AudioGaming

NATURAL BORN INTERACTIVE

INP ENSEEIHT

Long Project with Audiogaming

Additive Synthesis with Inverse Fourier Transform for Non-Stationary Signals

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Content

AudioGaming

NATURAL BORN INTERACTIVE

- ▶ Localization: Toulouse, Paris
- ▶ Activity: Audio plug-in (VSTs and RTAS)
- ▶ Main customers: Film and Video Game Industry (Sony, Ubisoft)
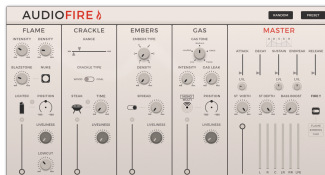- ▶ 10 employees

Figure: Audiofire: audio plug-in that recreates fire sound

Introduction
Objective

▶ We are continuing the Audiogaming long project from 2015 (Emilie Abia, Lili Zheng, Quentin Biache)

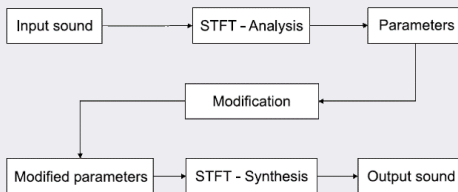*Objective* : Synthesizing sounds from their spectrum with a FFT^{-1}

Figure: General approach for modifying a sound in the spectral domain

▶ We have to implement a new method of additive synthesis ⇒ computationally very fast

► 6 weeks only $\Rightarrow$ Focus on the synthesis method only.
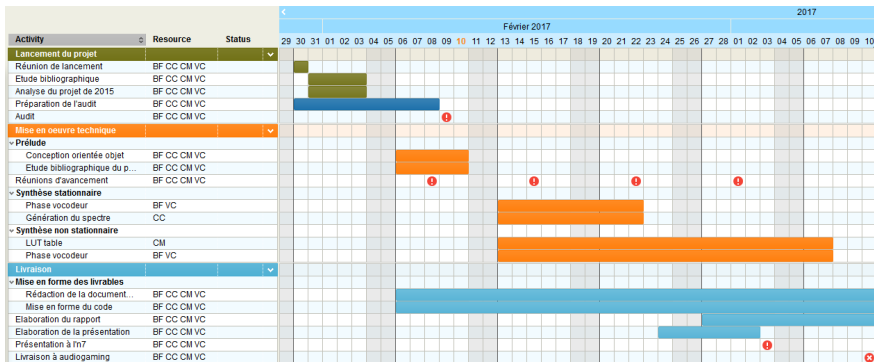
Given codes in Python and Matlab from the 2015 project :

► Python : Analysis estimator of sinus parameters and sinus generation with those parameters (only stationary)

► Matlab : Some reasearch on the Non-stationary synthesis with the LUT of lobes

► We made our own OOP codes in Python

► We have taken the analysis estimator code to test our final synthesis

Figure: *PyCharm* as Python IDE , *Slack* to communicate,*GitHub* to stock the codes and have a versionning, *Freedcamp* to plan the project events

Activity	Resource	Status
Lancement du projet		
Réunion de lancement	BF CC CM VC	
Etude bibliographique	BF CC CM VC	
Analyse du projet de 2015	BF CC CM VC	
Préparation de l'audit	BF CC CM VC	
Audit	BF CC CM VC	
Mise en oeuvre technique		
Prélude		
Conception orientée objet	BF CC CM VC	
Etude bibliographique du p...	BF CC CM VC	
Réunions d'avancement	BF CC CM VC	
Synthèse stationnaire		
Phase vocodeur	BF VC	
Génération du spectre	CC	
Synthèse non stationnaire		
LUT table	CM	
Phase vocodeur	BF VC	
Livraison		
Mise en forme des livrables		
Rédaction de la document...	BF CC CM VC	
Mise en forme du code	BF CC CM VC	
Elaboration du rapport	BF CC CM VC	
Elaboration de la présentation	BF CC CM VC	
Présentation à l'n7	BF CC CM VC	
Livraison à audiogaming	BF CC CM VC	

The additive synthesis
General approach: The time domain

The sound signal is represented as a sum of N sinusoids:

$$x(t) = \sum_{k=1}^{N} a_n sin(2\pi f_n t + \phi_n)$$

- ► Very costly to implement
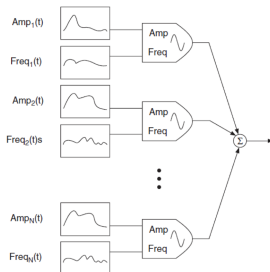- ► Impossible to compute in real-time

Figure: *The additive synthesis*

The additive synthesis
General approach: The frequency domain

We generate the sinusoids in frequency domain in order to reduce the computation time :

- ▶ Window the signal to maximize the energy in the main lobe
- ▶ We only keep the main lobe for each sine (9 points)
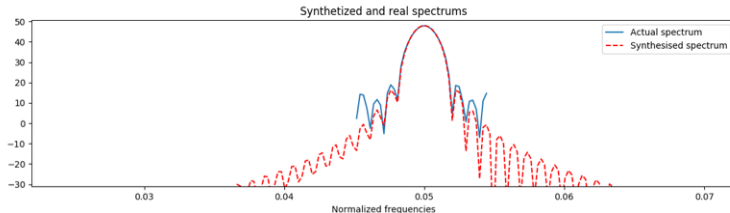- ▶ We assume that the parameters (amplitude, frequency, phase) are already given by the analysis

Figure: *Windowed sine lobe*
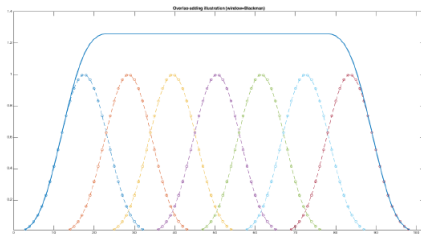
The sound signal is a frame-by-frame signal:
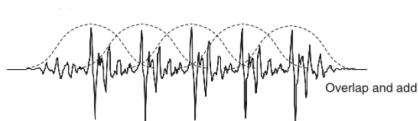

Figure: *Sum of small size Hanning windows*

Figure: *Overlap and add*

The theme contains 4 source files:

- ► beamercolorthemeFeather.sty
- ► beamerouterthemeFeather.sty
- ► beamerinnerthemeFeather.sty
- ► beamerthemeFeather.sty

The theme can be installed for **local** or **global** use.

Local Installation

▶ Local installation is the simplest way of installing the theme.

▶ You need to placing the 4 source files in the same folder as your presentation. When you download the theme, the 4 theme files are located in the `local` folder.

Global Installation

▶ If you wish to make the theme globally available, you must put the files in your local latex directory tree. The location of the root of the local directory tree depends on your operating system and the latex distribution.

▶ Detailed steps on how to proceed installation under various operating systems can be found at Beamer documentation.

For using the Feather Theme you will need the Bemaer class installed and the following 2 packages

- ► TikZ[1]
- ► calc

Due to the fact that the packages are very common they should be included in your latex distribution in the first place.

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[1]TikZ is a package for creating beautiful graphics. Have a look at these online examples or the pgf user manual .

The Presentation Theme

The Feather Theme can be loaded in a familiar way. In the reamble of your `tex` file you must type

`\usetheme[<options>]{Feather}`

The presentation theme loads the inner, outer and color Feather theme files and passes the `<options>` on to these files.

The Inner and Outher Themes

If you wish you can load only the inner, or the outher theme directly by

`\useinnertheme{Feather}` (and it has no options)

`\useoutertheme[<options>]{Feather}` (it has one option)
  `progressstyle={fixedCircCnt or movingCircCnt}`

- ▶ which set how the progress is illustrated;
- ▶ the value `movingCircCnt` is the default.

The Color Theme

Also you can load only the color theme by writing in the preamble of the tex file

- \usecolortheme{Feather}

...or to change the colors of the various elements in the theme

- Change the bar colors:
  \setbeamercolor {Feather}{fg=<color>, bg=<color>}

- Change the color of the structural elements:
  \setbeamercolor{structure}{fg=<color>}

- Change the frame title text color:
  \setbeamercolor{frametitle}{fg=<color>}

- Change the normal text color background:
  \setbeamercolor{normal text}{fg=<color>, bg=<color>}

The Feather Background Image

- ▶ In Feather theme, the title page frame and the last frame have the Feather image as the background image.
- ▶ The Feather background image can be produced to any frame by wrating on the begining at the choosen frame the following

```
{\1bg
\begin{frame}[<options>]{Frame Title}{Frame Subtitle}
...
\end{frame}}
```

Thank you for using Feather Beamer Theme!