Music and Computers

CH. 5 THE TRANSFORMATION OF SOUND BY COMPUTER

TERMS AND CONCEPTS

In order of appearance

5.1 Introduction to the Transformation of Sound by Computer
transformation techniques
- crossfade
- cut & paste
- deconstruct
- filter
- mutate
- overlap
- retrograde

time-domain restructuring
Rabelais' Argeïphontes Lyre
probabilistic decisions
sampling as quotation
drum machines
digital audio workstations (daw)
breakout box
Firewire

5.2 Reberb
direct sound
dry/wet mix
physical space simulation
imaginary soundscapes
reverberant chamber
resonance characteristics
first reflection
early reflections
reverb tail
room model
- room size
- surface qualities
- absorption coefficient
- brightness

signal
- delay
- gain change
- phase inversion
- feedback
- feedforward

convolution
smoothed function
blended reverb
taps
multitaps
comb filter
impulse
impulse response (analysis)
impuse response libraries
music function
filter function
pointwise product
flanges

5.3 Localization/Spatialization
filter-based localization
binaural localization
interaural time delay (ITD)
speed of sound (345 m./sec.)
head-related transfer functions

5.4 Introduction to Spectral Manipulation
phase vocoder
analysis/resynthesis
filtering
- time domain
- spectral domain

time stretching
pitch shifting
chipmunk efect
varispeed
windowing
- overlapping

5.5 More on Convolution
cross synthesis

5.6 Morphing
amplitude crossfade
source/target
sonic morph
morphing
- interpolation
- replacement
- feature

spectral centroid
spectral metric

5.7 Graphical Manipulation of Sound
Lecain's Spectrogram
Xenakis' UPIC
IRCAM's AudioSculpt
Erbe's QT-coder
Penrose's Hyperupic
Repetto's Squiggy

Text

Burk, Phil, Larry Polansky, Douglas Repetto, Mary Roberts and Dan Rockmore. *Music and Computers: A Theoretical and Historical Approach*. Emeryville, CA: Key College Publishing, 2005.

Reference

Dodge, Charles and Thomas A. Jerse. *Computer Music: Synthesis, Composition and Performance*, Second Edition. New York: Schirmer, 1997.
Roads, Curtis. *The Computer Music Tutorial*. Cambridge, MA: MIT Press, 1999.

Quotable

"Composers have experimented a lot with unusual *time-domain restructuring* of sound. By chopping up waveforms into very small segments and radically reordering them…the ironic and interesting juxtaposition of very familiar materials can be used to create new works that are perhaps greater than the sum of their constituent parts."

"*Sampling* refers to taking small bits of sound, often recognizable ones, and recontextualizing them via digital techniques."

"There are a number of…techniques for simulating and modeling different reverberations…One interesting technique is [*convolution*, a technique where you] record the ambience of a room and then superimpose that onto a sound recorded elsewhere."

"The *pointwise product* is the frequency content at any point in the convolution and is calculated by multiplying the spectrums of the music function and filter function at that particular point."

"…one of the great properties of the FFT; it made convolution just about as easy as multiplication."

"Any filter that attenuates the higher frequencies (like 5 kHz or up) makes a signal sound farther away from us, since high frequencies have very little energy and don't travel far."

"…comb filtering [is a]…short delay with feedback that emphasizes specific harmonics."

"…humans are extremely adept at locating sounds in two dimensions, or the plan. We're great at figuring out the source direction of a sound, but not the height."

"Two of the most important ways that musicians have used the *phase vocoder* technique are…*time stretching* and *pitch shifting*."

"By imposing a smoothing window on the time domain signal and doing an FFT of the windowed signal, we de-emphasize the high-frequency artifacts created by these sharp vertical drops at the beginning and end of the frame. By changing the length of the overlap when we resynthesize the signal, we can change the speed of the sound without affecting its frequency content."

"…multiplication in the time domain is the same as convolution in the frequency domain (and vice versa)."