University of Notre Dame
Department of Electrical Engineering
EE 30344 – Signals and Systems I
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September 22, 2006 mh

Homework 6

Due: Friday, October 6, 2006, in class

Reading: cf. `http:/www/nd.edu/~mhaenggi/ee344/overview.html`

Problems from textbook: 3.31, 3.41, 3.32a*; 3.34a,b; 3.38, 3.44; 3.56**

*Solve the equations in Matlab using `inv()` and hand in your result with the written homework. Remember that both i and j are pre-defined in Matlab as $\sqrt{-1}$.
**Use the multiplication property.

Problems from exercise book: 3.5a-d (read 3.1 first).

Matlab problems:

(a) Modify the function you wrote in Computer Explorations exercise 1.5a to implement equation (2.113) of the text with N=M=1. This will require the declaration to be of the form `y=diffeqn(a, b,x,yn1)`, where a,b and x are vectors. x may be of arbitrary length, so `diffeqn()` should use the `length()` function to figure out its dimension. For this exercise you may "hard wire" N=M=1, or have your function find and use the lengths of a and b.

(b) In the directory `/afs/nd.edu/courses/ee/ee30344.01/sounds/` you will find several digital audio files. Write a MATLAB program which will load the file audio.mat (or similarly named files) and play it using the command `soundsc(audio)`. Write a MATLAB function which calls your new `diffeqn()` to process the the audio vector. Write two output data files, `audiofilt1.mat` and `audiofilt2.mat` which result from setting, respectively, a_0=1, a_1=-0.9, b_0=1.0 ,b_1=0.5, and a_0=1, a_1=0.9, b_0=1.0, b_1=-0.5. Listen to the filtered vectors and comment on the effects your filters have had on them. A convenient way to listen to them all together for comparison is to dump them all into one vector: `soundvec = [audio audiofilt1 audiofilt2]` (for all row vectors); `soundsc(soundvec)`. Put your MATLAB programs with comments and all output files into your dropbox under `(afs_id)/hw6`.

(c) Read tutorial 2.2 in the Computer Explorations book and write a Matlab program that does the filtering operations above using the `filter` command.