ELEN E6820 Speech & Audio Processing & Recognition   Assignment 2

Dan Ellis <dpwe@ee.columbia.edu>

Assigned: Thursday 2009-01-29   Due: Thursday 2009-02-05

Background reading: Read the chapters in Gold & Morgan from the section on acoustics i.e. chapters 10, 11, 12 and 13. Some of this is background material – in particular, the holography is purely for your curiosity – and much of the rest recaps what we covered in class.

Reading assignment: "Sound Synthesis of the Harpsichord Using a Computationally Efficient Physical Model," Vesa Välimäki, Henri Penttinen, Jonte Knif, Mikael Laurson, Cumhur Erkut, EURASIP Journal on Applied Signal Processing 2004:7, 934–948. `http://www.ee.columbia. edu/~dpwe/e6820/papers/ValPK04-harpsi.pdf`
This is a fairly recent paper on a very realistic model of the harpsichord, based on the simple traveling wave simulation we saw in class. Post a summary and some personal comments or reflections on the Courseworks discussion site.

Practical assignment: The matlab script `pluck1a.m` is an implementation based loosely on Smiths C-code. You can download it at:
`http://www.ee.columbia.edu/~dpwe/e6820/matlab/pluck1a.m`

The basic usage is: `x = pluck1a(len, count, r);` where `len` is the length of the two digital waveguide delay lines in samples, `count` is the number of output samples to generate (and hence the duration of the sound, at a given sampling rate), and `r` is a parameter controlling the lumped 'loss' filter at the bridge reflection. The output value `x` is a waveform sequence (sampled at one end of the string) which can be listened to via `soundsc(x)`. Starting with `len = 20`, `count = 16000`, and `r = 2`, try some different values for `len`. How does this affect the sound? Now try changing `r` e.g. to 10. How does this affect the sound? Can you generate some spectrograms to support your subjective impressions? What happens if `r` is made smaller than 2, e.g. `r = 0.1`? Feel free to look at the code if you want to find out how `r` is used and why it might behave in the way you have observed.

Project: Do some background research for your favorite project idea: Find a paper or two, or some information on the web, summarize it and link it to your web page.