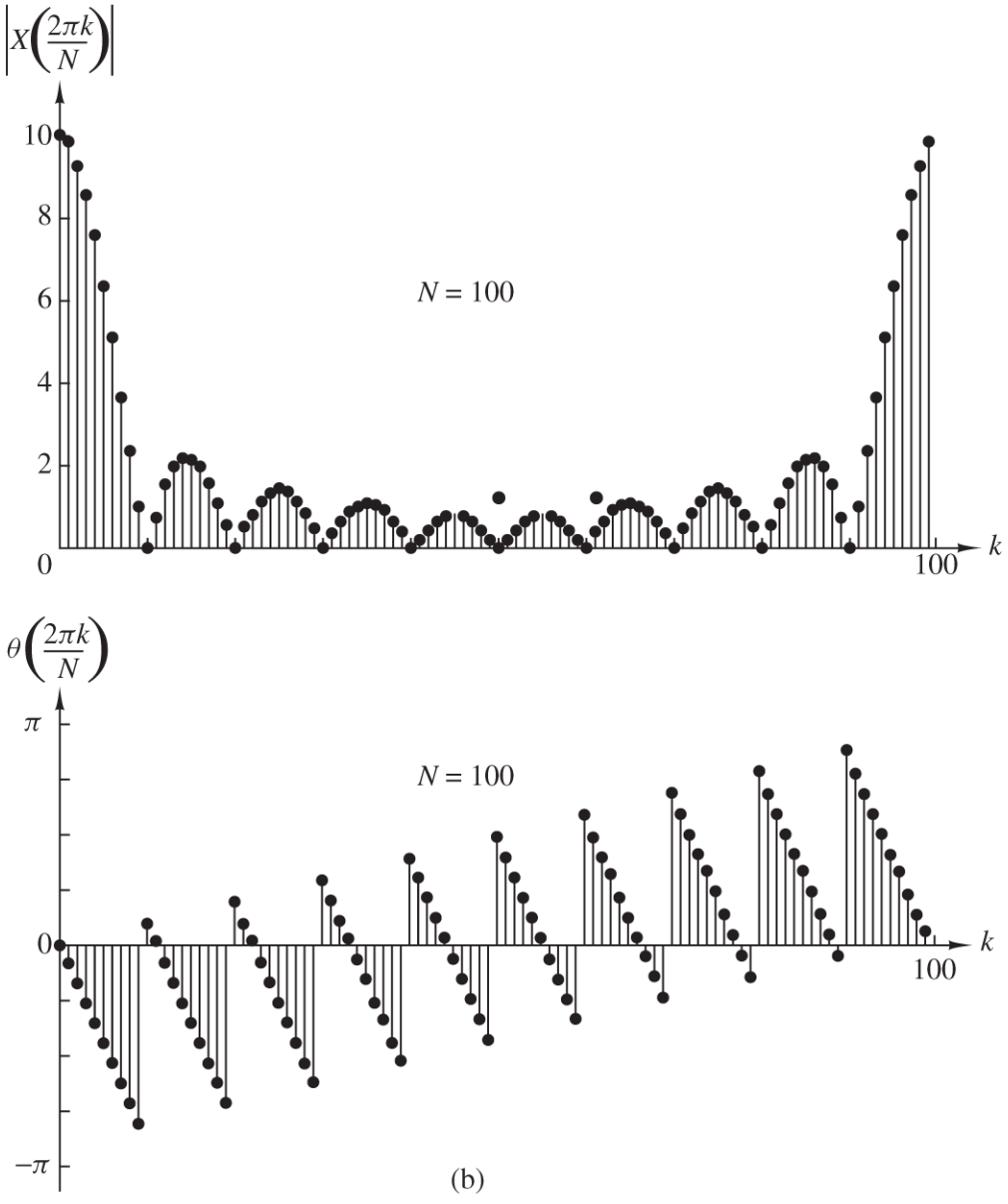


Figure 7.1.6 **Figure** *continued*

Properties of DFT

- Periodicity
- Linearity
- Circular Symmetries

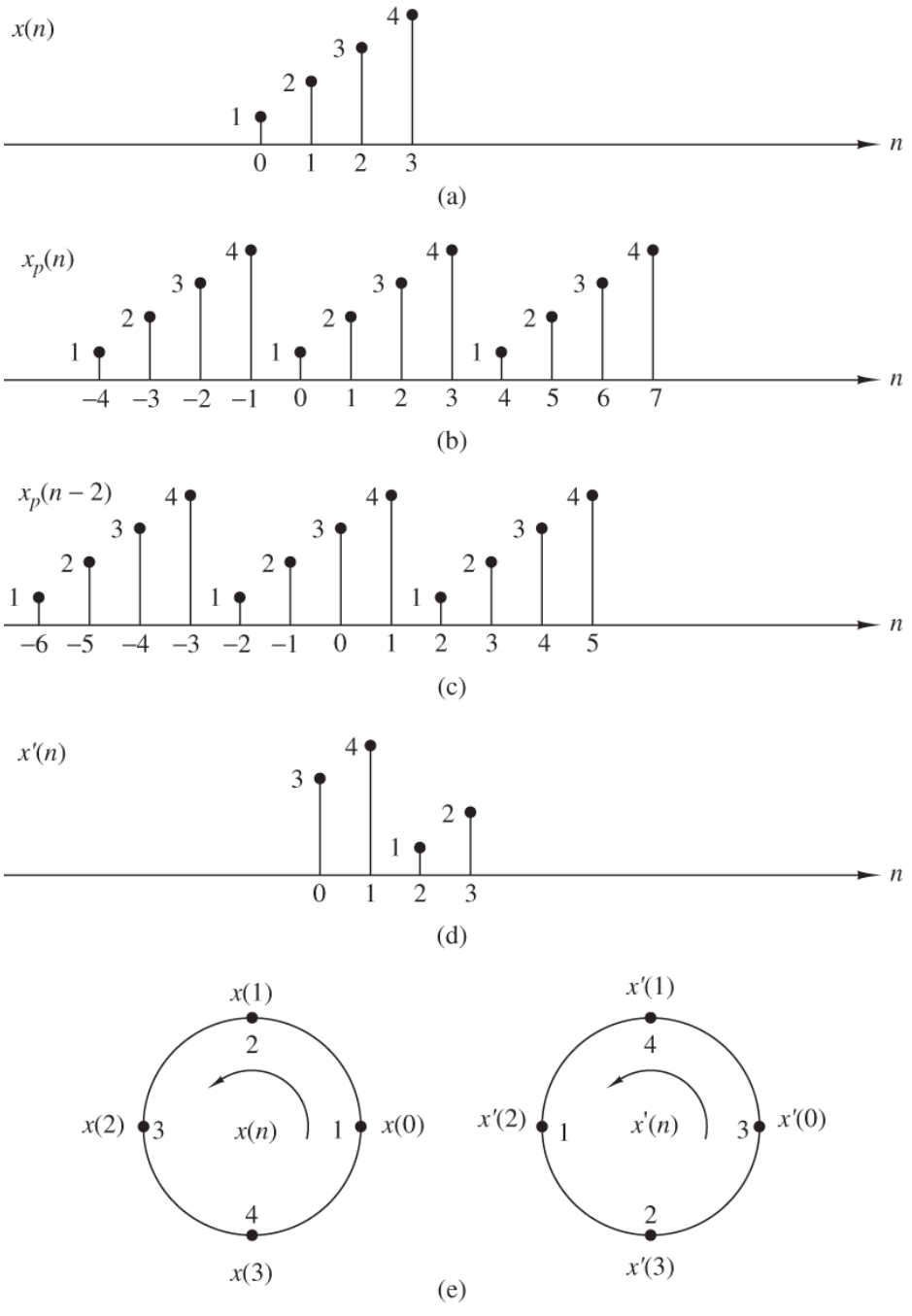


Figure 7.2.1 Circular shift of a sequence.

Additional DFT Properties

- Time reversal of a sequence
- Circular time shift of a sequence
- Circular frequency shift
- Complex-conjugate properties
- Circular correlation
- Multiplication of two sequences
- Parseval's Theorem

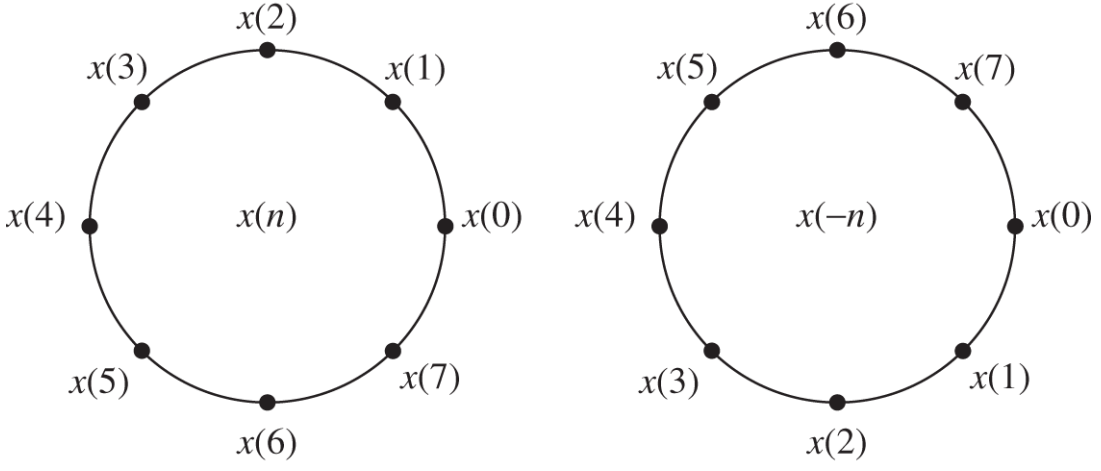
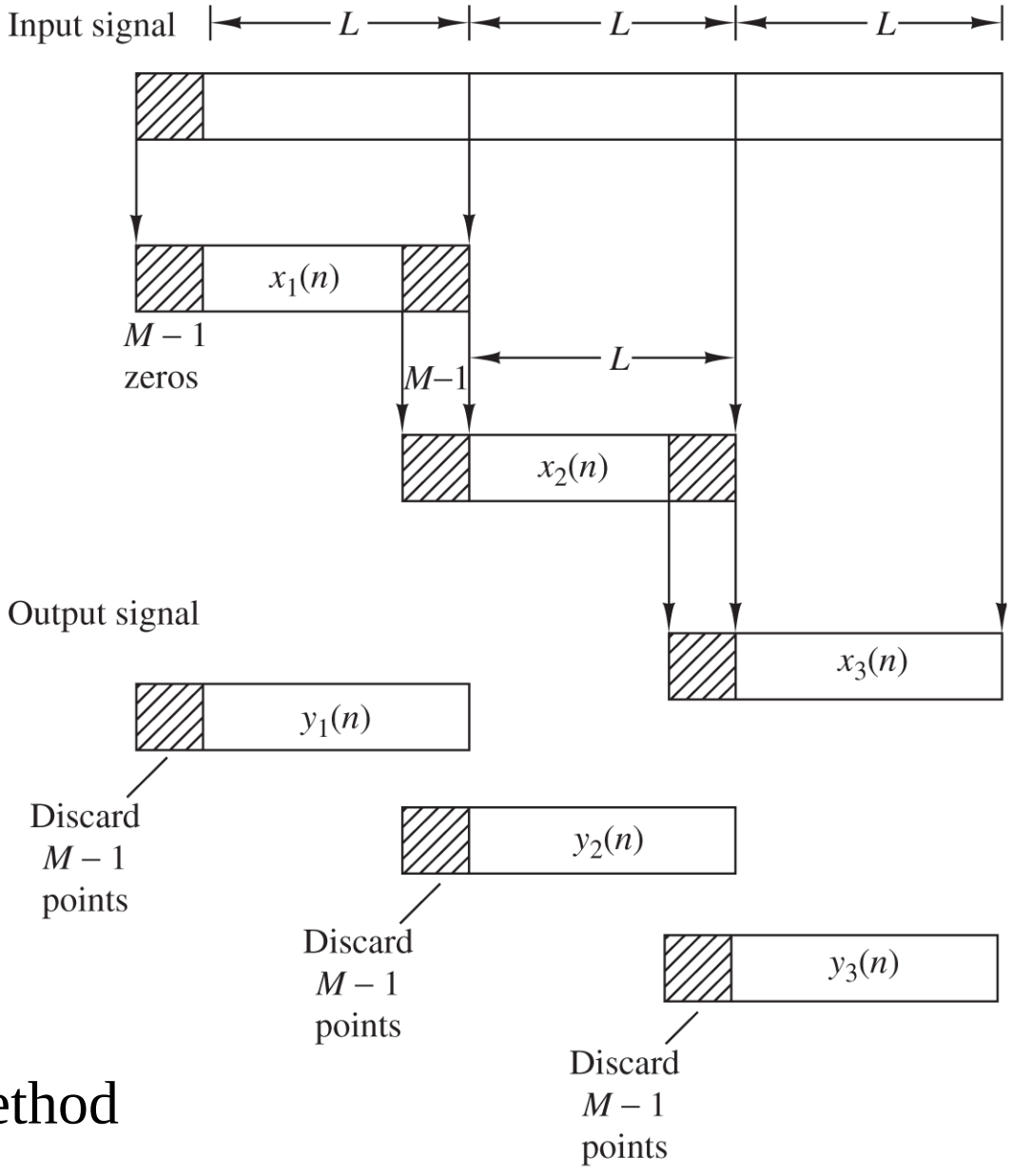


Figure 7.2.3 Time reversal of a sequence.

Filtering of Long Data Sequences



Overlap-save method

Figure 7.3.1 Linear FIR filtering by the overlap-save method.

Overlap-add method

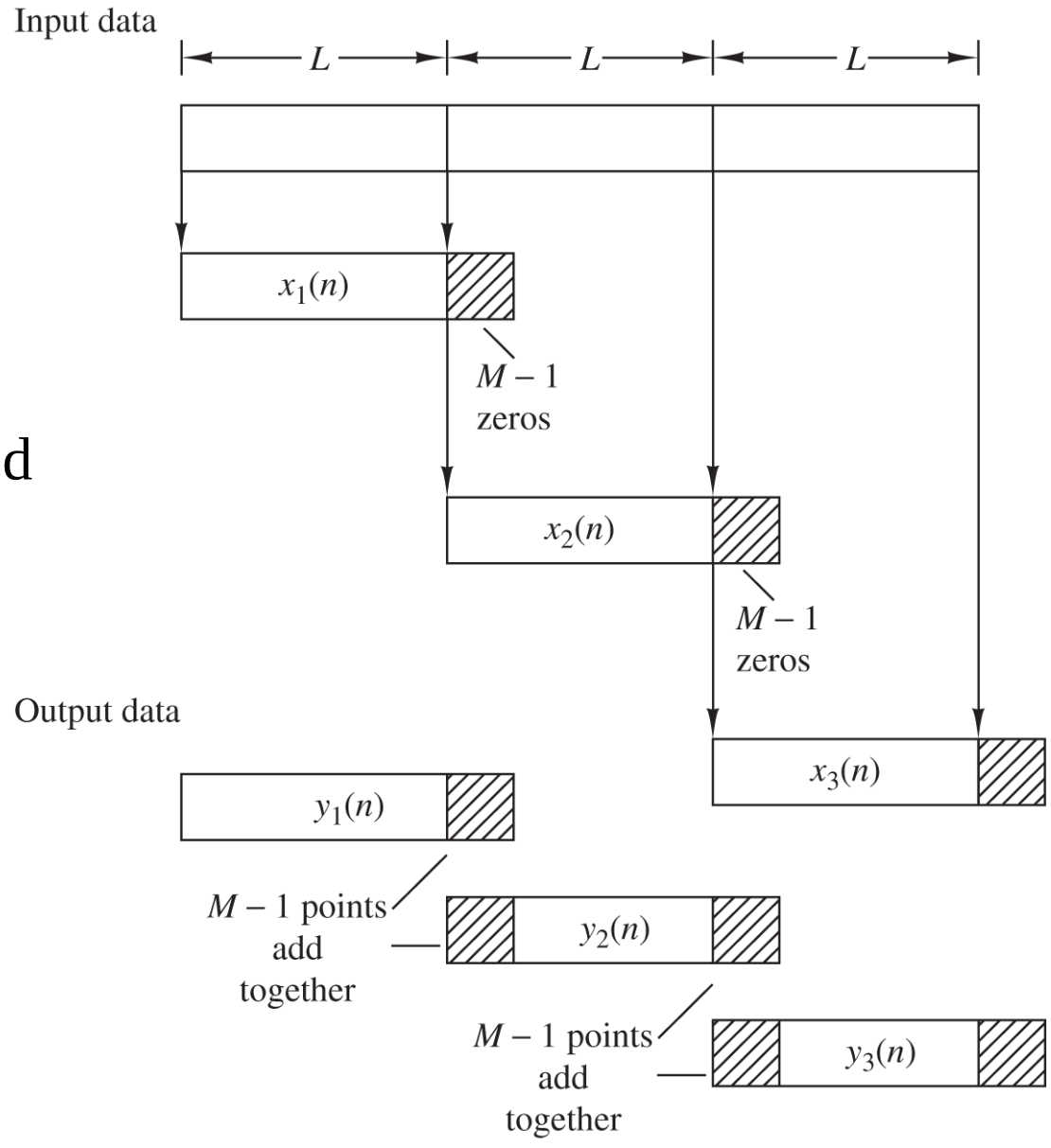


Figure 7.3.2 Linear FIR filtering by the overlap-add method.

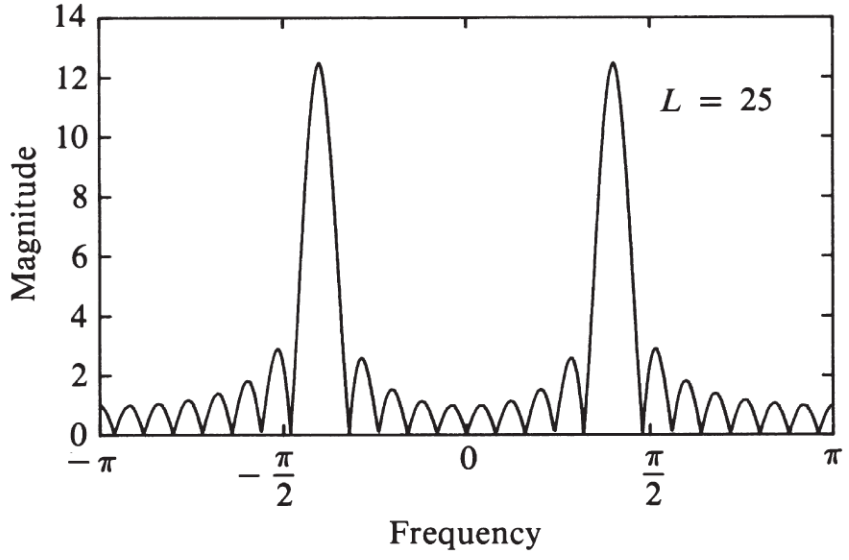


Figure 7.4.1 Magnitude spectrum for $L = 25$ and $N = 2048$, illustrating the occurrence of leakage.

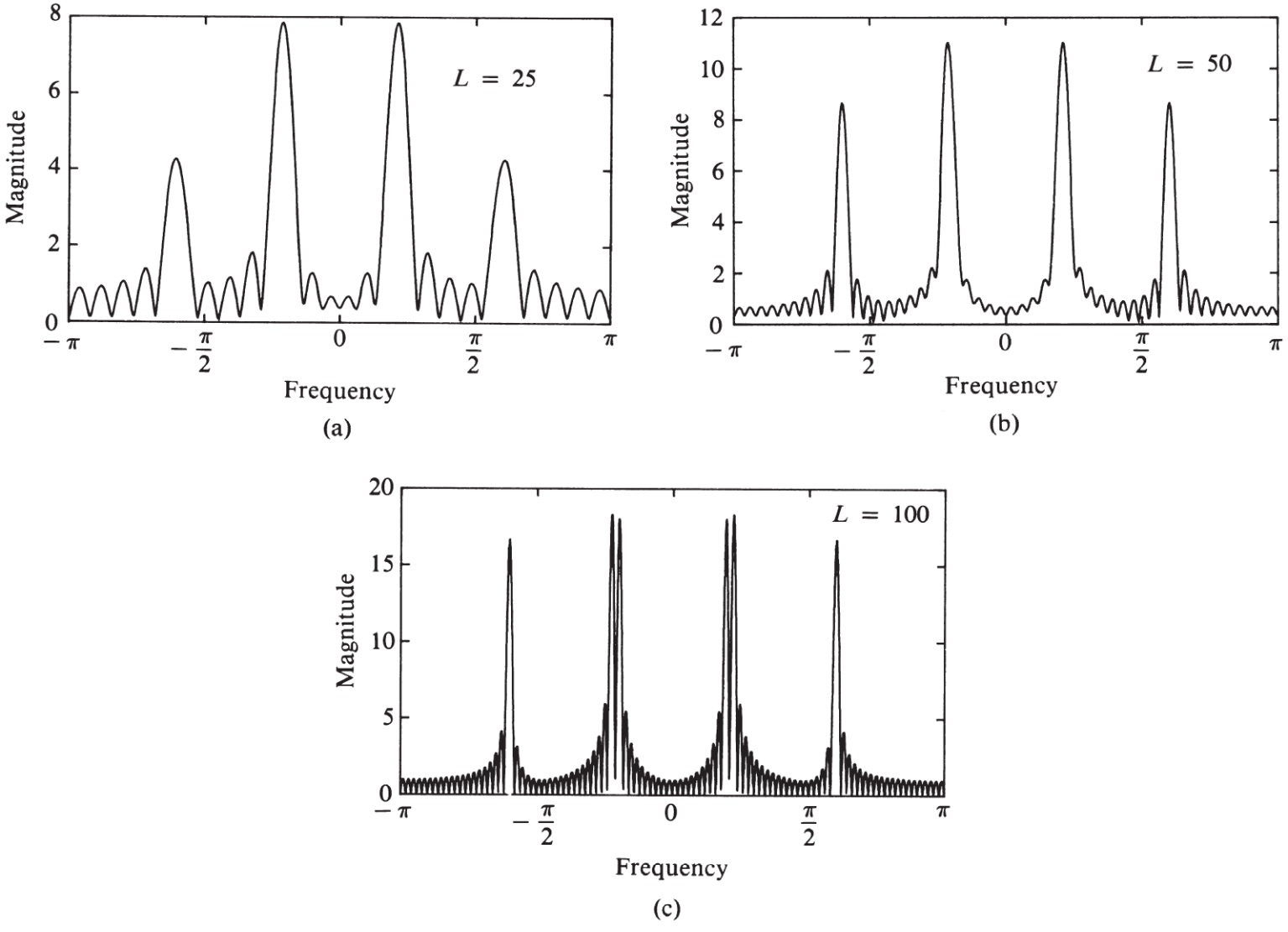


Figure 7.4.2 Magnitude spectrum for the signal given by (7.4.8), as observed through a rectangular window.

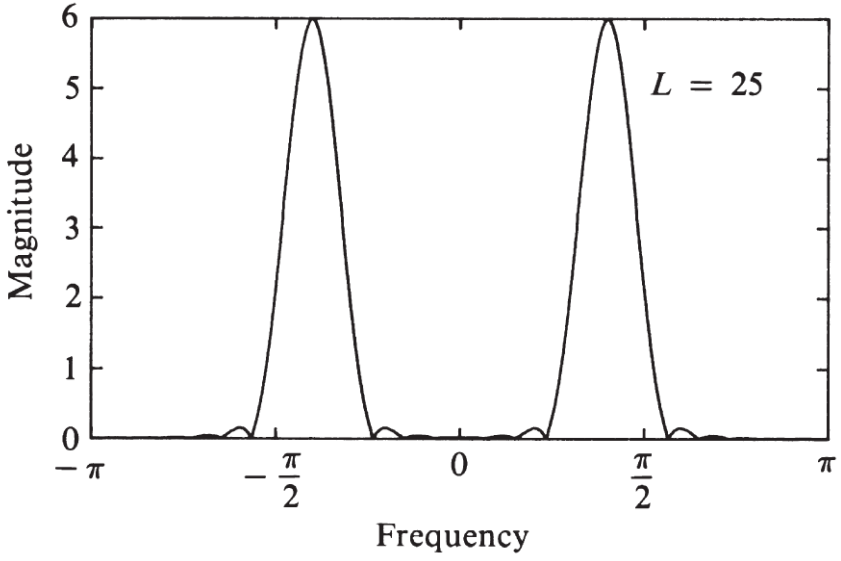


Figure 7.4.3 Magnitude spectrum of the Hanning window.

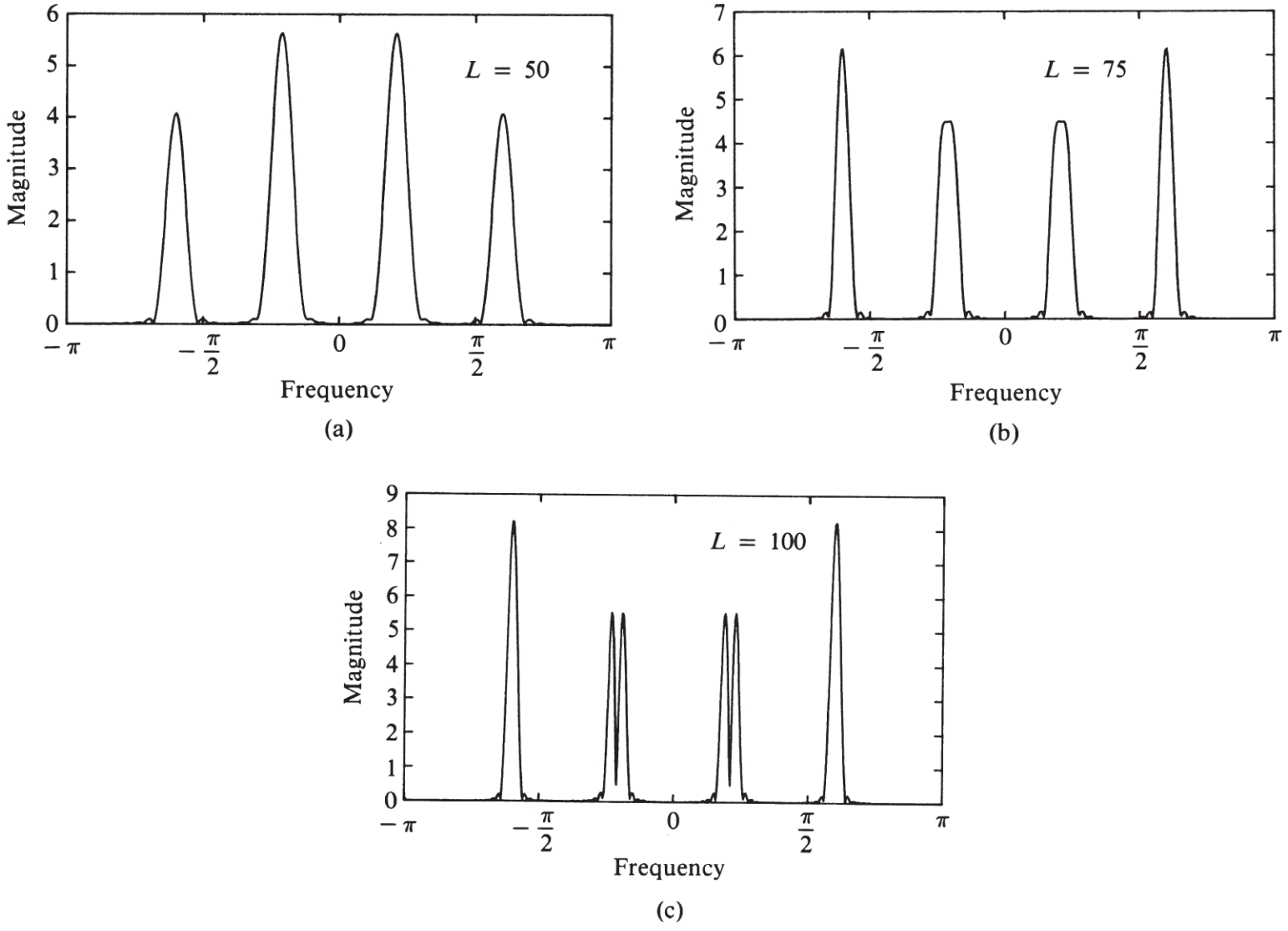


Figure 7.4.4 Magnitude spectrum of the signal in (7.4.8) as observed through a Hanning window.

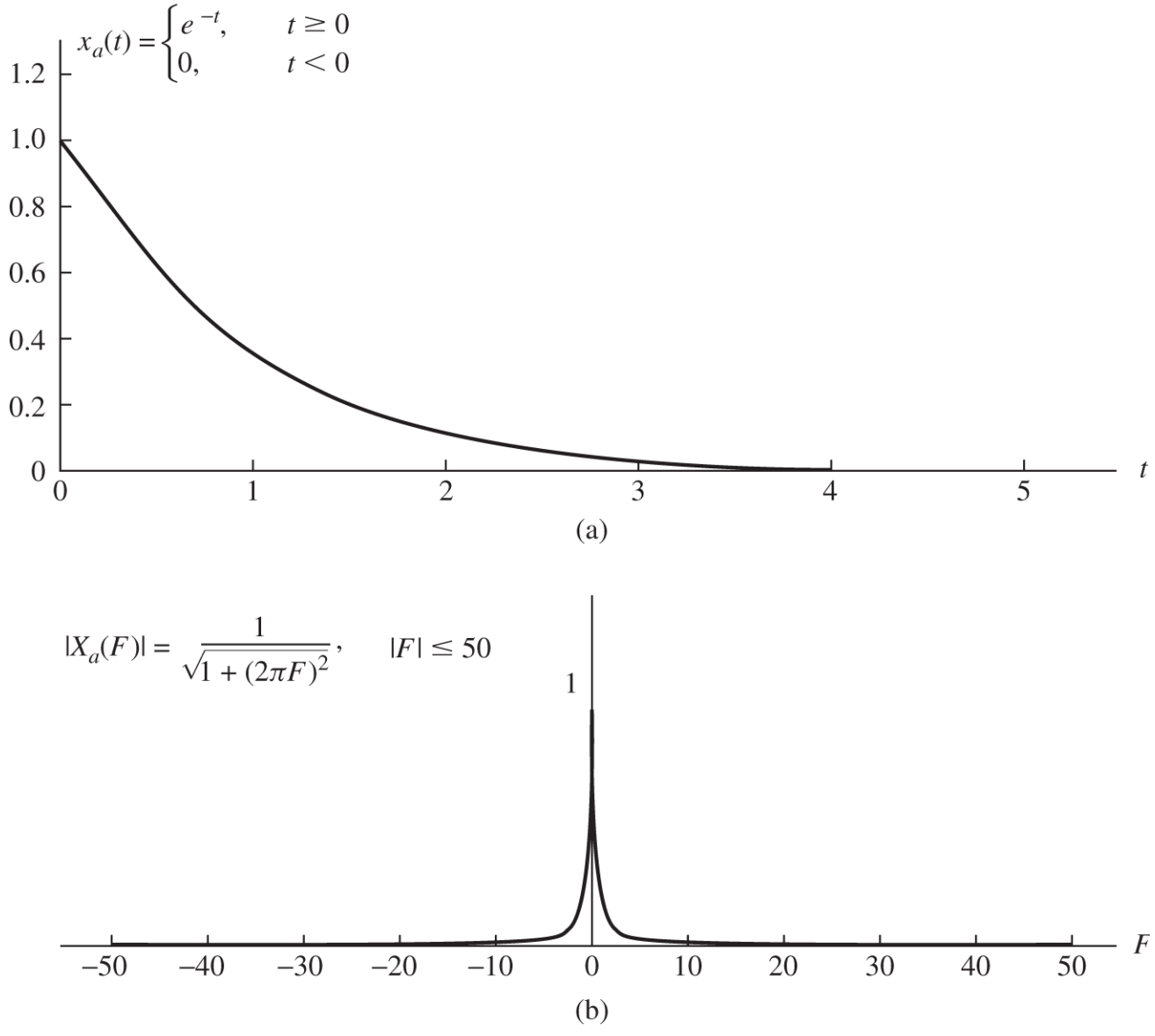
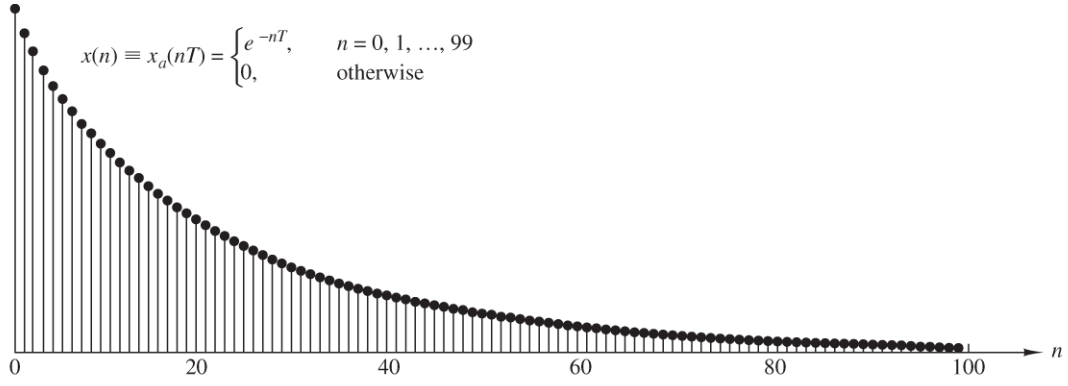
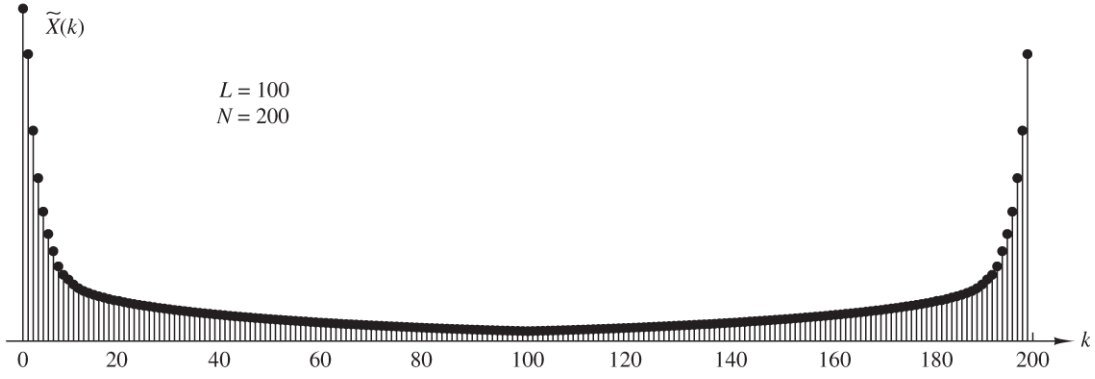


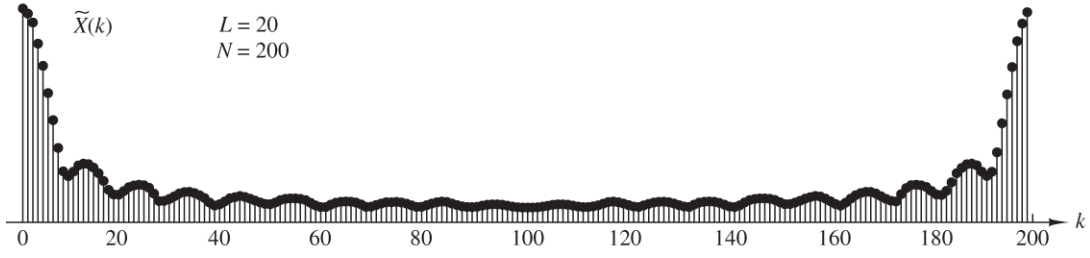
Figure 7.4.5 Effect of windowing (truncating) the sampled version of the analog signal in Example 7.4.1



(c)



(d)



(e)

Figure 7.4.5 *Continued*