21M.380 Music and Technology
Sound Design

Lecture №21
Granular synthesis

Monday, April 25, 2016

1 Preview QZ2

Will cover synthesis techniques we have discussed:

- Additive synthesis (Farnell 2010, ch. 17)
- Wavetable synthesis (ibid., ch. 18)
- Waveshaping (ibid., ch. 19)
- Amplitude and frequency modulation (ibid., ch. 20)
- Granular synthesis (ibid., ch. 21)

2 Granular synthesis

2.1 Applications

- Time stretching (at constant pitch)
- Pitch shifting (at constant speed)
- Generating sound 'textures' (water, wind, fire, rain, crowds of people, flocks, swarms)

2.2 Disadvantages

- Lots of control data (ibid., p. 305) (but can be automated)
- Computationally expensive (ibid., pp. 257, 305)
- Lack of precision (ibid., p. 257)

2.3 Types[1]

[1] Farnell 2010, pp. 307 ff.

2.3.1 Synchronous granular synthesis (single, regular stream)

- Can be used for *independent* pitch shift or time stretch operations ☺
- But introduces pitch artefacts due to 'window frequency' ☹

2.3.2 Asynchronous granular synthesis (single, irregular stream)

- Can prevent pitch artefacts of synchronous granular synthesis ☺
- So used for creating sustained versions of dynamic sounds
- E.g., textures of strings, voices, noisy sounds
- But introduces amplitude envelope inconsistencies ☹ (use reverb to minimize)

2.3.3 Mixed streams (multiple, regular streams)

- Cross-synthesis of different sources

2.3.4 Cloud synthesis (multiple, irregular streams)

- Artistic-compositional applications (Roads, Vaggione, Truax, Xenakis)

References and further reading

Farnell, Andy (2010). *Designing Sound*. Cambridge, MA and London: MIT Press. 688 pp. ISBN: 978-0-262-01441-0. MIT LIBRARY: 001782567. Hardcopy and electronic resource.

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