

MUS421–571.1 Electroacoustic Music Composition

Kirsten Volness – 27 Feb 2018

Additive Synthesis

- WDR in Cologne
- Oscillators (Voltage-Controlled Oscillator)
- Record sounds on tape + manipulate with multiple tape machines / further overdubbing

Harmonic Series



Waveforms



Figure 3.11. The four basic waveshapes and their harmonic content (up to the 9th multiple)

Noise

- White noise equal, random amplitudes across frequency spectrum
- Pink noise Amplitude decreases 3 dB per octave from bottom to top of frequency spectrum
- Brown(ian)/red noise Amplitude decreases 6 dB per octave from bottom to top of frequency spectrum





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Filtering (Equalization)

• Graphic EQ

- Pre-determined bandwidths (frequency ranges)



Filtering (Equalization)

- Parametric EQ
 - User can change bandwidths (frequency ranges)
 - -Q = how broad or narrow each bandwidth is

Q (bandwidth)









Low Pass Filter

(low frequencies are allowed to pass to the speakers) - aka high cut



High Pass Filter

(high frequencies are allowed to pass to the speakers) - aka low cut



Band Pass Filter

(a set range of frequencies is allowed to pass to the speakers)



Filtering

- Changes timbre by changing frequency content
- Effective for creating sense of distance / space
- Effective for deconstructing sound (e.g., only highs are captured)
- Effective for tuning sound (clarify various elements / pitches you want to stand out)
- Good mixes control what occupies each range of frequency spectrum

EQ Chart



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AM (Amplitude Modulation) FM (Frequency Modulation)



The Modulating Wave *affects* the Carrier Wave (source)

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Parameters of Modulation

- **Rate** = frequency of modulating waveform (how fast a wobble?)
- **Depth** = amplitude/strength of modulating waveform (how large a wobble?)
- Feedback = how much of output is fed back in to process
- Phase = crest/trough relationship between carrier and modulating wave
- LFO = Low Frequency Oscillator (modulating wave is lower than hearing range)

Phase Relationships

- Two waves in sync (crest+crest) increase resulting amplitude
- Two waves 180° out of sync (inversion–crest+trough) cancel sound completely
- Feedback = amplification
 of second signal in phase
 with the first.



Phaser

- Uses phase relationships to modulate carrier wave – some amplitudes are boosted, others reduced
- Amplitude modulation is achieved by manipulating 180° phase relationships



- Two identical copies of sound mixed, except one is delayed by a small and gradually changing period
- Creates sweeping comb filter effect



Flanging vs. Phasing



Chorus

- More than one copy of the same sound
 - Differences in pitch and/or timing cause modulation
 - Automatic double tracking (ADT) is an example of a chorus effect

Ring Modulation

Mostly sidebands in output



If Carrier wave = 300 Hz and Modulating wave = 100 Hz

lower sideband = 300-100 = 200 Hz upper sideband = 300+100 = 400 Hz

Since you can't have -100Hz, at 0 Hz the lower sideband goes back up frequency range – absolute value

Lower sideband = 300-400 = 100 Hz upper sideband = 300+400 = 700 Hz

Listening Examples

- Pink Floyd Wish You Were Here
- Arcade Fire My Body Is A Cage
- Tom Petty You Don't Know How It Feels
- Cocteau Twins Carolyn's Fingers
- Radiohead Planet Telex
- The Cure Lullaby
- The Rolling Stones Brown Sugar