MAS.160 / MAS.510 / MAS.511 Signals, Systems and Information for Media Technology
Fall 2007

MAS 160/510 Problem Set Two

1. **Phase and Time shifting.** *DSP First* **2.17(a)**

2. **Switching between frequency-domain and time-domain**

   (a) *DSP First* **3.2**

   (b) *DSP First* **3.3(a),3.3(b)**

3. **Fourier Series**

   Determine the Fourier series for the following periodic signals of period T_o:

   (a)

   $$x(t) = \quad t^2, \quad 0 \leq t < T_o$$

   (b)

   $$x(t) = \begin{cases} t, & 0 \leq t < T_o/2 \\ 1, & T_o/2 \leq t < T_o \end{cases}$$

   For the following lab exercises (found in Appendix C of the *DSP First* text), please turn in a hard copy of your functions.

4. *DSP First* **Lab 3**

   You only need to synthesize one of the 5 musical pieces given (your choice).

   Items to be turned in:

   (a) Your `note` function.

   (b) Your `play_scale` fuction.

   (c) A function that outputs sound for one of the given musical pieces.

   (d) **(MAS.510)** Now that you have listened to your synthesised notes, aren't the transitions between different notes very choppy and abrupt? Generate a function that outputs the same piece of music you had selected in (c) but with a smoother transition or basically gives the notes a nice fade. *Hint: make a mathematical expression or function that degrades the magnitude of the note against time.*

5. *DSP First* **Lab 4**

You only need to synthesize one of the FM instruments (bell or clarinet).

Items to be turned in:

(a) Your `mychirp` function (this should look familiar :).

(b) Your `beat` function.

(c) Plots and answers to questions specified in C.4.3.3.

(d) Either your `bellenv` and `bell` functions, or your `woodwenv` and `clarinet` functions.

6. **Additional problem (for MAS.510)**

Playing with sounds in your envoironment

(a) Record a simple "pure" tone. Choose any length of time you desire. Plot the sound in time and also using a spectrogram (use the `specgram` function in MATLAB). Try to determine the dominant pitch in the simple tone and justify how it was determined.

(b) Record your favorite piece of music or any sound for a time duration of 2 secs(in wav format, using `wavread` command in MATLAB). Plot the spectrogram of the sound you just recorded. Suggest a way in which you could determine the pitch from the spectrogram if you didn't know what it was to begin with.