AALBORG UNIVERSITET

General module information
Title: Sound processing
Type: course module
Language of instruction: English

ECTS points: 5 ECTS

Period: 1 September 2015 — 31 January 2016

Placement
1th semester, M.Sc. in Sound and Music Computing

Module coordinator
Aalborg: Jesper Rindom Jensen (coordinator), Anne Marie Rasmussen (secretary)
Copenhagen: Stefania Serafin (coordinator)

Academic content and relationships to other modules/semesters
The formal study plan description of the module can be found here (page 7):
http://www.sict.aau.dk/digitalAssets/101/101078_94332_kandidat-lyd--og-musik.pdf

The Sound processing course module introduces sound technology in terms of sound synthesis and digital audio effects. To understand how such systems are build, it is of utmost importance to understand basic concepts regarding acquisition and manipulation of sounds. The course module therefore covers:

- Transforms, such as the fast Fourier transform, which enables analysis and manipulation of sounds in the frequency domain
- The concepts of digital sampling, quantization, and reconstructions of audio signals and related technical specifications
- Implementations of filters that can change the characteristics of acquired audio signals
- Delay lines and delay based effects which are key ingredients in many other audio effects as well (e.g., flanger, vibrato, chorus, echo)
- Different types of modulation such as amplitude and frequency modulation, which are commonly used in audio effects.
- Reverberation of sound in rooms to understand how artificial reverb effects can be build.

Learning about these concepts is also of great relevance to the semester theme, i.e., foundations of sound and music computing. These basics are then used as a foundation to introduce a number of widely used and important audio effects such as delay, flanger, vibrato, chorus, modulation, and reverb.

Objectives and learning goals
Based on the material covered in the course, the **first goal** is that the student should be able to apply digital filters to sound and music signals, since this is key to build advanced audio effects. The student should also be able to evaluate whether the filter is functioning as desired, e.g., by applying the fast Fourier transform. The **second goal** is that the student should be able to design, implement, and analyze the covered digital audio effects such as delay, flanger, vibrato, chorus, modulation, and reverb.

Extent and expected work load
Sound processing is a 5 ECTS course, corresponding to a total work load of 140 hours. The work load is expected to be distributed as:

- Lectures: 25 hours
- Exercises: 30 hours
- Preparation: 45 hours

- Mini project: 40 hours

Pre-requisites for participation
None

Examination

As part of the course, each student is required to complete an individual project in which contents covered in the course is applied. The exam will be oral and based on a presentation of this project and the theory covered in the lectures. In the project, the student must solve a sound processing design and implementation problem. This could, for example, be the design and real-time implementation of IIR or FIR filters, audio effects (chorus, flanger, vibrato, etc.), or spatial effects. He/she must demonstrate that he/she understands the basic concepts and methods.

In summary, the project and the presentation must at least satisfy the following criteria:

- Sound processing must be designed and implemented
- The theory behind the sound processing must be described
- The implemented sound processing must be tested
- A demonstration of the program/device created during the project must be given.

Failure to meet these criteria will lead to an automatic failed grade. The exam will be an individual oral exam. It will be based on the project (practice) and the contents of the lectures (theory). The student will present the project to the examiner who will ask questions about the project and the general curriculum. The student must prepare a demonstration of the sound processing and a set of slides for presenting the project. The source code used in the project must be available at the exam and failure to comply will result in a failed grade. The grade will depend on the quality of the project, the presentation, and the ability of the student to answer questions in relation to the project and the course contents in relation to both theory and practice.

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