

# 1T2: Introduction to Audio Signal Processing

***Xavier Serra***

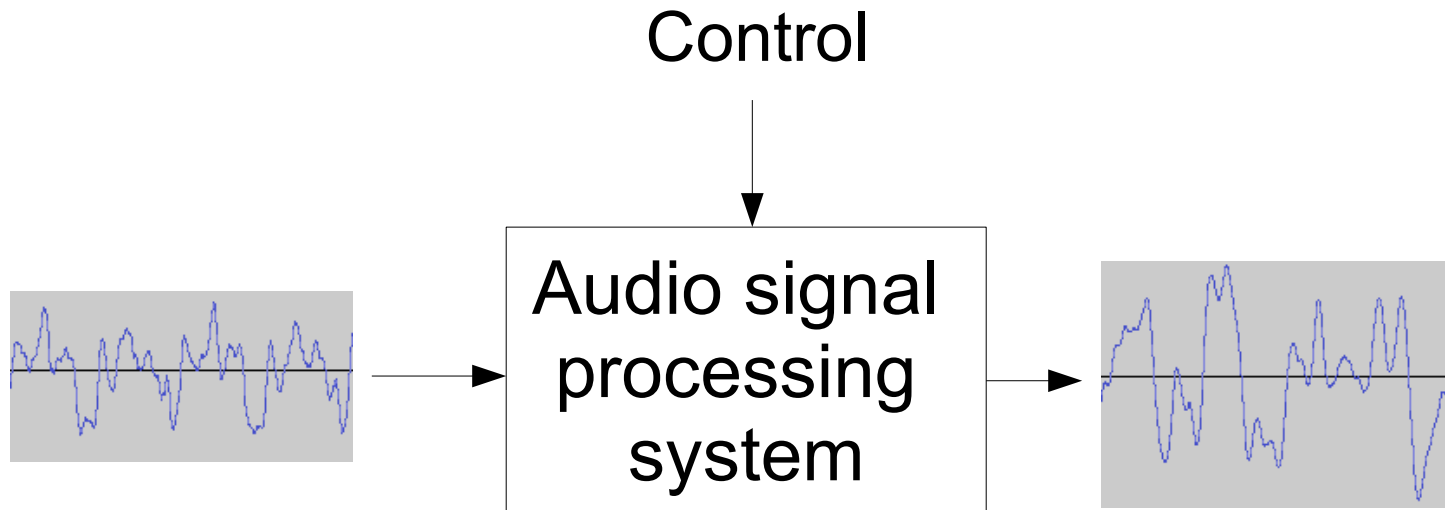
Universitat Pompeu Fabra, Barcelona

# Index

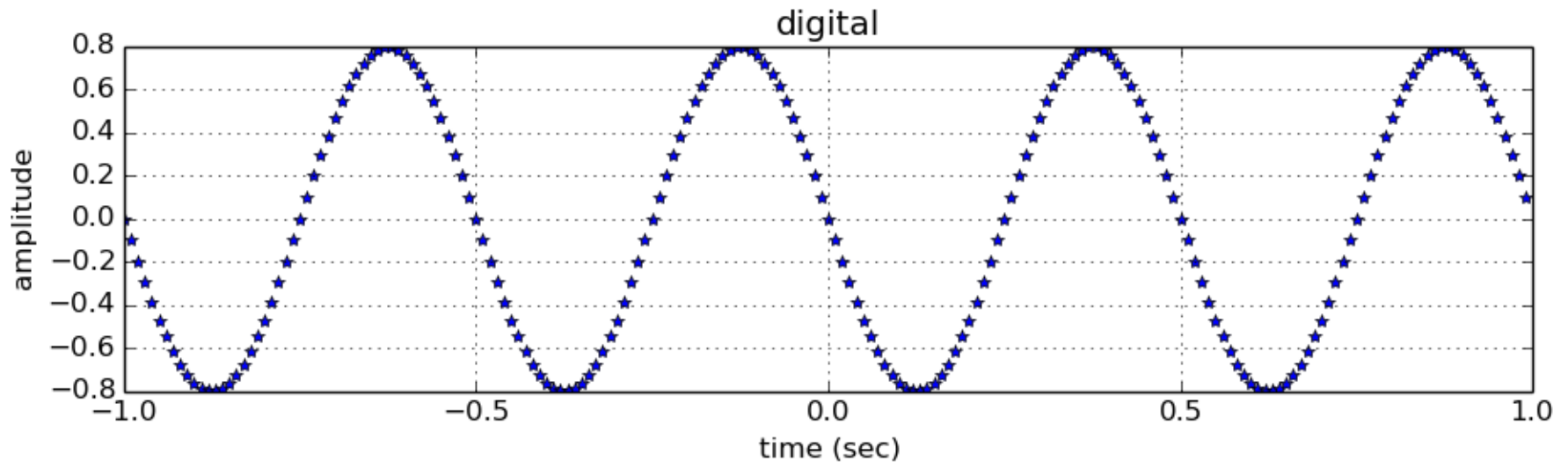
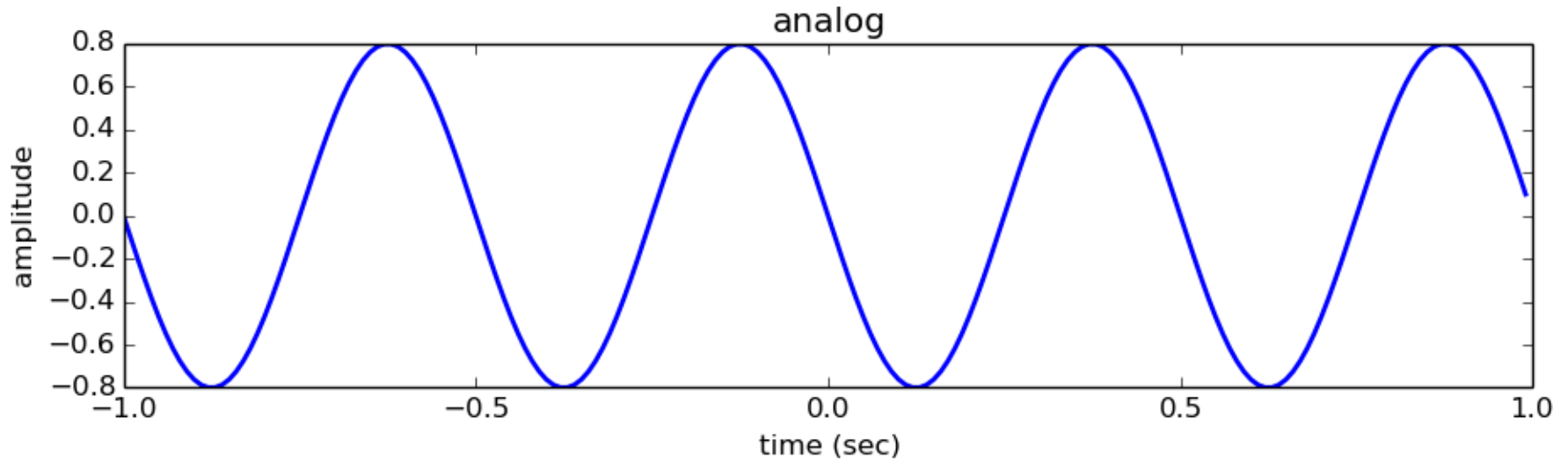
- What is audio signal processing?
- Applications:
  - storage, data compression, effects and transformations, synthesis, description.

# What is audio signal processing?

- Intentional alteration of sound



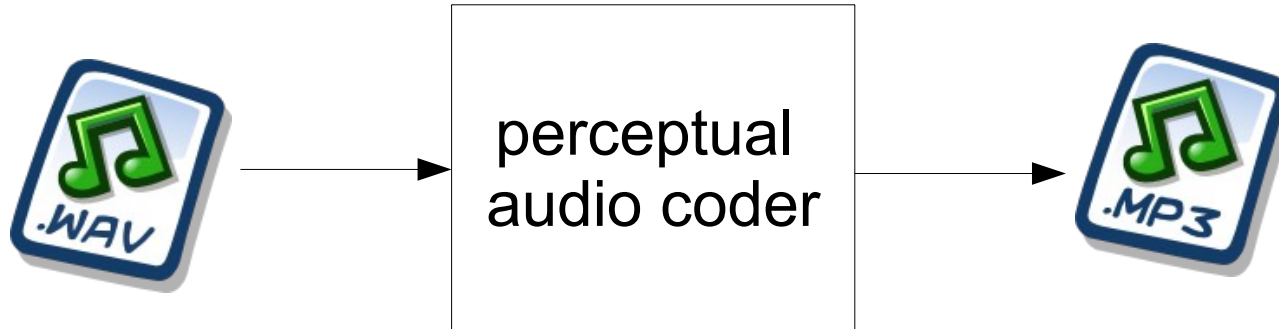
# Analog versus digital signals



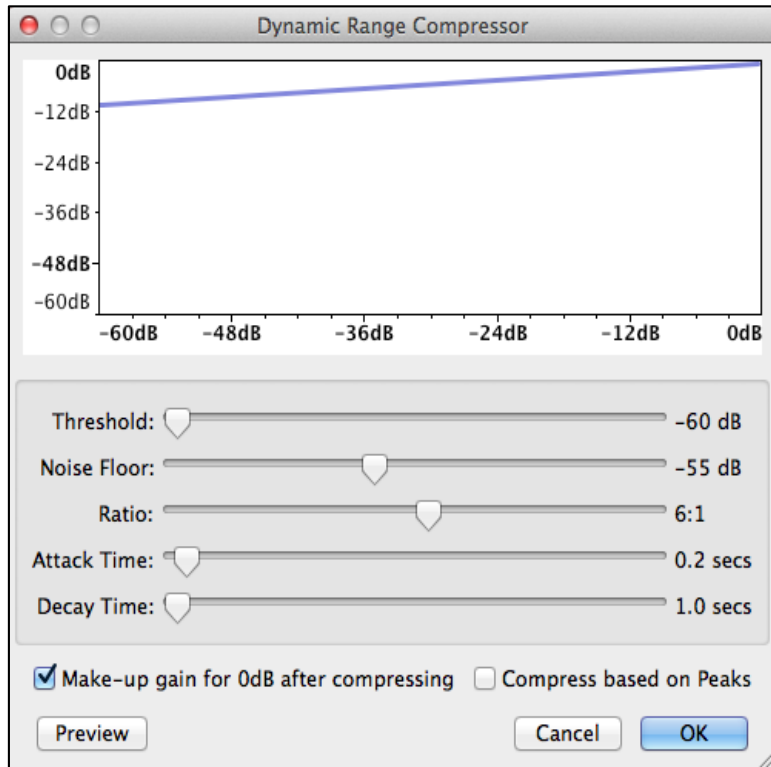
# Applications: Storage



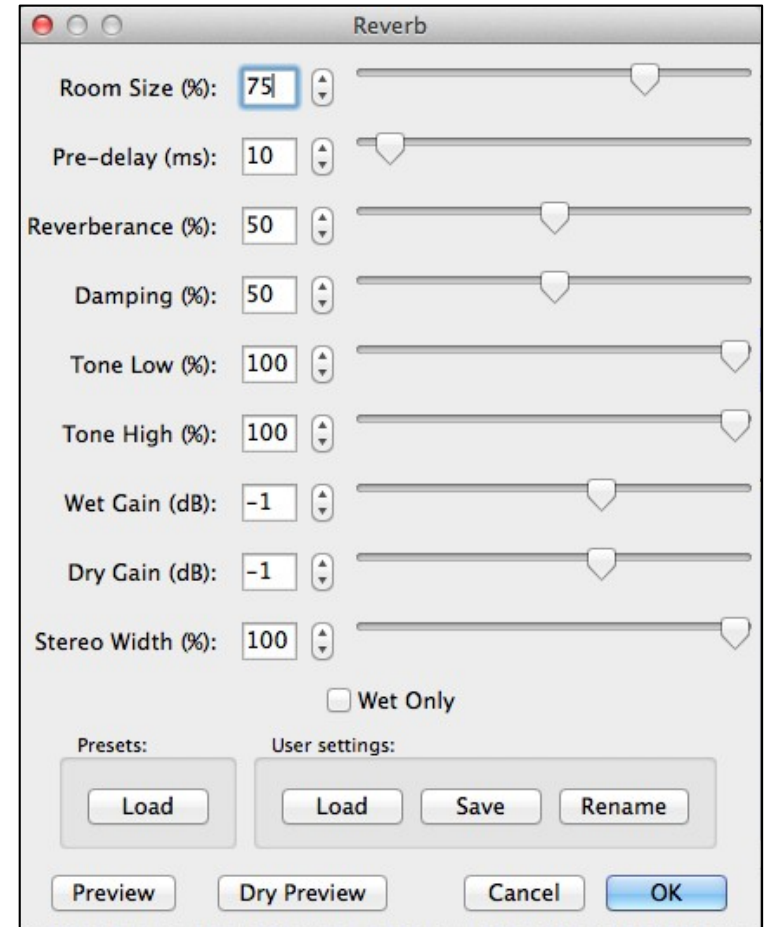
# Applications: Data compression



# Applications: Transformations



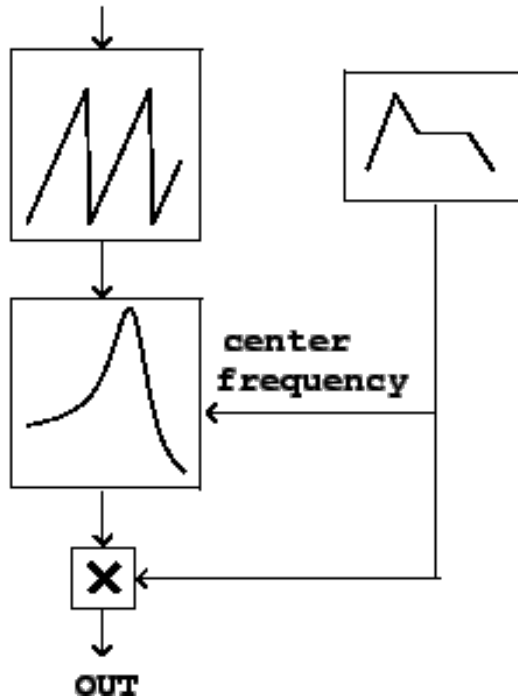
[from  
Audacity]



*Others:* echo, equalizer, flanger, phaser, chorus, pitch shift, time stretching, voice effects, 3D audio effects, morphing, ....

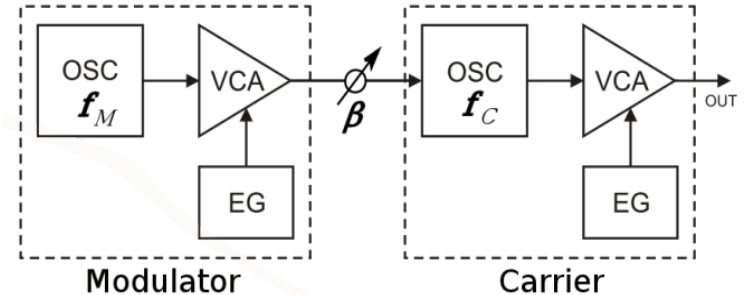
# Applications: Synthesis

frequency

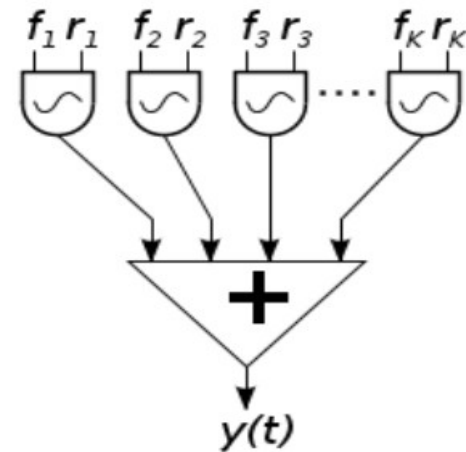


Subtractive  
synthesis

*Others:* granular synthesis,  
physical modeling, waveshaping,  
sampling, spectral synthesis, ...



FM synthesis



Additive synthesis

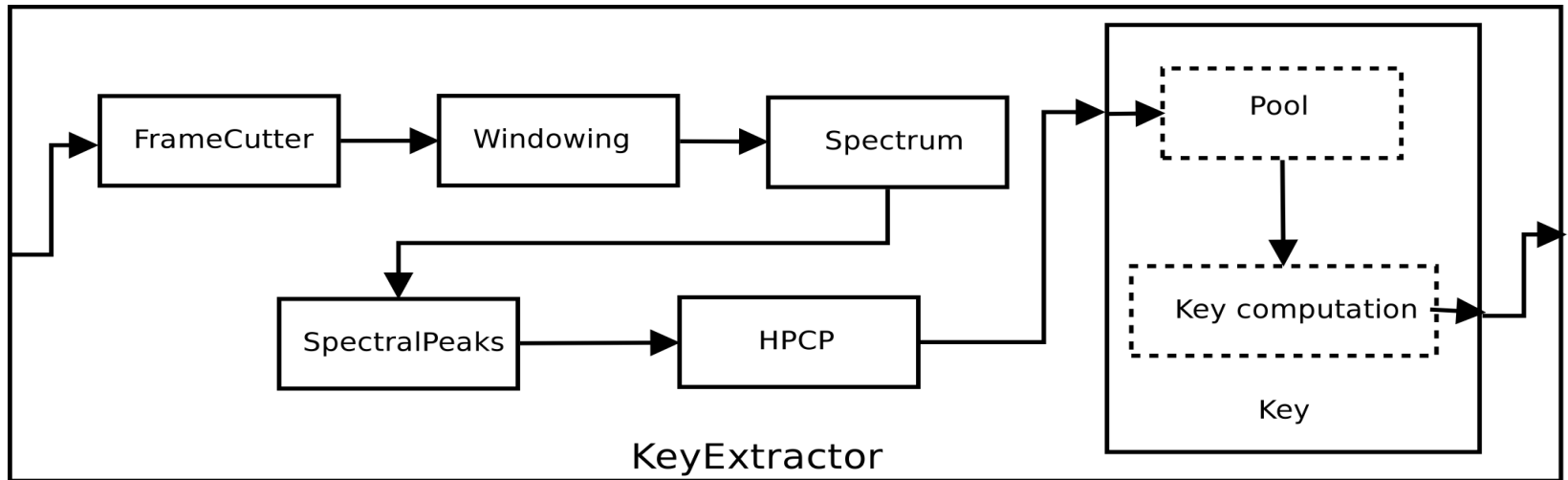
<http://msp.ucsd.edu/techniques/v0.11/book-html/node152.html>

[http://commons.wikimedia.org/wiki/File:2op\\_FM.svg](http://commons.wikimedia.org/wiki/File:2op_FM.svg)

[http://commons.wikimedia.org/wiki/File:Additive\\_synthesis.svg](http://commons.wikimedia.org/wiki/File:Additive_synthesis.svg)



# Applications: Description



*Low-level:* loudness, timbre, pitch, ..

*Mid-level:* rhythm, harmony, melody, ...

*High-level:* genre, emotions, similarity, ...

# References and credits

- More information in:  
[https://en.wikipedia.org/wiki/Audio\\_signal\\_processing](https://en.wikipedia.org/wiki/Audio_signal_processing)
- Audacity: <https://www.audacityteam.org/download/>
- Slides released under *CC Attribution-Noncommercial-Share Alike* license and code under *Affero GPL* license; available from <https://github.com/MTG/sms-tools>

# 1T2: Introduction to Audio Signal Processing

***Xavier Serra***

Universitat Pompeu Fabra, Barcelona