Homework 8

Chapter 14

25. Using MATLAB (or an equivalent mathematical computer tool), graph the signal

$$x(t) = 3\cos(20\pi t) - 2\sin(30\pi t)$$

over a time range of $0 < t < 400$ ms. Also graph the signal formed by sampling this function at the following sampling intervals: (a) $T_s = 1/120$ s, (b) $T_s = 1/60$ s, (c) $T_s = 1/30$ s and (d) $T_s = 1/15$ s. Based on what you observe, what can you say about how fast this signal should be sampled so that it could be reconstructed from the samples?

32. Find the Nyquist rates for these signals.

(a) $x(t) = 15\text{rect}(300t)\cos(10^4\,\pi t)$
(b) $x(t) = 7\text{sinc}(40t)\cos(150\pi t)$

34. Graph the signal $x[n]$ formed by sampling the signal $x(t) = 10\sin(8\pi t)$ at twice the Nyquist rate and $x(t)$ itself. Then on the same axes, graph at least two other continuous-time sinusoids that would yield exactly the same samples if sampled at the same times.

39. How many sample values are required to yield enough information to exactly describe these bandlimited periodic signals?

(a) $x(t) = 8 + 3\cos(8\pi t) + 9\sin(4\pi t)$
(b) $x(t) = 8 + 3\cos(7\pi t) + 9\sin(4\pi t)$

44. Sample the bandlimited periodic signal $x(t) = 15\cos(300\pi t) + 40\sin(200\pi t)$ at exactly its Nyquist rate over exactly one fundamental period of $x(t)$. Find the DFT of those samples. From the DFT, find the CTFS harmonic function. Graph the CTFS representation of the signal that results and compare it with $x(t)$. Explain any differences. Repeat for a sampling rate of twice the Nyquist rate.