

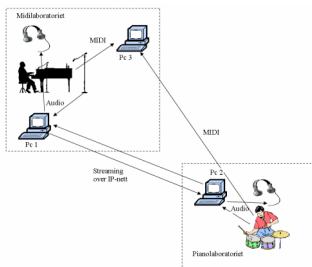
Audio and Music Technology

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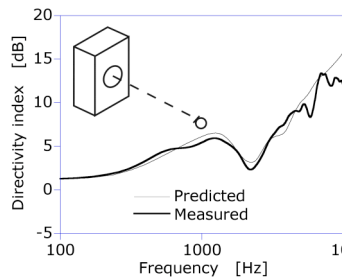
We study the whole chain of music and speech communication: the sound source (a musician with an instrument, a loudspeaker, a singing person), the sound propagation in a room or other environment, and the perception by a human listener. For musicians, the interaction between the performer, the instrument and the environment is of great interest. Computer modelling can make auralization possible, that is, to be able to listen to a computer simulation - as if you would be there. This requires accurate modelling techniques of the sound generation and propagation as well as accurate reproduction techniques over headphones or loudspeakers, so called 3D-sound techniques. Real time performance control of acoustical instruments and digital audio systems are extensively examined to give us basic knowledge for the development of new controllers, handheld media terminals, instruments and processing algorithms. We also study room acoustics: how should a room be designed to function for acoustic communication?

Applications of audio and music technology

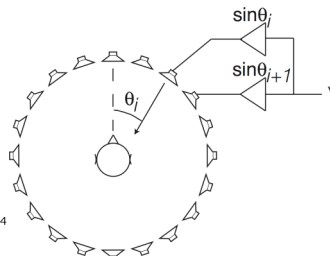
- Auralization, that is, the generation of audible virtual sound fields.
- Room acoustic design
- Sound installations and synthesis of musical instruments
- Digital audio effects
- Music information retrieval systems



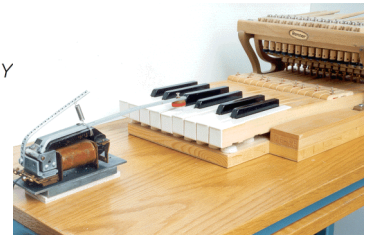
Playing music together over the Internet



Modelling loudspeakers



Reproducing sound fields



The artificial piano player

COURSES

Audio Technology - TTT4170

Deals with acoustic communication in audio systems and multimedia applications and covers the topics of propagation and radiation of sound waves, hearing and psychoacoustics, transducers and techniques for sound recording and reproduction, digital audio, electrical analogies for mechanical and acoustical analogies, room acoustics, acoustical measurement techniques. Several lab. classes form an important part of the course.

Music Technology - TTT4190

Gives insight into signal processing of singing and music, an understanding of acoustical and electronic music instruments functioning and use, as well as an introduction into computer aided production, storage and distribution of music. Topics covered include singing and music signals, music informatics, acoustical and electronic music instruments, psychoacoustics, music psychology and perception, analysis and synthesis of music, MIDI, music performing, and sound media. Several lab. classes are an integrated part of the course.

Room Acoustics - TT8302

Gives the theoretical foundation for sound fields in rooms and how they are perceived by a listener. The course includes methods for calculating sound fields in rooms as well the psychoacoustic foundations for room acoustical requirements. Methods include wave theoretical methods, statistical methods, geometrical acoustics methods and computational implementations. Acoustical measurement techniques, sound absorption, and psychoacoustic criteria for evaluation of room acoustic quality are covered as well.

Acoustics, Specialization - TTT4700

Includes a project as well as two smaller course modules. Elective modules include 3D sound, Music and perception, Effects of sound, Numerical acoustics, Building acoustics and others.

Music and perception - (TT2010)

Offers detailed insight into binaural hearing models strongly related to music signals. Topics include musical measures (pitch, interval, timbre etc), models of the hearing mechanism (acoustical, mechanical and electrical models) and the listening experience of single and complex sound stimuli. Listening paradoxes are demonstrated (pitch chroma, stretched octave, cocktail party effect, melodic fusion-fission, dissonance-consonance, circling pitch, tri-tone paradox).

BSc & MSc in Music Technology

NTNU offers cross-disciplinary BSc and MSc degrees in Music Technology. The courses above are closely connected to those programs.

Nordic courses on acoustics

The acoustics program cooperate with the International MSc programs on Sound and Vibration at Chalmers, Gothenburg and KTH, Stockholm. You can find a wide range of acoustics courses either for remote studies or by spending a semester abroad.

RESEARCH PROGRAM

Music Technology

The research activity has previously been closely related to successful EU projects like DAFx (1998-2001, with annual conferences still being active) and MOSART (2000-2003). Today the focus is on the ConGAS project (Gesture CONTROLled Audio Systems), where the action for performing and controlling acoustical instruments or audio systems are recorded and analysed - in order to understand artistic human behaviour and to find limits for deviation in performing control.

Audio over IP networks

The Centre of excellence "Quantifiable quality of service in communication networks" includes Audio over IP Networks. How can we capture, describe and reproduce 3D sound fields for tomorrow's advanced audio applications? Will telepresence be "as good as being there" - can we interact like in real life, for playing music together, for tele-meetings etc? What is the influence of the inevitable delays in such applications?

Computer modelling - auralization

Computer modelling involves a large number of techniques: geometrical acoustics for large rooms, hybrid methods for loudspeakers, numerical solving of the wave equation for the highest accuracy. In virtual acoustics we sometimes want to use real-time techniques that permit a walk-through a virtual environments. The computer modelling of music instruments can often employ combinations of analytic models and numerical models, as well as non-linear models.