ECEN 444: Matlab Assignment 1

Due February 26, 2009

1 Overview

We will start to explore the use of MATLAB to represent, manipulate, and analyze discrete-time signals and systems. MATLAB can be started by typing "matlab" at most workstations. Links to some MATLAB tutorials are located on the website and you can also look at:

http://www.mathworks.com/access/helpdesk/help/techdoc/matlab.html

You may also be able check out a copy of "The Student Edition of MATLAB User's Guide" or "The Matlab User's Guide". However, in most cases you should be able to get the explanation of the functions needed for the homework by typing "help [function name]" in the MATLAB command window. Or if you just have some idea of what you are looking for, you may type "lookfor [keyword]". It will list all functions related to the keyword.

When working on the project, please follow the instructions and respond to each item listed. Your project grade is based on: (1) your Matlab script, (2) your report (plots, explanations, etc. as required), and (3) your final results. Several example Matlab script files have been posted on the website. The desktop version of Matlab also includes a script editor which highlights the syntax.

The project report should include all your scripts and plots. It is often easier to combine these using Microsoft Word or Powerpoint. For example, you can copy/paste figures from MATLAB into these applications. You must clearly display the associated problem number and label the axes and on your plots to get full credit. Submission can be done electronically in PDF format or on paper.

2 Exercises

2.1 Basic Sinusoid

Consider the continuous-time signal

$$x_a(t) = \sin\left(2\pi F t + \frac{\pi}{4}\right),$$

where $F = 0.25$ Hz.

(a) Plot this signal for `t=-10:0.01:10` using `plot(t,xa)`. Use the commands `xlabel` and `ylabel` to label the axes.

(b) Generate the discrete-time signal $x(n) = x_a(nT)$ for $T = 1$ and `n=-10:10`. Plot this using `stem(n,x)`.

(c) Use a `for` loop to compute and plot the DTFT (for `w=-3.14:0.01:3.14`) of

$$y(n) = \begin{cases} x_a(nT) & \text{for } n = 0, \ldots 99 \\ 0 & \text{otherwise} \end{cases}.$$

2.2 Convolution

Use the MATLAB command `conv` to compute the convolutions $x(n)*h(n)$ and $h(n)*x(n)$ of the following two sequences:

$$x(n) = \{1, 2, 3, \underset{\uparrow}{5}, 2, 4\}$$

$$h(n) = \{4, \underset{\uparrow}{0}, -2, 3, 1\}$$

(a) Plot the input sequences with the correct time indices using the `stem` command.

(b) Plot the output sequences from both convolutions with the correct time indices using the `stem` command. Notice that there will be non-zero values with negative time indices.

(c) Verify the convolution identity of the DTFT by plotting the DTFT of $x(n) * h(n)$ and the product of the DTFTs of $x(n)$ and $h(n)$.

2.3 For Next Time

There are a number of ways to record sound on your computer. First, you need to find a microphone that works with your computer sound card. Then, you will need an application that allows you to record with a chosen sample rate and bit resolution (e.g., this feature is included in the XP sound recorder application but was removed in Vista).

One method is to use the `audiorecorder` function in MATLAB. Type `help audiorecorder` and follow the directions there. Make sure that you can record sound at at 16-bit resolution with an 8 KHz sample rate.