Homework 6

Wednesday, April 7, 2021 3:33 PM

"I pledge my honor I have abided by the Stevens Honor system."

- Alex Jaskins

5.19 **What would be the minimum sampling rate to avoid false aliasing for the function in Problem 5.16?**

$$f(t) = 5\sin(10\pi t) + 3\cos(40\pi t)$$

$$f_s = 30 \text{ samples/second}$$

$$f_m = \frac{40\pi}{2\pi} = 20 \text{ Hz}$$

$$f_s = 2f_m = 2(20) = \boxed{40 \text{ Hz}}$$

5.22 **What would be the minimum sampling rate to avoid false frequencies in the sampled data for the function in Problem 5.20?**

$$x(t) = 3\cos(500\pi t) + 5\cos(800\pi t)$$

$$f_s = 400 \text{ samples/second}$$

$$f_m = 400 \text{ Hz}$$

$$f_s = 2f_m = 2(400) = \boxed{800 \text{ Hz}}$$

1. You are given a non-sinusoidal periodic signal with a frequency of F cycles/sec. At what frequency (or frequencies) would you expect to find the energy of the signal located?

$$\text{Energy} = \int_{-\infty}^{\infty} |x(t)|^2 \, dt$$

$$= \int_{-\infty}^{\infty} |x(t)|^2 \, df$$

Energy of a signal is calculated at all of the frequencies from $-\infty$ to $+\infty$.

2. When is the Fourier transform used and not the Fourier series?

Fourier transform is used for aperiodic signals while fourier series is used for periodic signals.

3. In our lecture, we discussed an important observation on how the Fourier transform was obtained from the Fourier series. What was this observation? Please discuss.

If the period of the signal increases, then then the frequency decreases.

As Period $(T) \to \infty$, $\omega = \frac{2\pi}{T} \to 0$

Thus, the discrete spectrum will become a continuous signal.