
CHAPTER 4

Signals

4.1 REVIEW QUESTIONS

1. A sine wave has three characteristics: the amplitude, the period or frequency and the phase. The amplitude is the value of the signal at any point on the wave; it is the distance from a given point on the wave to the horizontal axis. The period is the time a signal needs to complete one cycle and the frequency gives the number of periods in one second. The phase indicates the status of the first cycle and describes the position of the waveform at time zero.
3. Information can be in the form of data, voice, pictures, etc. To transmit information a transformation into electromagnetic signals is necessary.
5. Digital information: number of pages in a book, time measurement with a digital watch
7. Periodic signals consist of a continuously repeated pattern, whereas aperiodic signals have no repetition pattern.
9. Digital signal.
11. Seconds, milliseconds, microseconds, nanoseconds, and picoseconds.
13. A high frequency signal changes value in a short period of time; there are many changes in a short time. A low frequency signal has less changes within a certain time; the signal changes slowly.
15. The frequency of a signal refers to the number of periods in one second.
17. The vertical axis of both plots represents the amplitude. In the time-domain plot the horizontal axis represents the time and in the frequency-domain plot, the frequency.
19. Frequency-domain.
21. Time-domain.
23. Fourier analysis (Appendix D).
25. Bit rate refers to the number of bit intervals per second. It is equivalent to the frequency in analog signals.

4.2 MULTIPLE CHOICE QUESTIONS

27. c 29. a 31. b 33. d 35. c 37. b 39. b 41. b 43. c 45. b

4.3 EXERCISES

47.

- a. 10 KHz
- b. 25.34 MHz
- c. 108×10^6 KHz
- d. 2.456764 MHz

49.

- a. 4.17×10^{-2} s, 41.7 ms, 4.17×10^4 μ s, 4.17×10^7 ns, 4.17×10^{10} ps
- b. 1.25×10^{-7} s, 1.25×10^{-4} ms, 0.125 μ s, 1.25×10^2 ns, 1.25×10^5 ps
- c. 7.14×10^{-6} s, 7.14×10^{-3} ms, 7.14 μ s, 7.14×10^3 ns, 7.14×10^6 ps
- d. 8.33×10^{-14} s, 8.33×10^{-11} ms, 8.33×10^{-8} μ s, 8.33×10^{-5} ns, 8.33×10^{-2} ps

51.

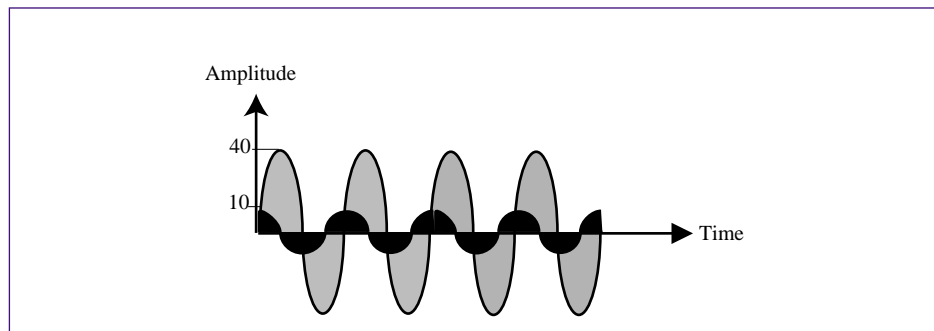
- a. 90 degrees
- b. 0 degrees
- c. 90 degrees
- d. 180 degrees

53.

- a. 1/8 cycle
- b. 1/4 cycle
- c. 1/6 cycle
- d. 1 cycle

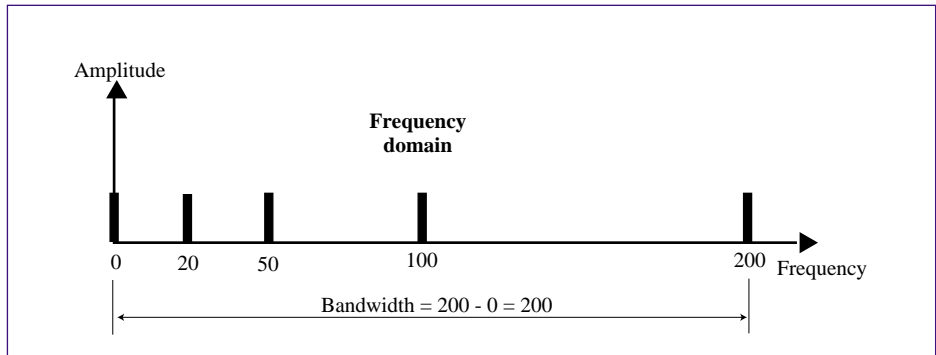
55. See Figure 4.1.

Figure 4.1 Exercise 55



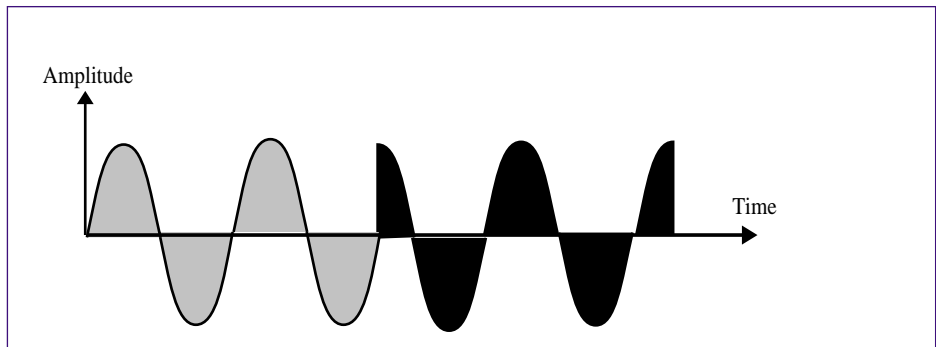
57. See Figure 4.2

Figure 4.2 Exercise 57



59. See Figure 4.3

Figure 4.3 Exercise 59



61. The bandwidth of a signal is the width of its frequency spectrum. In both cases, the frequency spectrum is not applicable, therefore the question can not be answered on this basis.

63.

- a. 0.01 s
- b. 5 μ s
- c. 0.2 μ s
- d. 1 ns

65. 500 Mbps

67. See Figure 4.4

69. 25 Hz

71. See Figure 4.5

73. 90 degrees

Figure 4.4 *Exercise 67*

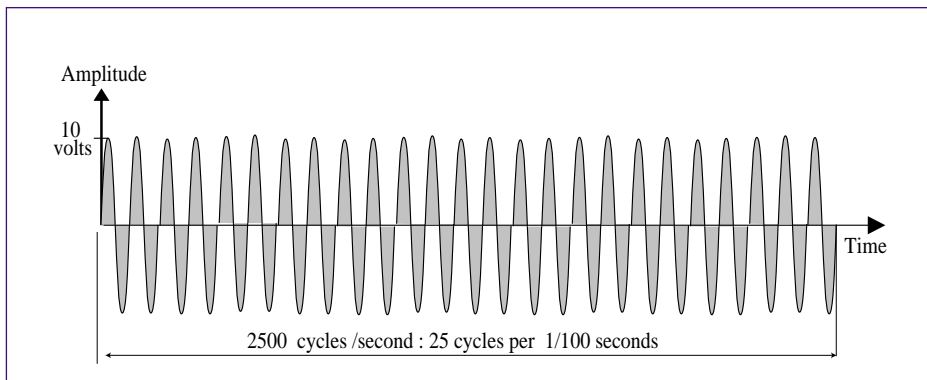


Figure 4.5 *Exercise 71*

