COMPUTER MUSIC TECHNIQUES: DSP
Faculty of Arts and Sciences, Music Department, NYU
Fall 2013

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Tuesdays (4) / 5 - 7pm

Description:

In this course we will study the theory and technique for the synthesis, analysis, and transformation of digital audio signals. We'll mainly look at ways to produce sounds that come out of loudspeakers either by synthesizing them or by transforming incoming signals. Some of these techniques are digital implementations of electronic music techniques and others are native to the digital medium. These techniques are potential building blocks for future creative work in interactive music composition, instrument design, sound installation, among others, and an opportunity to review concepts in music and sound cognition, and electronic music history. We will try to explore examples in these fields whenever possible.

The course examples will be presented in the Pure Data programming languages (Pd), and this will be an excellent opportunity to learn or further your knowledge of this programming environment. However, using a similarly flexible environment of your preference (Max, SuperCollider, Csound, RTcmix, and the like) is not only possible, but very welcome.

The class will meet once a week for a two hour lecture preceded by one hour of "lab session". The theory and the new Pd "objects" and skills will be presented in detail during each lecture, while the "lab session" provides an opportunity to try out these techniques with the help of the instructor, and each other.

Grading?

Exercises will be provided, but they are optional. I would encourage you to see this course as laying the groundwork for a larger project which you can complete in the spring.

Recommended Books:

Dodge, Charles, and Thomas A. Jerse. *Computer Music: synthesis, composition and performance*. Macmillan Library Reference, 1997.
Moore, F. Richard. *Elements of computer music*. Prentice-Hall, Inc., 1990.
Puckette, Miller. *The Theory and Techniques of Electronic Music*. World Scientific, 2007.
Roads, Curtis. *The computer music tutorial*. The MIT press, 1996.

Tentative Outline:

Weeks 1-2:   Installing, testing and running Pure Data / Brief introduction to digital audio / Sampling Rate / Creating, editing and saving patches / Defining sine waves or sinusoids / Learning to control the frequency and amplitude of a sinusoid / Adding sinusoids / Multiplying signals / line segments and time varying amplitude / clicking / controlling / hot and cold inlets. {New objects: osc~, +~, *~, dac~, bang, print/print~, number boxes, array, tabwrite~, line/line~, metro, delay, +, -, *, /, delay}

Week 3-4:   Wavetable oscillators / interpolation / frequency and pitch / amplitude units / writing and reading tables / sending and receiving / packing and unpacking / sub-patches. {New objects: phasor~, cos~, tabread~, tabwrite, mtof/ftom, dbtorms/rmstodb, send/receive, pack/unpack}

Week 5-7:   Toggle / Building a counter / loading sound files into tables / playing back sound files / third order interpolation / transposition and playback speed / loops / sample scratching / windowed sample playback / polyphonic sampler / dollar-sign arguments / creating abstractions / granular synthesis 1. {New objects: float, mod, loadbang, soundfiler, tabread4~, toggle, trigger, route, inlet/outlet, poly, throw~/catch~, random}

Weeks 8-9:   Introduction to spectra / graphing spectra / advanced additive synthesis / waveshaping / harmonic and inharmonic spectra / ring modulation / polynomials / exponential / frequency modulation / ADSR envelope generators. {New objects: clip~, abs~}

Week 10-12: Basic delay / recirculating delay network / artificial reverb / resonant filters / pitch shifting / low pass filter / high pass filter / band-pass filter / granular synthesis 2. {New objects: block~, noise~, delwrite~, delread~, vd~, hip~, lop~, bp~, vcf~}

Week 13-14: Connecting midi interfaces / envelope followers / pitch detectors / keyboard and mouse information / building an autotune? / from timbre to pitches. {New objects: env~, fiddle~, sigmund~, midi objects}