### Summary

The objective of the course is to introduce theory, methods, and basic psychoacoustics that is needed to understand state-of-the-art techniques used in pro audio and consumer audio, including microphones, surround sound, mixing and audio coding.

### Content

- Acoustics and audio is covered and the manipulation and processing of audio signals. It is shown how Fourier analysis of a sound field yields the representation of the sound field with plane waves. These and other acoustic insights are used to explain microphone techniques and reproduction of sound fields.
- Psychoacoustics, loudness perception and spatial hearing are covered in detail. The latter is used to motivate stereo and surround mixing and audio playback. Audio playback is put into context with a detailed coverage of room acoustics.
- The short-time Fourier transform is introduced as a tool for flexible manipulation of audio signals, such as filtering, delaying and other spectral modification. Matrix surround, audio coding, and beamforming are also treated.

### Learning Prerequisites

**Recommended courses**

Signal processing for communication, any course on Signals and Systems

### Learning Outcomes

By the end of the course, the student must be able to:

- Apply basics of acoustics, signal processing, reproduction and capture
- Understand and implement linear and adaptative filtering, beamforming, noise suppression, audio coding, stereo and multichannel sound capture and reproduction

### Teaching methods

In class ex-cathedra + exercises + mini-project supervision

### Expected student activities

- Theoretical and practical exercises
• Mini-projects: individual or in small groups

Assessment methods

• Final exam
• Midterm exam
• Mini-project

Supervision

| Office hours | Yes |
| Assisting    | Yes |
| Forum        | Yes |