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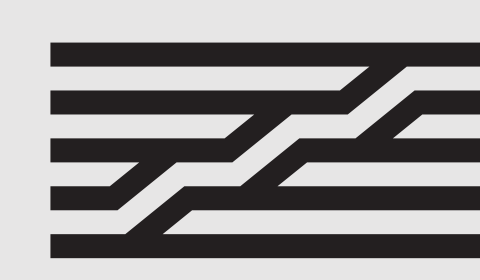
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An Analysis/Synthesis tool using mathematical morphology based on the Sinusoids + Transients + Noise audio model

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Introduction

What we present: An analysis/synthesis tool based on a Spectral Modeling Synthesis (SMS).

Which model we use: We decompose the sound in three parts:
Sinusoids Transients Noise

How we estimate the parameters: We use Mathematical Morphology (MM) on a STFT spectrogram to retrieve the parameters.

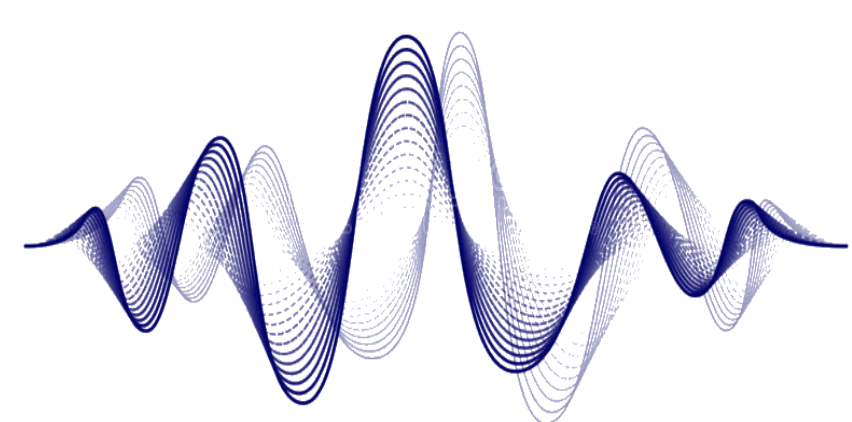
Analysis/Synthesis

Analysis/Synthesis is a process that takes a sound as input and retrieves parameters in order to generate a synthetic approximation of it. This process requires a **Synthesis Model** and **Parameter Estimation Method**.

The diagram below illustrates the steps of the process and the choices involved.

Analysis/Synthesis diagram

Parameter Estimation Method:



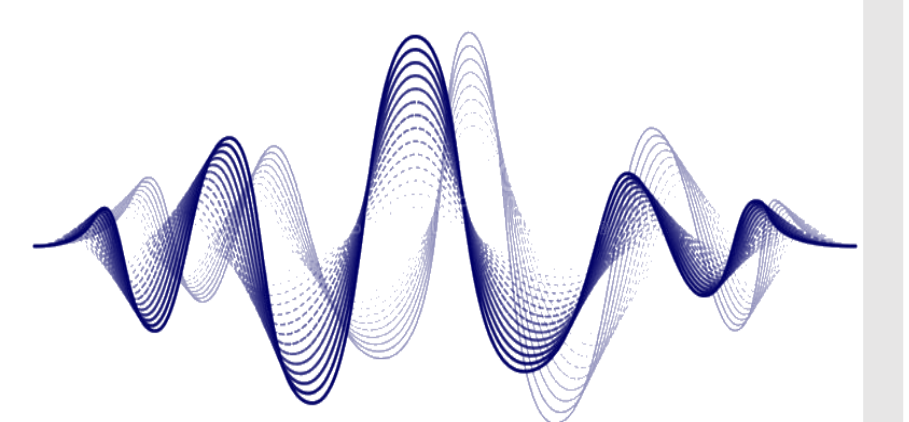
Mathematical Morphology on STFT spectrograms

Parameters

Synthesis Model:



Sinusoids + Transient + Noise



Sinusoids + Transients + Noise model

Sinusoids

The sinusoids component is of the form

$$s(t) = \sum_{n=0}^N a_n(t) \sin(2\pi\Phi_n(t))$$

where

- $\Phi_n(t) = \int_0^t f_n(\tau) d\tau$,
- $a_n(t)$ is the amplitude of the n^{th} sinusoid,
- $f_n(t)$ is the instantaneous frequency of the n^{th} sinusoid.

Transients

The transient component is of the form

$$s(t) = \sum_{n=0}^N s_n(t)$$

where

- $s_n(t) = \text{iCT}[S_n(f)](t)$,
- $S_n(f)$ is the n^{th} modulated sinusoid in the frequency dimension,
- iCT is the **inverse Cosine Transform** defined by $\text{iCT}[X(f)](t) = \int_{-\infty}^{\infty} X(f) \cos(2\pi ft) df$.

Noise

The noise component is of the form

$$s(t) = \text{iSTFT}[W(\tau, \omega) \cdot M(\tau, \omega)](t)$$

where

- iSTFT is the **inverse Short-Time Fourier Transform**,
- $W(\tau, \omega)$ is the STFT of a white noise,
- $M(\tau, \omega)$ is the mask representing a time-varying filter.

Parameter estimation with Mathematical Morphology

