Методы и средства
Цифровой Обработки Сигналов

Свойства оцифровки

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Процедура дискретизации

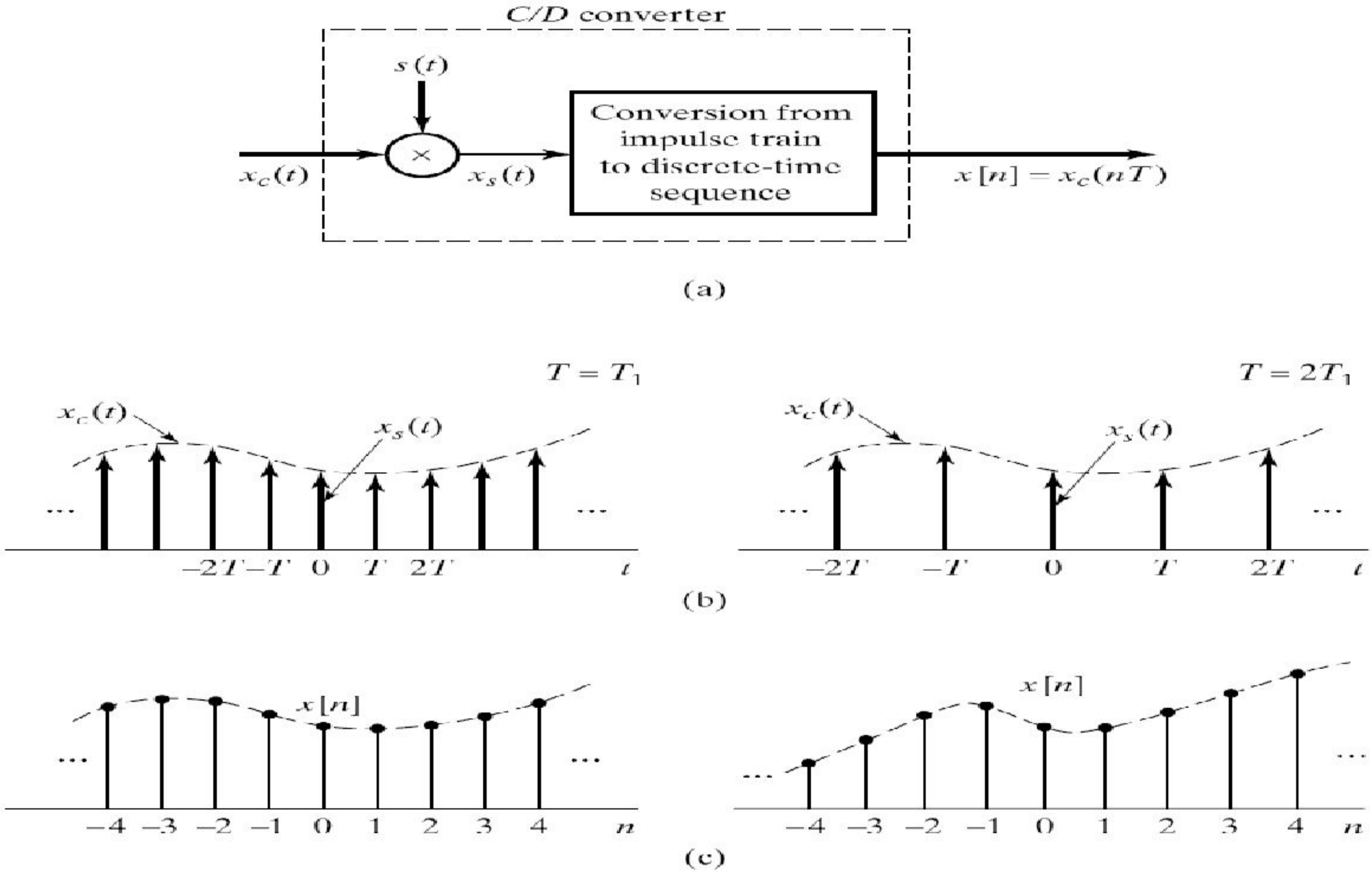


Figure 4.2 Sampling with a periodic impulse train followed by conversion to a discrete-time sequence. (a) Overall system. (b) $x_s(t)$ for two sampling rates. (c) The output sequence for the two different sampling rates.

Фиксация уровня

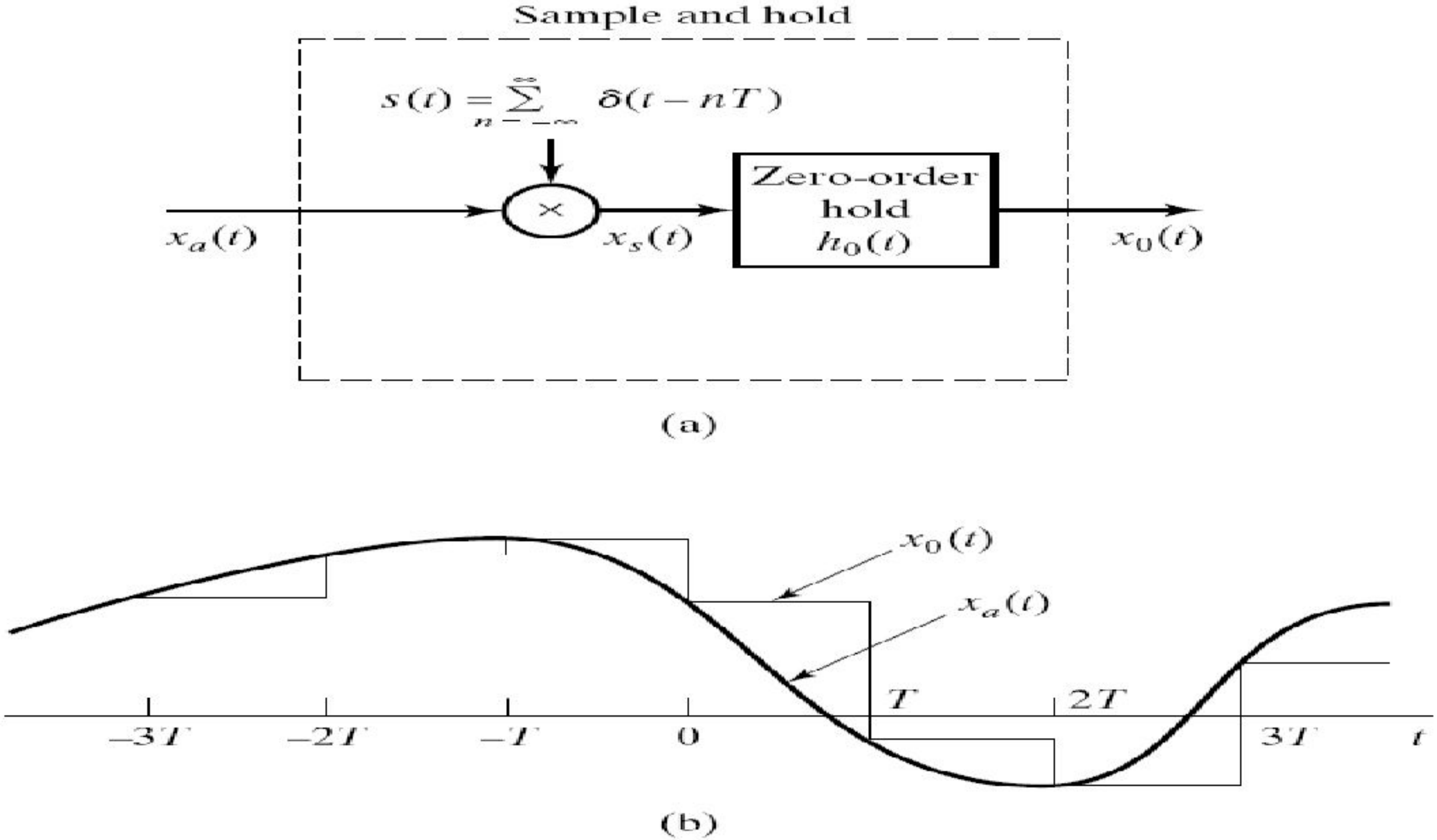


Figure 4.46 (a) Representation of an ideal sample-and-hold.
(b) Representative input and output signals for the sample-and-hold.

Дискретизация и квантование

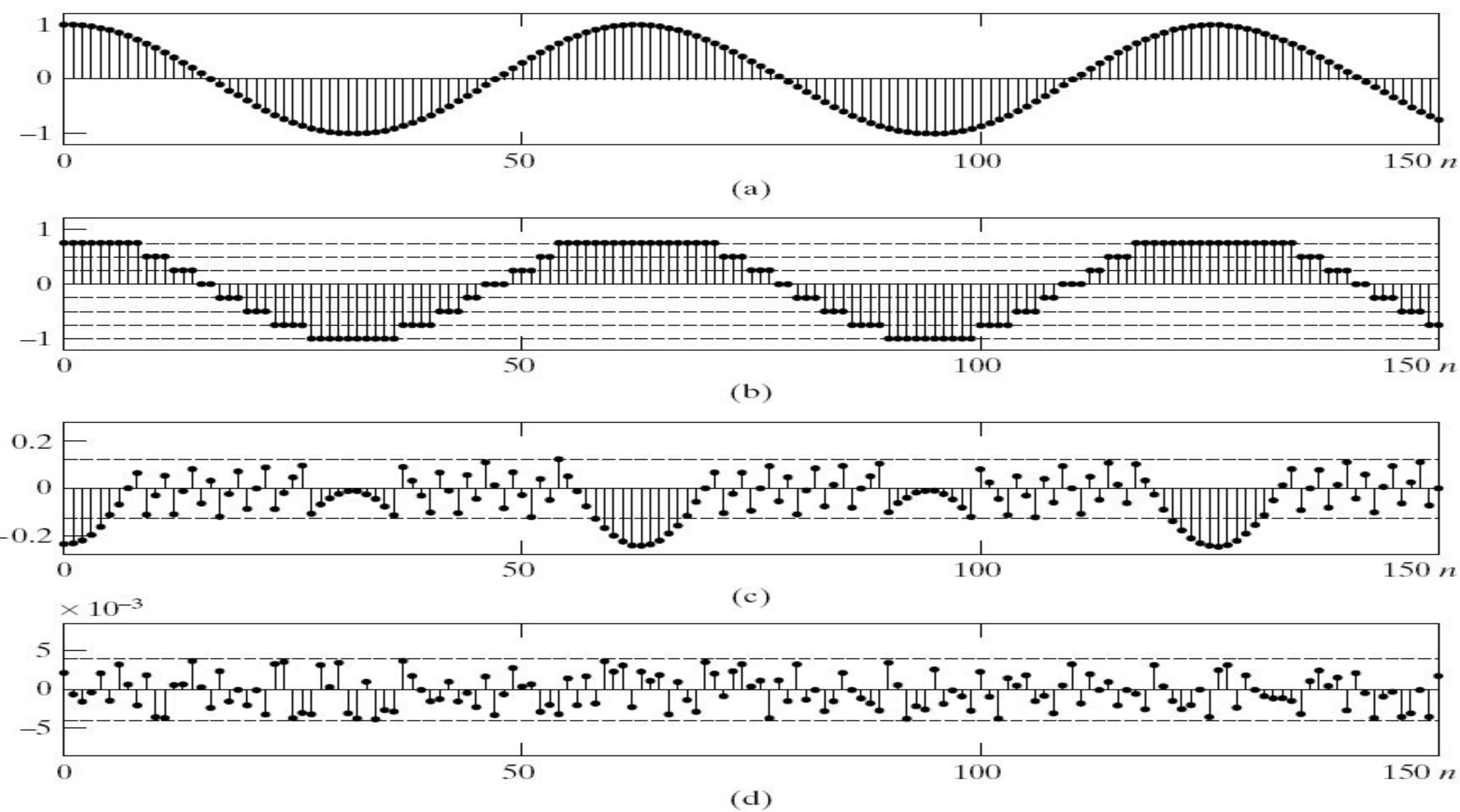


Figure 4.51 Example of quantization noise. (a) Unquantized samples of the signal $x[n] = 0.99\cos(n/10)$. (b) Quantized samples of the cosine waveform in part (a) with a 3-bit quantizer. (c) Quantization error sequence for 3-bit quantization of the signal in (a). (d) Quantization error sequence for 8-bit quantization of the signal in (a).

Восстановление по Котельникову

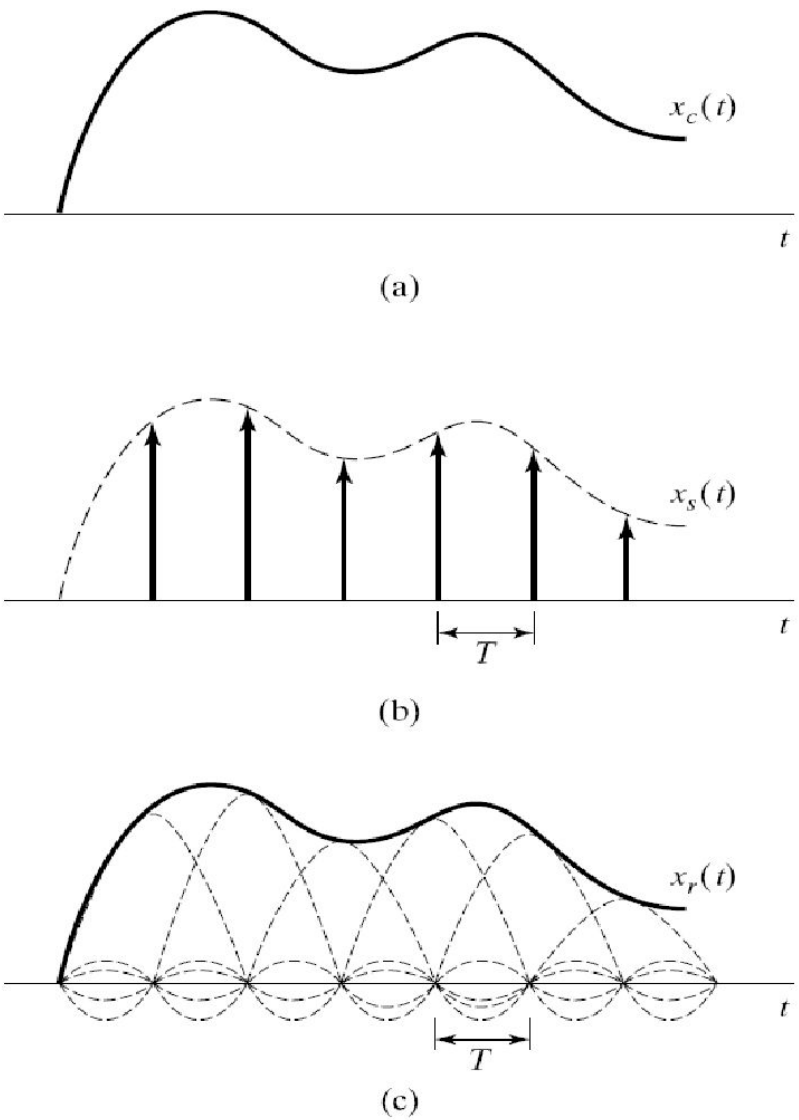


Figure 4.9 Ideal bandlimited interpolation.

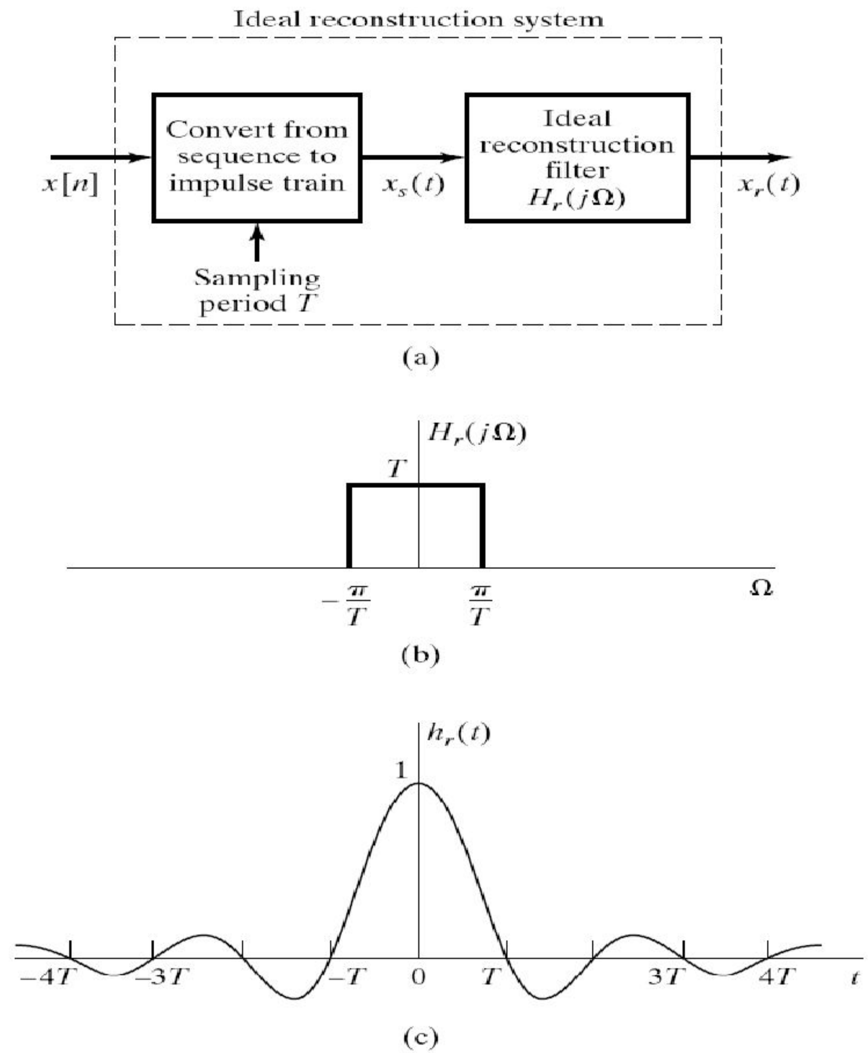
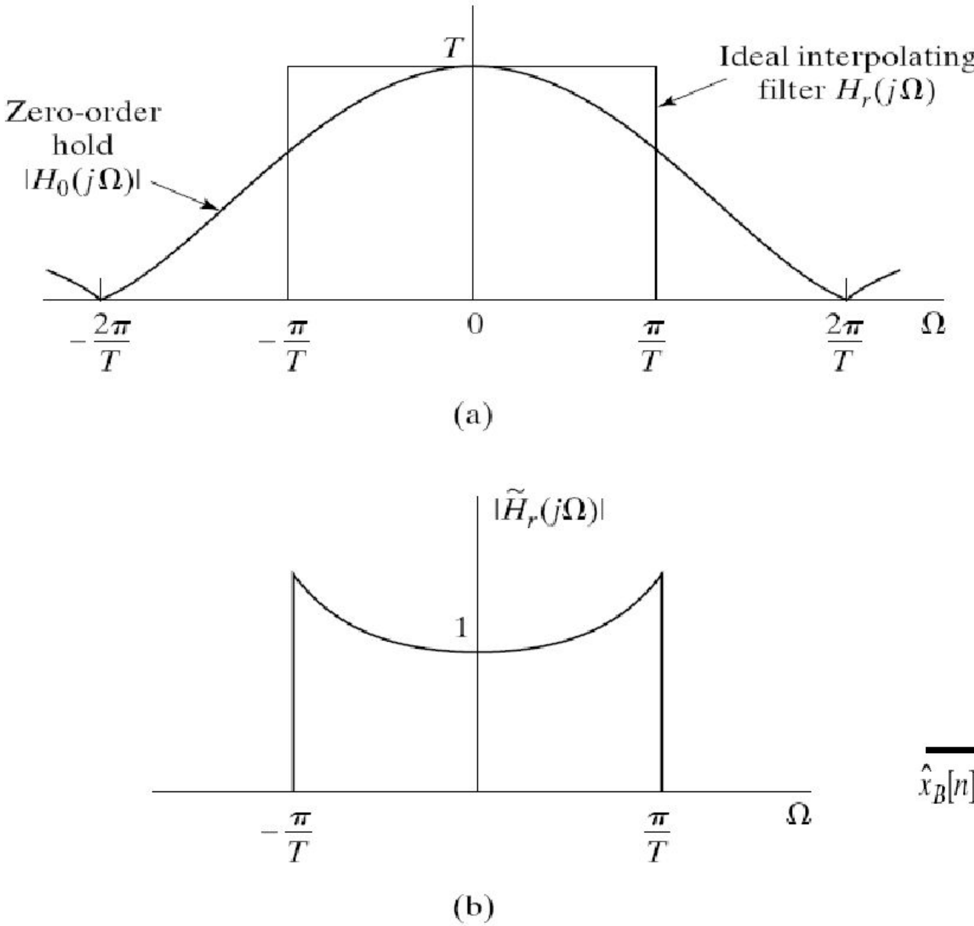
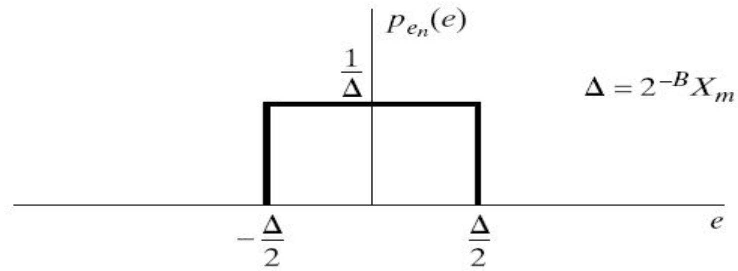


Figure 4.8 (a) Block diagram of an ideal bandlimited signal reconstruction system. (b) Frequency response of an ideal reconstruction filter. (c) Impulse response of an ideal reconstruction filter.

Идеальное восстановление





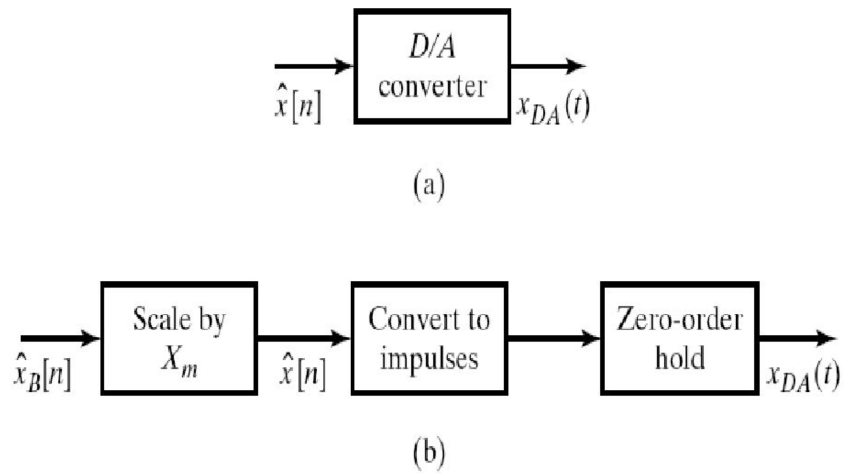


Figure 4.54 (a) Frequency response of zero-order hold compared with ideal interpolating filter. (b) Ideal compensated reconstruction filter for use with a zero-order-hold output.

Figure 4.53 (a) Block diagram of D/A converter. (b) Representation in terms of a zero-order hold.

Перенос спектра

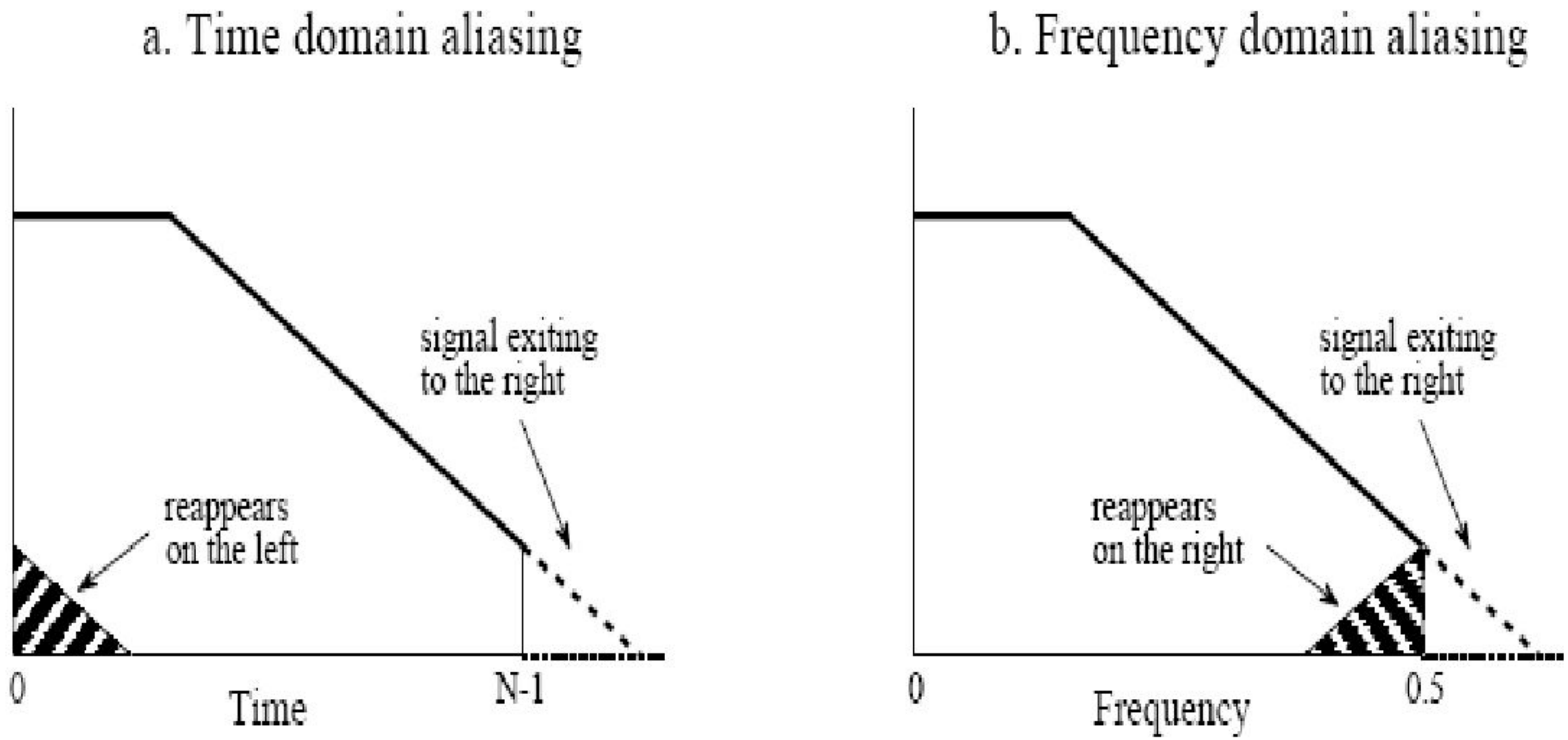


FIGURE 10-10
Examples of aliasing in the time and frequency domains, when only a single period is considered. In the time domain, shown in (a), portions of the signal that exits to the right, reappear on the left. In the frequency domain, (b), portions of the signal that exit to the right, reappear on the right as if they had been folded over.

Трансформации спектра

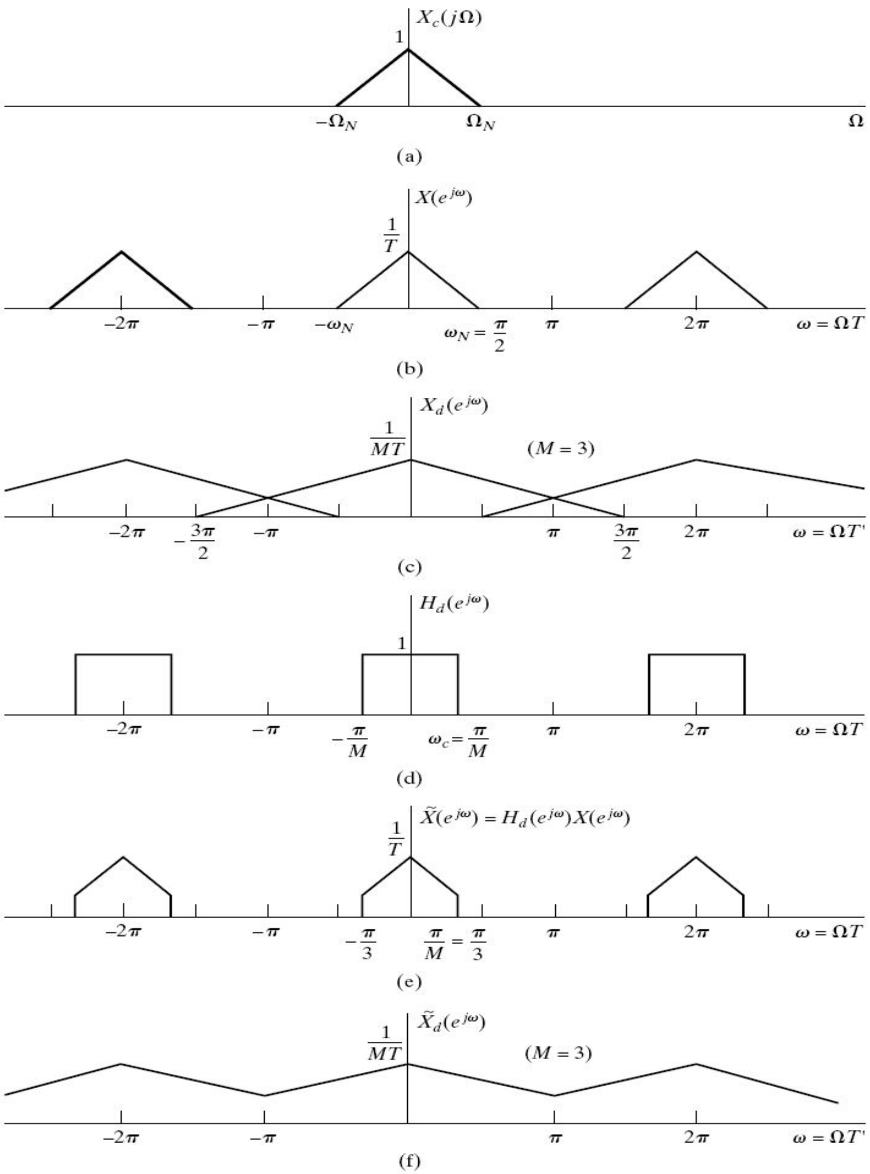


Figure 4.22 (a)–(c) Downsampling with aliasing. (d)–(f) Downsampling with prefiltering to avoid aliasing.

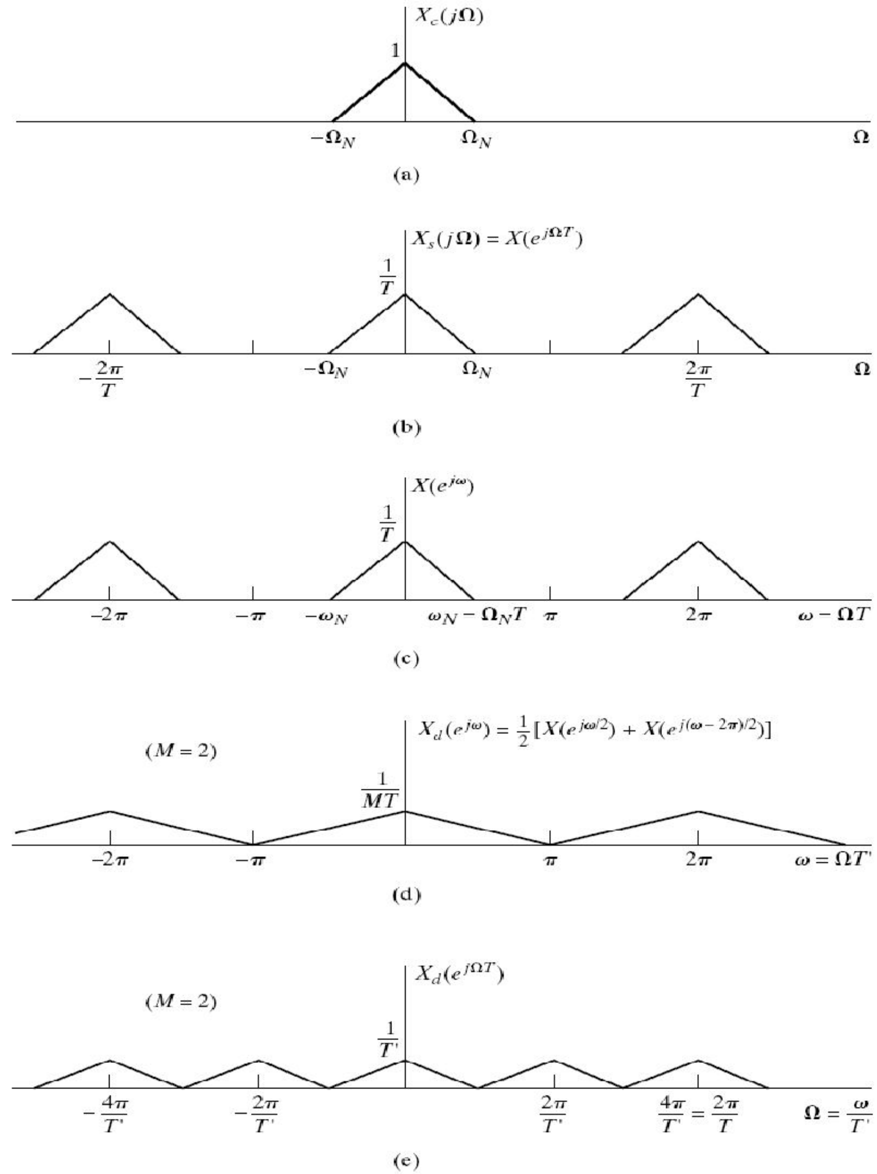


Figure 4.21 Frequency-domain illustration of downsampling.

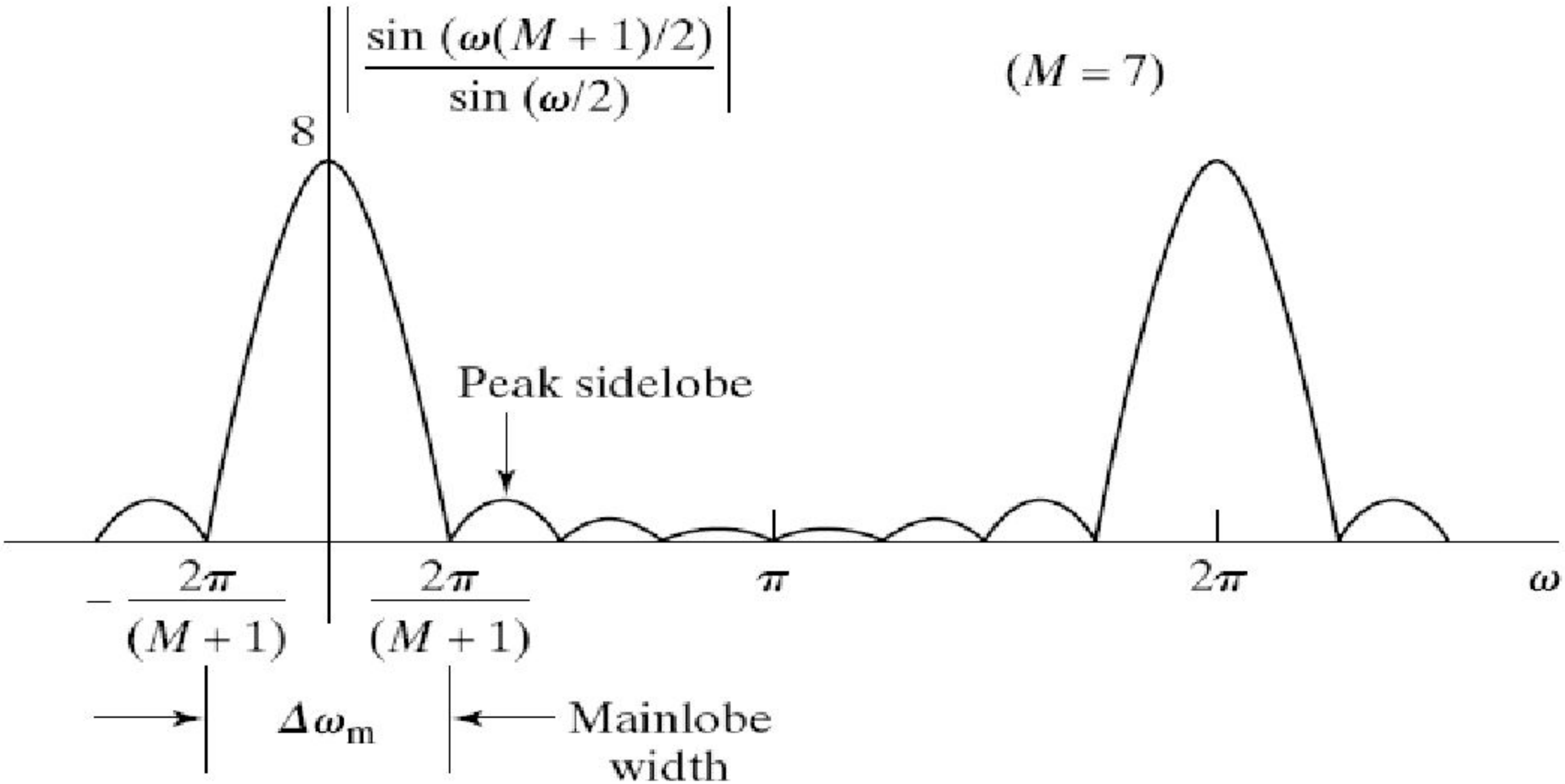


Figure 7.20 Magnitude of the Fourier transform of a rectangular window ($M = 7$).

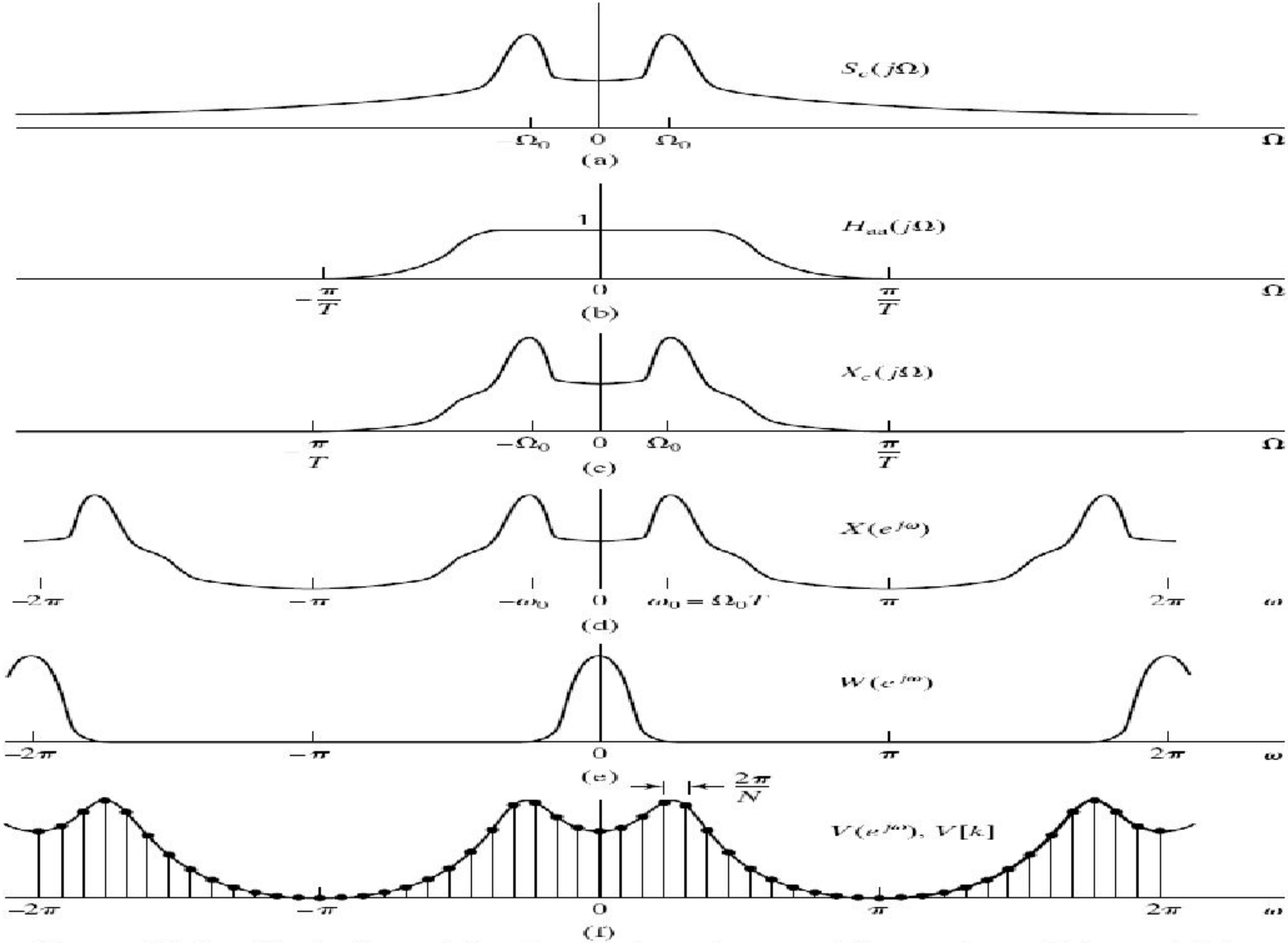


Figure 10.2 Illustration of the Fourier transforms of the system of Figure 10.1. (a) Fourier transform of continuous-time input signal. (b) Frequency response of antialiasing filter. (c) Fourier transform of output of antialiasing filter. (d) Fourier transform of sampled signal. (e) Fourier transform of window sequence. (f) Fourier transform of windowed signal segment and frequency samples obtained using DFT samples.

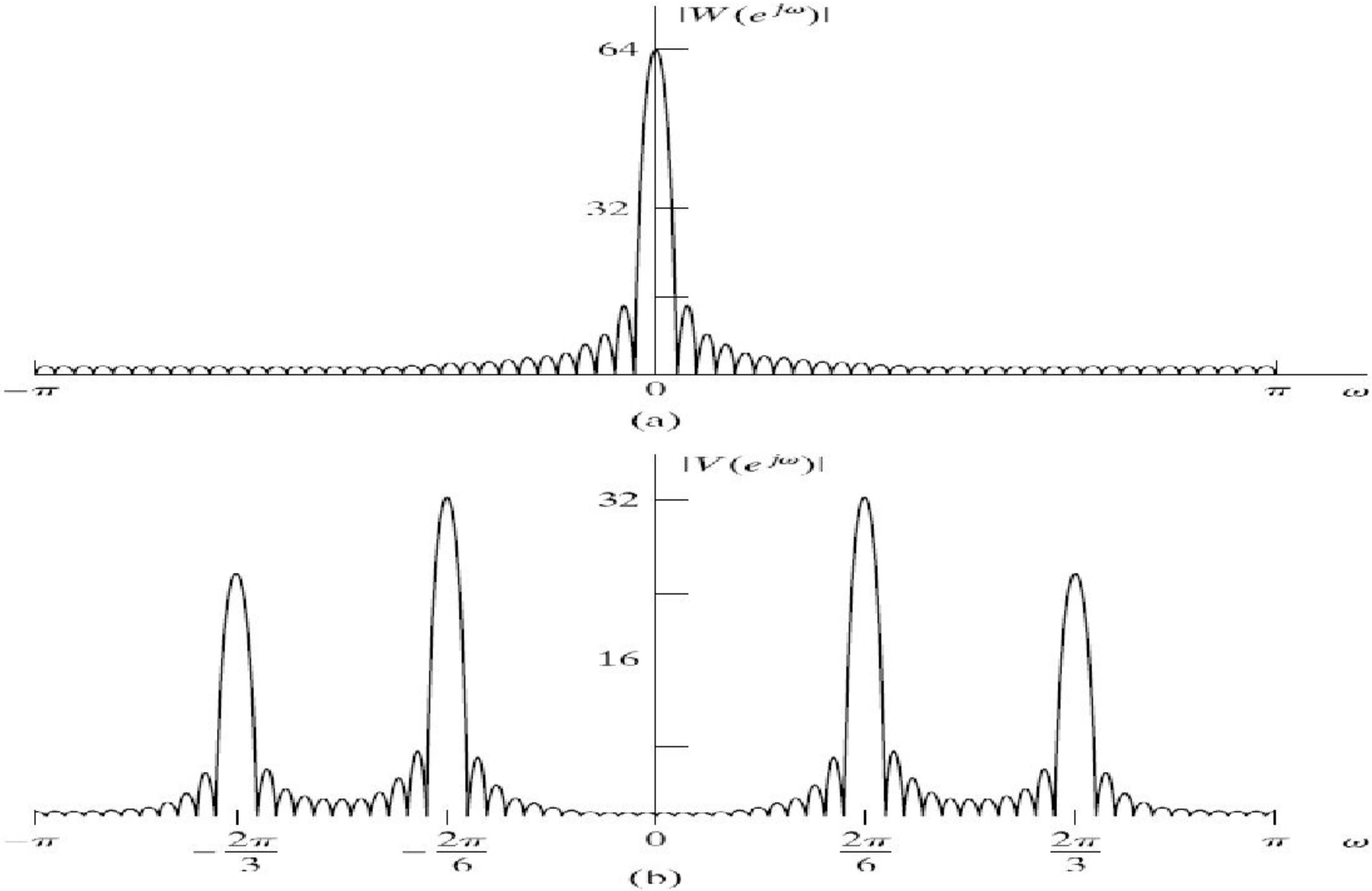


Figure 10.3 Illustration of Fourier analysis of windowed cosines with a rectangular window. (a) Fourier transform of window. (b)–(e) Fourier transform of windowed cosines as $\Omega_1 - \Omega_0$ becomes progressively smaller. (b) $\Omega_0 = (2\pi/6) \times 10^4$, $\Omega_1 = (2\pi/3) \times 10^4$.

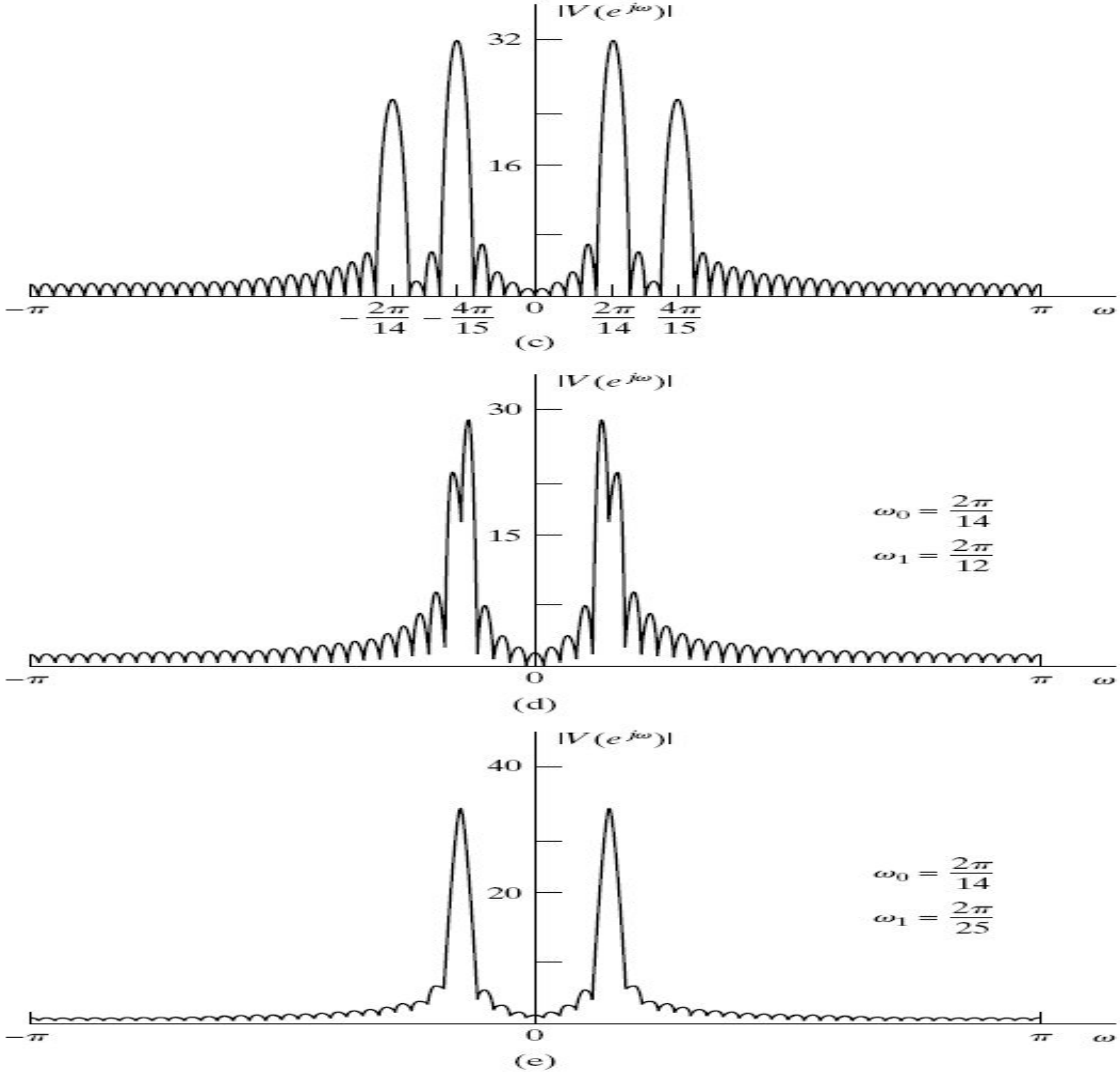


Figure 10.3 (*continued*) (c) $\Omega_0 = (2\pi/14) \times 10^4$, $\Omega_1 = (4\pi/15) \times 10^4$. (d) $\Omega_0 = (2\pi/14) \times 10^4$, $\Omega_1 = (2\pi/12) \times 10^4$. (e) $\Omega_0 = (2\pi/14) \times 10^4$, $\Omega_1 = (4\pi/25) \times 10^4$.

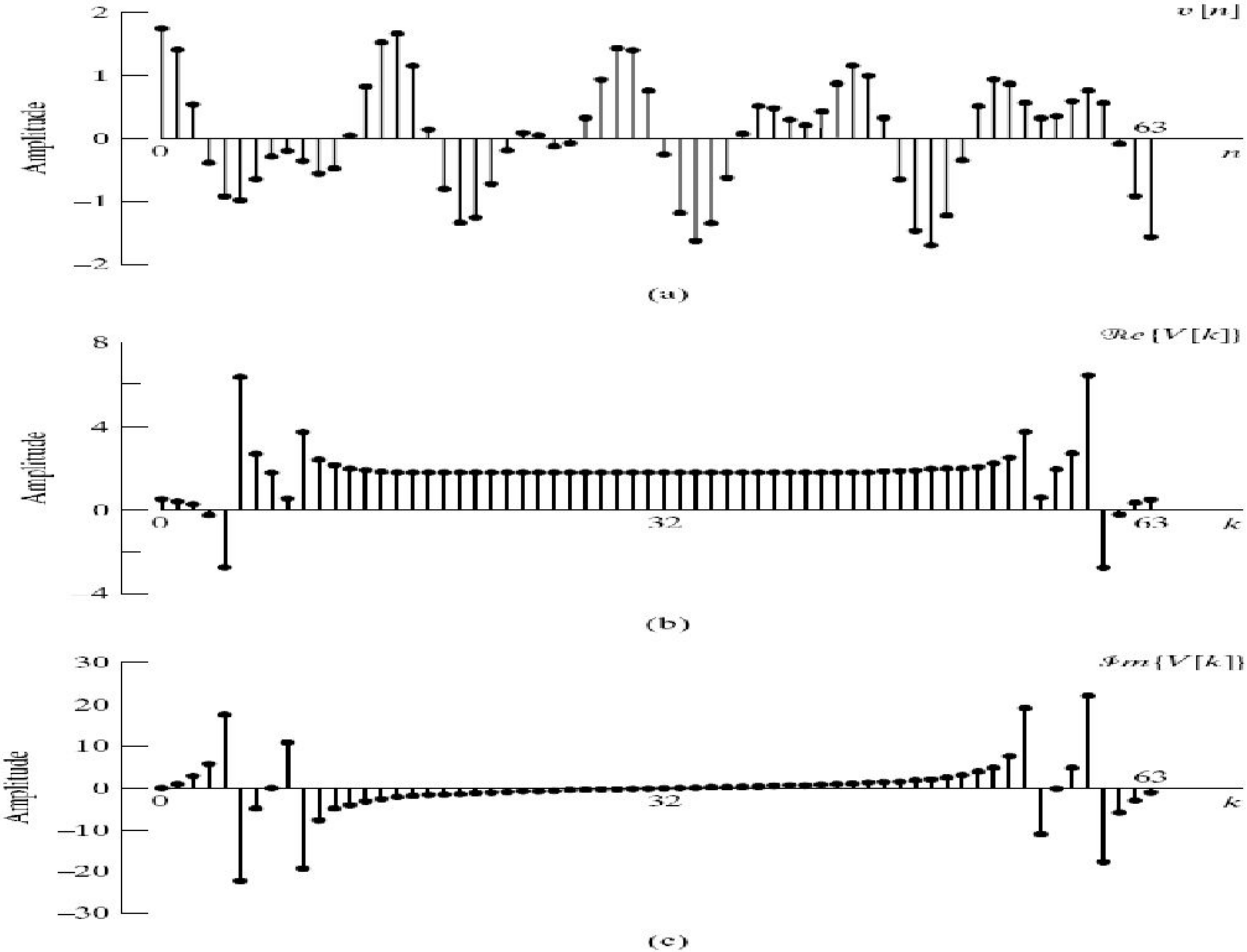


Figure 10.5 Cosine sequence and discrete Fourier transform with a rectangular window. (a) Windowed signal. (b) Real part of DFT. (c) Imaginary part of DFT.

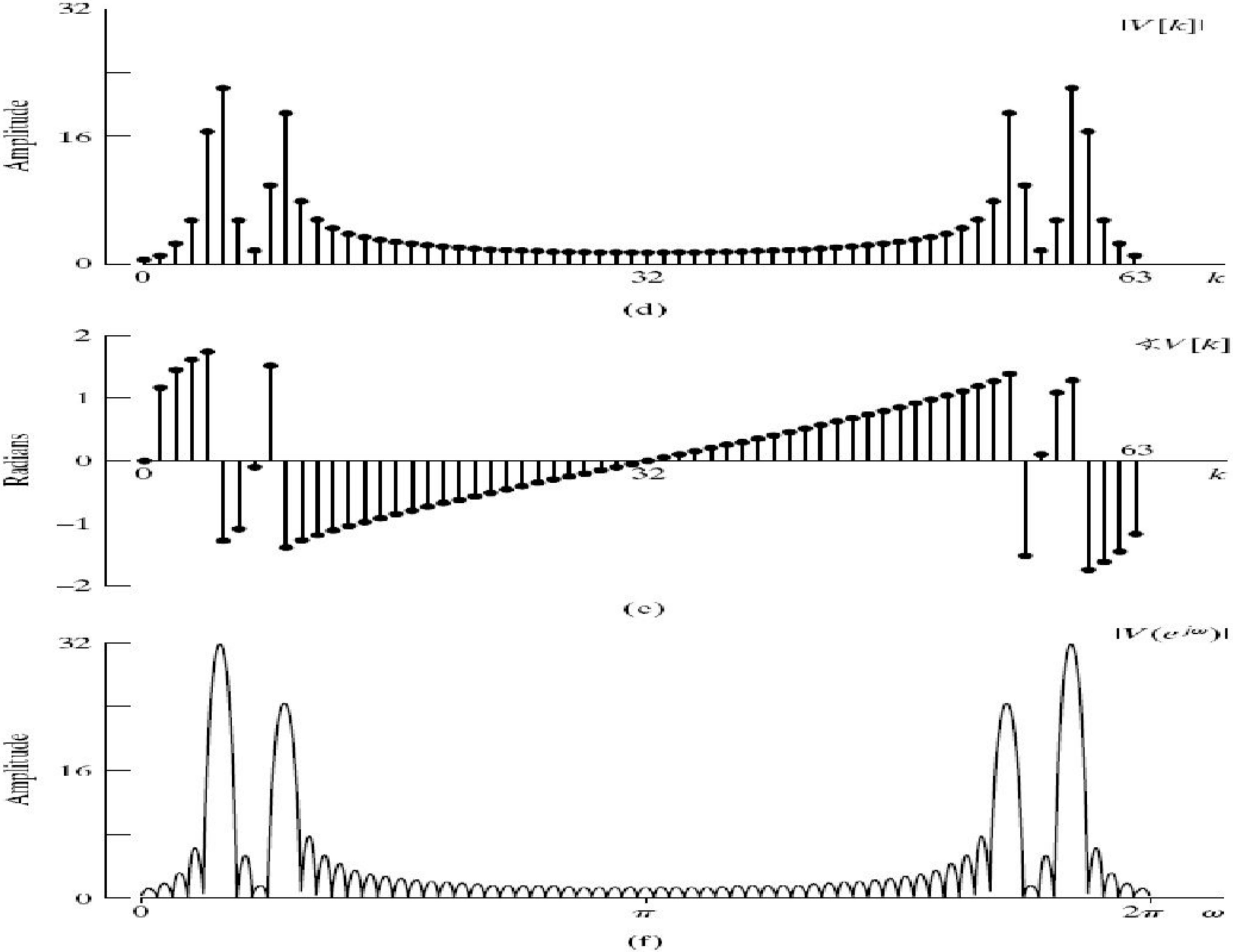


Figure 10.5 (*continued*) (d) Magnitude of DFT. (e) Phase of DFT. (f) Magnitude of discrete-time Fourier transform.

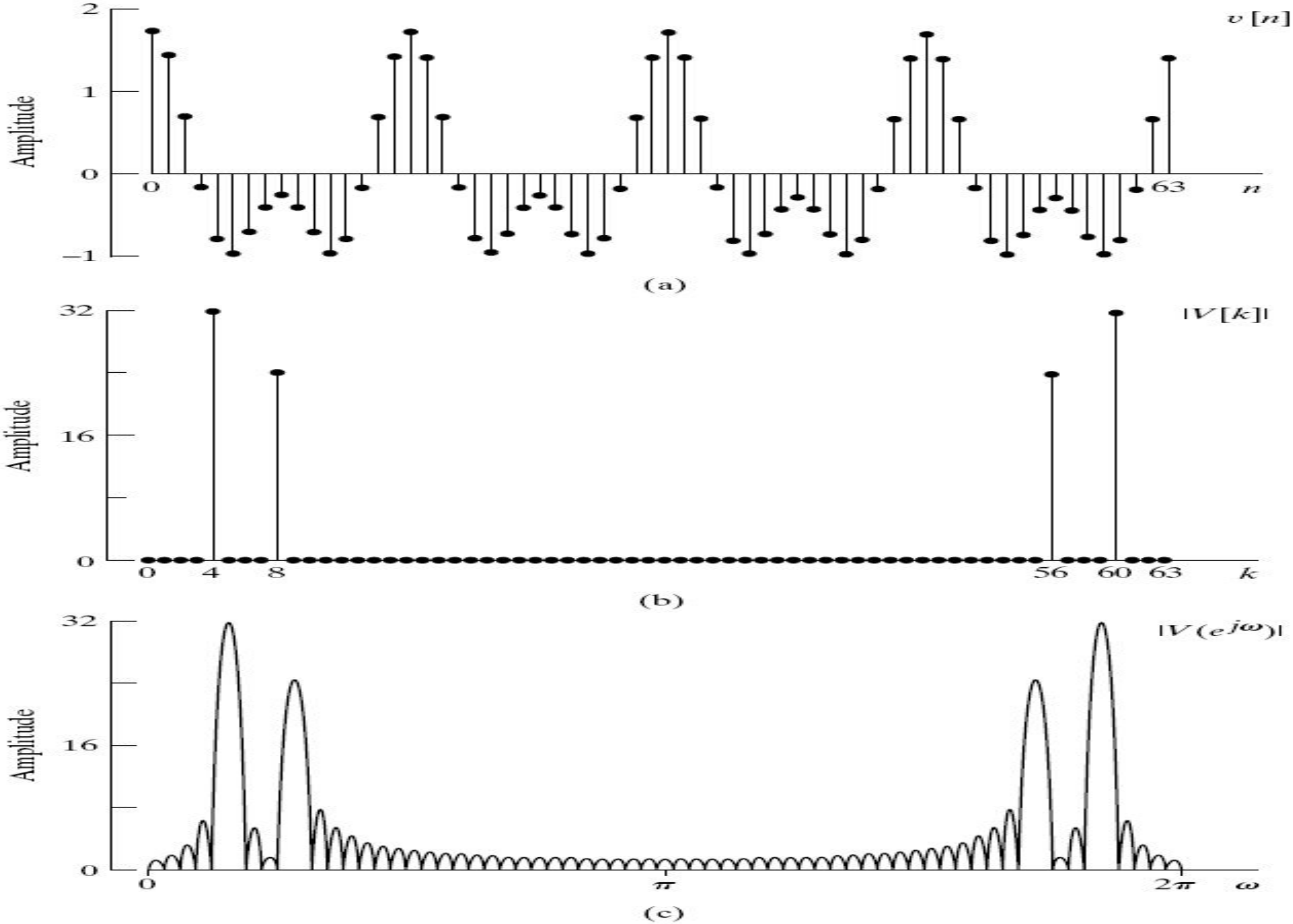


Figure 10.6 Discrete Fourier analysis of the sum of two sinusoids for a case in which the Fourier transform is zero at all DFT frequencies except those corresponding to the frequencies of the two sinusoidal components. (a) Windowed signal. (b) Magnitude of DFT. (c) Magnitude of discrete-time Fourier transform ($|V(e^{j\omega})|$).

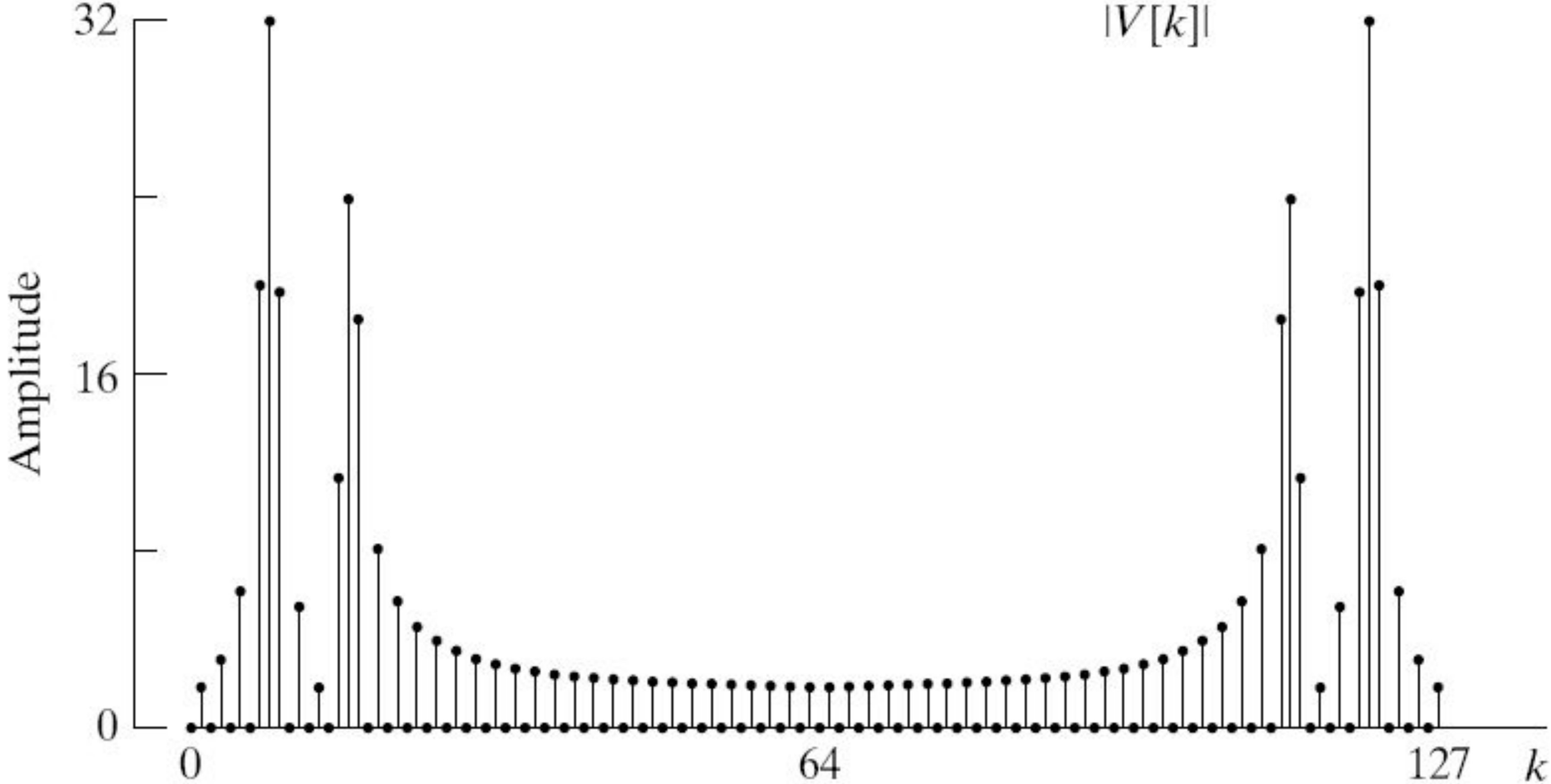


Figure 10.7 DFT of the signal as in Figure 10.6(a), but with twice the number of frequency samples used in Figure 10.6(b).

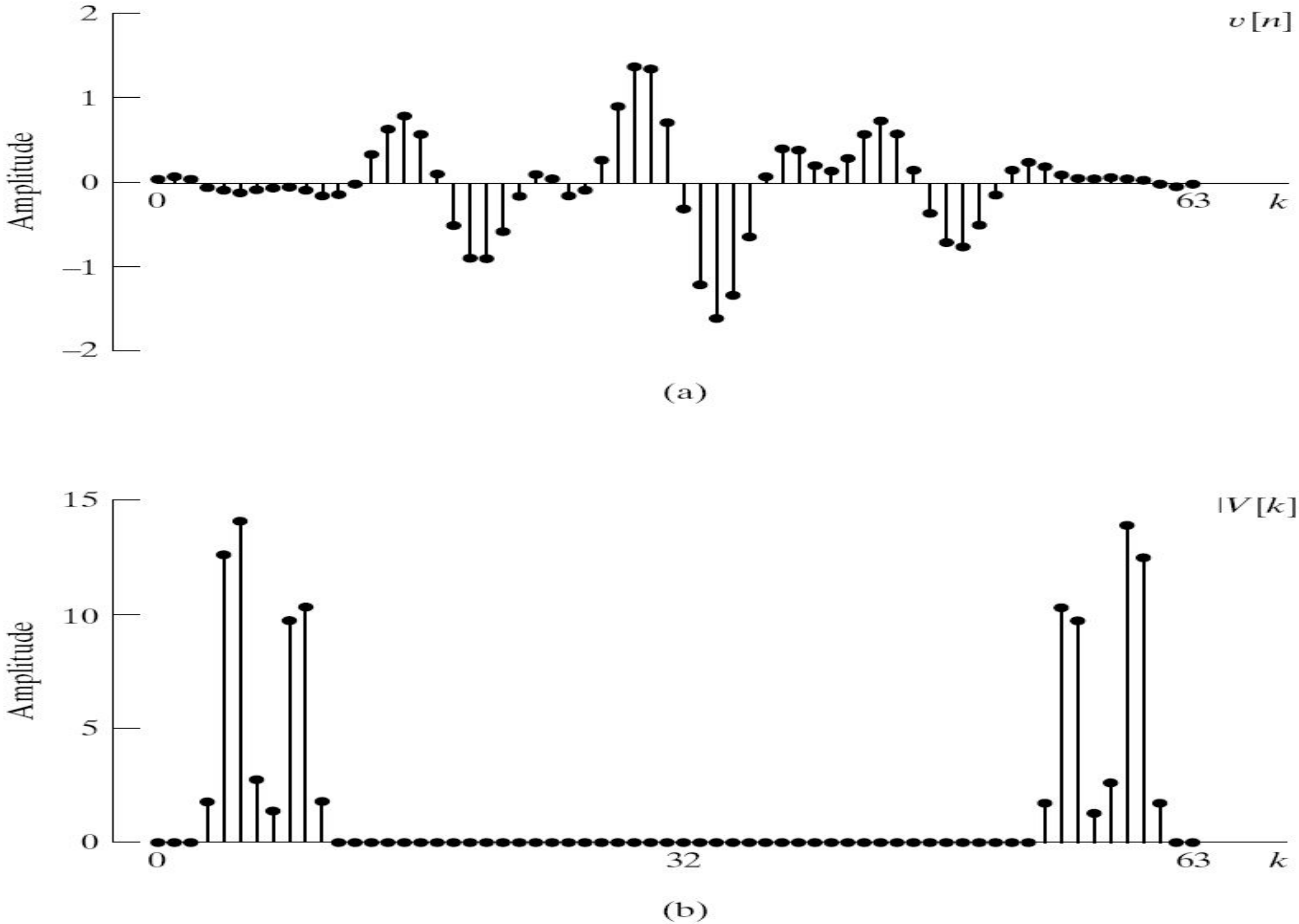


Figure 10.8 Discrete Fourier analysis with Kaiser window. (a) Windowed sequence for $L = 64$. (b) Magnitude of DFT for $L = 64$.

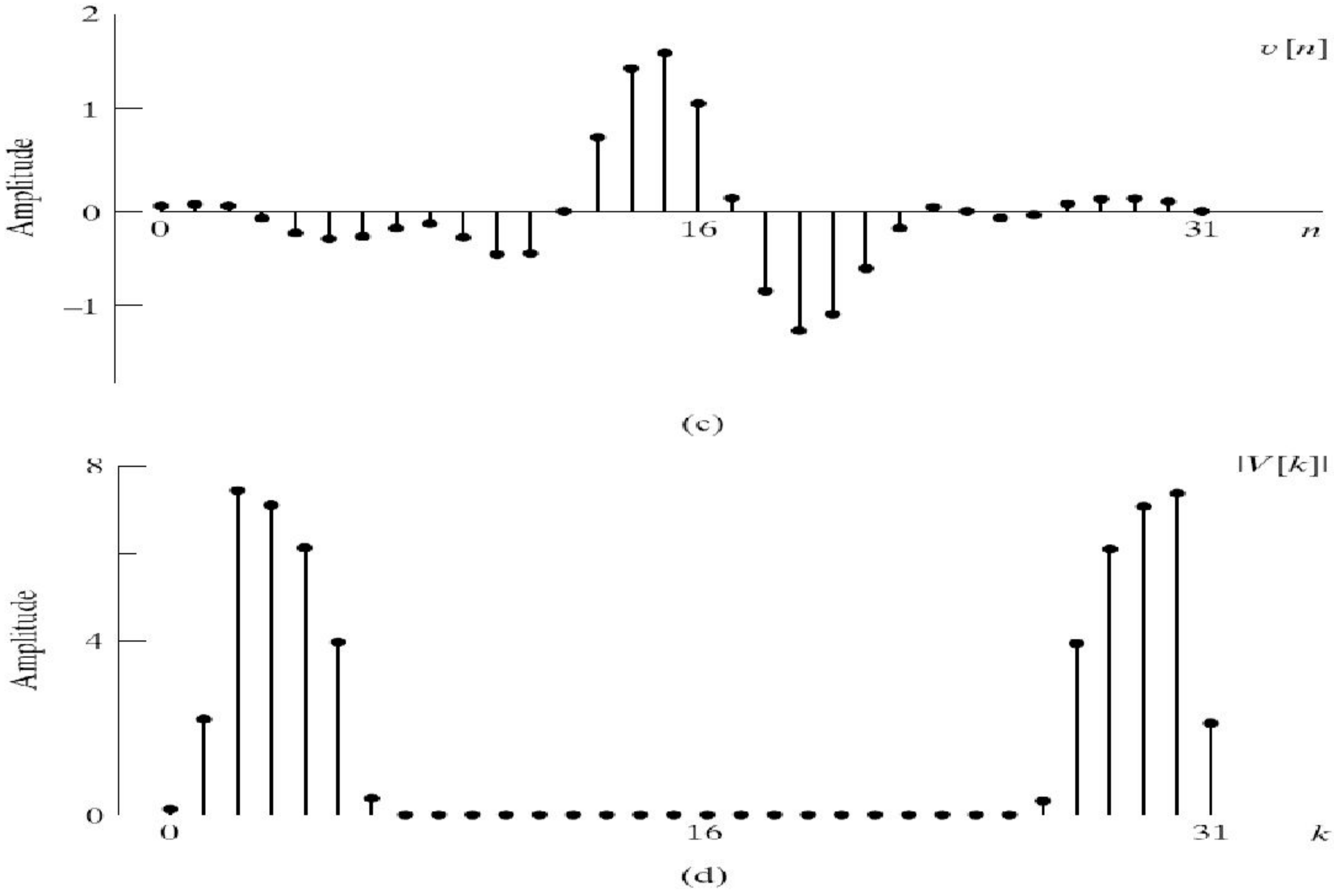


Figure 10.8 (*continued*) (c) Windowed sequence for $L = 32$. (d) Magnitude of DFT for $L = 32$.

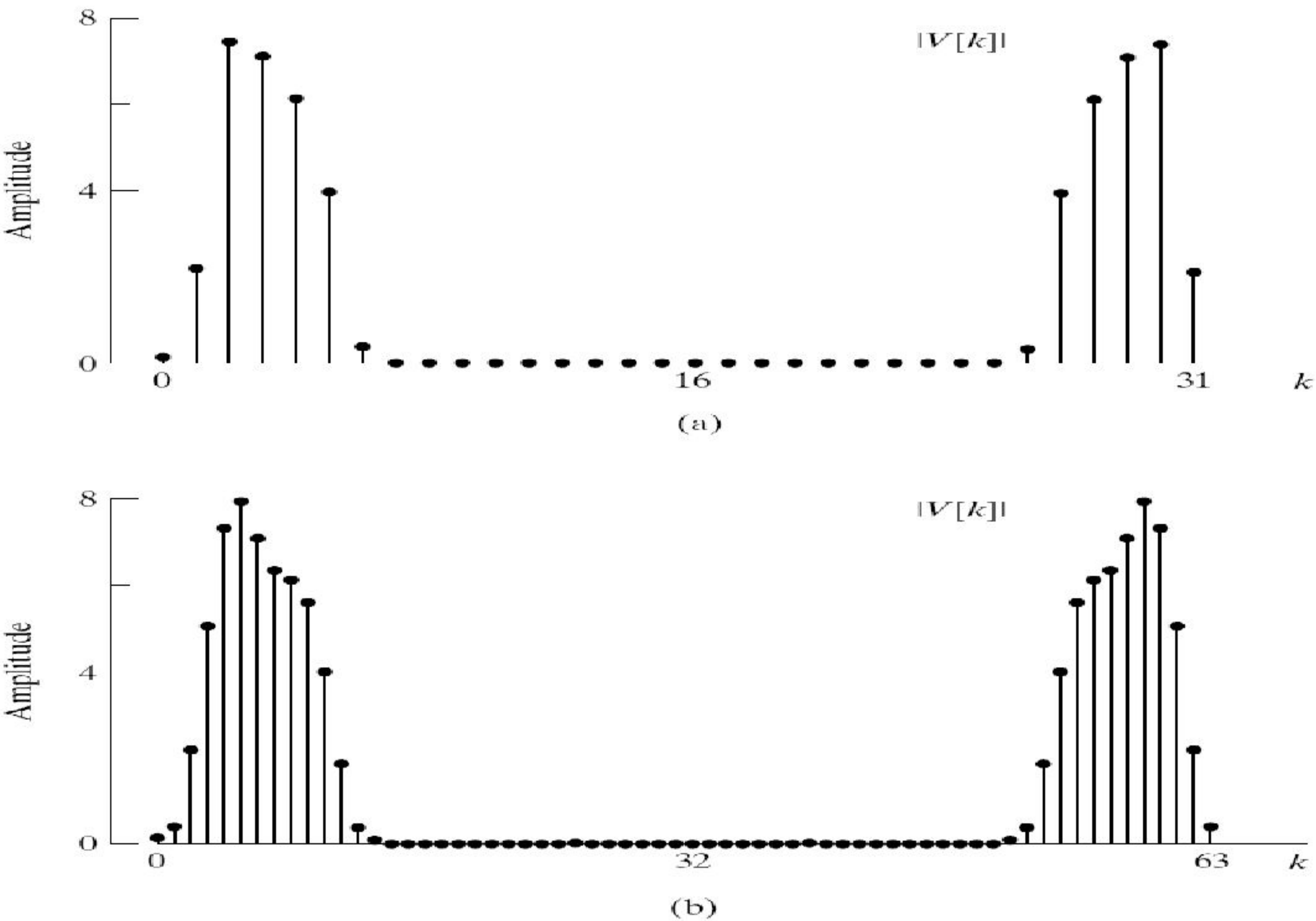


Figure 10.9 Illustration of effect of DFT length for Kaiser window of length $L = 32$. (a) Magnitude of DFT for $N = 32$. (b) Magnitude of DFT for $N = 64$.

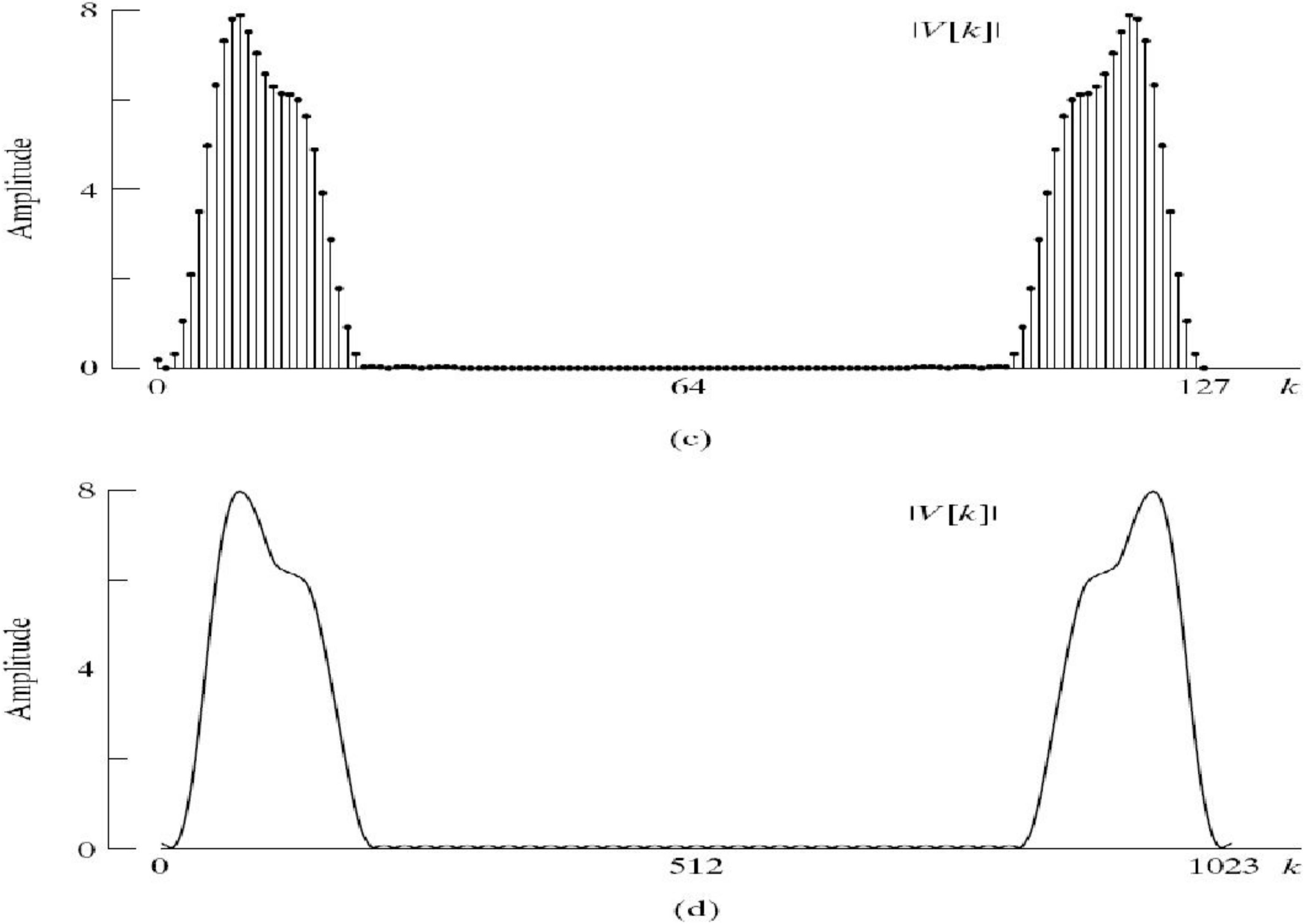


Figure 10.9 (*continued*) (c) Magnitude of DFT for $N = 128$. (d) Magnitude of DFT for $N = 1024$. (DFT values are linearly interpolated to obtain a smooth curve.)

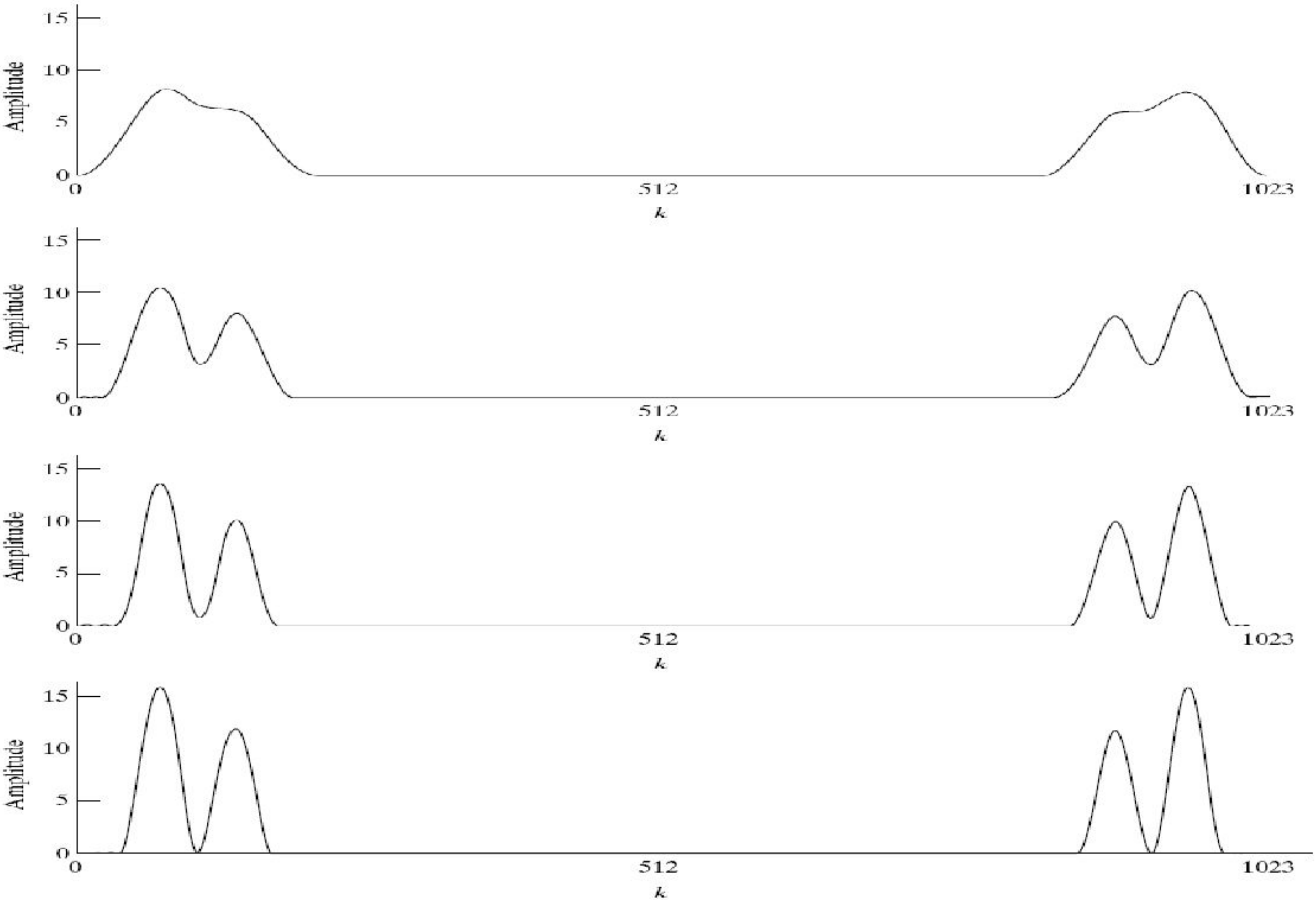


Figure 10.10 Illustration of the computation of the DFT for $N \gg L$ with linear interpolation to create a smooth curve (a) $N = 1024,\ L = 32$ (b) $N = 1024,\ L = 42$ (c) $N = 1024,\ L = 54$ (d) $N = 1024,\ L = 64$.