EECS351 Discussion 1 with MATLAB demo SOLUTIONS, 09/08/16

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6 MATLAB Problem Solutions

6.1 Generate a Signal

» x = [3 5 1];

6.2 Plot a Signal

» stem(x)

6.3 Generate a longer signal

This question was somewhat open ended. But to create a cosine wave, there's a certain way we often declare t:

» t = 0:1/(fs):duration;

» cosWave = cos(t);

6.4 Music Processing Basics

What is x[n]?

$$x[n] = \begin{cases} x(n/(fs)), & n \,\epsilon\, \mathbb{Z} \text{ (T is the sampling frequency)} \\ 0, & otherwise \end{cases}$$

$$x[n] = \begin{cases} cos(2\pi 400n/44100), & n \,\epsilon\, \mathbb{Z} \text{ (fs is the sampling frequency)} \\ 0, & otherwise \end{cases}$$

Create x[n] in MATLAB using the variable t from 1.3. Name the variable x.

» t = 0:1/44100:duration;

» x = cos(2*pi*400*t)

» plot(t,x) or stem(t,x)

» xlabel('time')

» ylabel('Value of Cosine')

6.5 Analyze the Signal

» Fourier = fft(x)

» plot(abs(fftshift(Fourier)))

Theoretical Problems

7 Alternative Expressions for Sequences

Let $x[n] = \begin{cases} \left(\frac{1}{2}\right)^n, & n \text{ nonnegative multiple of } 4 \\ -\left(\frac{1}{2}\right)^n, & n \text{ nonnegative multiple of } 2, \text{ but not a nonnegative multiple of } 4 \\ 0, & \text{otherwise} \end{cases}$

Express $x[n]$ mathematically in three different ways.

1. $x[n] = \{\underline{1}, 0, \frac{-1}{4}, 0, \frac{1}{16}, 0, \frac{-1}{64}, ...\}$
2. $x[n] = \delta[n] - \frac{1}{4}\delta[n-2] + \frac{1}{16}\delta[n-4] - \frac{1}{64}\delta[n] + ...$
3. $x[n] = \sum_{k=0}^{\infty} (-1)^k (\frac{1}{4})^k \delta[b-2k]$
4. $x[n] = u[n] cos\left(\frac{\pi}{2}n\right)\left(\frac{1}{2}\right)^n$