of a signal for notational convenience, but it is never dropped in any other place.

Self-Test

1. Change the equations for the following signals to describe the signals after they go through an ADC with a sample period of T seconds.

   (a) $x(t) = e^{-3t}$

   (b) $x(t) = 5t^2$

2. Compute the value of the sample for $n = 10$ for the following signals after they have gone through an ADC with the sample time $T = 0.05$ seconds.

   (a) $x(t) = 7\sin(25t)$

   (b) $x(t) = 2\cos(50t) - 4\cos(100t)$

3. Compute the values of the following signals after going through an ADC with $T = 0.1$ s for the values of n from 0 to 10.

   (a) $x(t) = 2\cos(10t)$

   (b) $x(t) = 2\cos(72.83t)$

4. For a digital filter system with the given ADC sample periods T, compute the Nyquist limit.

   (a) $T = 0.1$ s

   (b) $T = 0.002$ s

5. Determine which input signals to a digital filter or DSP system will be aliased by the given sample period T.

   (a) $x(t) = 2\cos(10t)$, $T = 0.1$ s

   (b) $x(t) = 8\cos(15t)$, $T = 0.2$ s

6. Determine whether the following signals will be aliased for the given sample period. If the signal is aliased into having the same sample values as a lower frequency sinusoidal signal, determine that lower sinusoidal signal.

   (a) $x(t) = 7\cos(25t)$, $T = 0.1$ s

   (b) $x(t) = 3\sin(37t)$, $T = 0.15$ s

   (c) $x(t) = 5\cos(160t)$, $T = 0.02$ s

7. Determine the equation $x(n)$ for the following signal $x(t)$, using only one cosine term, after it is sampled with a sample period of $T = 0.1$ s. Hint: The higher frequency sinusoid is aliased to what?

   $x(t) = 3\cos(7t) + 3\cos(69.83t)$

Problems

1. Change the equations for the following signals to describe the signals after they go through an ADC with a sample period of T seconds.

   (a) $x(t) = 3e^{-7t}$

   (b) $x(t) = 5\sin(3t)$

2. Compute the value of the sample for $n = 6$ for the following signals after they have gone through an ADC with the sample period $T = 0.02$ seconds.

   (a) $x(t) = 12\cos(3t)$

   (b) $x(t) = 7 - 8e^{-2t}$

3. Compute the values of the following signals after going through an ADC with $T = 0.05$ s for the values of n from 0 to 3.

   (a) $x(t) = 0.25t^2$

   (b) $x(t) = 3\sin(20t) - 5\cos(40t)$

4. For a digital filter system with the given ADC sample periods T, compute the Nyquist limit.

   (a) $T = 0.025$ s

   (b) $T = .001$ s

5. Determine which input signals to a digital filter or DSP system will be aliased by the given sample period T.

   (a) $x(t) = -2\cos(10t)$, $T = 0.3$ s

   (b) $x(t) = 4\sin(105t)$, $T = 0.03$ s

6. Determine whether the following signals will be aliased for the given sample period. If the signal is aliased into having the same sample values as a lower frequency sinusoidal signal, determine that lower sinusoidal signal.

   (a) $x(t) = 17\sin(25t)$, $T = 0.1$ s

   (b) $x(t) = 4\cos(3t) + 2.5\sin(100t)$, $T = 0.05$ s

   (c) $x(t) = 5\cos(160t)$, $T = 0.02$ s

7. Determine the equation $x(n)$ for the following signal $x(t)$, using only one cosine term after it is sampled with a sample period of $T = 0.003$ s. Hint: The higher frequency sinusoid is aliased to what?

   $x(t) = 2\cos(15t) + 2\cos(2079.4t)$

Answers to Self-Test

1a. $x(n) = e^{-3nT}$

1b. $x(n) = 5(nT)^2$

2a. $x(10) = -0.464$

2b. $x(10) = -1.877$

3. $x(0) = 2.0$, $x(1) = 1.08$

4a. 31.4 rad/s

4b. 1570.7 rad/s

5a. not aliased

5b. aliased

6a. not aliased

6b. aliased, $-3\sin(4.89t)$

6c. aliased, $5\cos(154.2t)$

7. $x(n) = 6\cos(0.7n)$