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Sound Engineering and Acoustic Education at the Széchenyi István University

Hang- és képtechnikai oktatás a villamosmérnök képzésben a győri Széchényi István Egyetemen

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Abstract:
At the Széchenyi István University in Győr, Hungary bachelor (BSc) degree can be achieved in electrical engineering from the academic year 2005-2006. The Department of Telecommunication offers during the specialization semesters three courses in basic sound engineering techniques and in electroacoustics. Furthermore, during the practice students are welcome to the laboratories to increase their measurement, testing and design skills. A short introduction is now given to these topics and to our future plans.

Abstract:
A Széchényi István Egyetemen 2005 őszétől a korábbi főiskolai oklevelet leváltó BSc végzettséget adó villamosmérnök képzés indul. A Távközlési Tanszék gondozásában a rádiórendszerek szakirányos hallgatói két féléven keresztül három tantárgyban részesülnek szakirányú hang- és képtechnikai alapképzésben és szereznek alapvető jártasságot a laborgyakorlatok során. Röviden bemutatjuk e tantárgyak vázlatos felépítését, a rendelkezésünkre álló laborhátteret és távlati céljainkat.

1. Introduction

In January 2002 the former college and education form was extended and replaced and a new university established. The Széchenyi István University is the biggest and most popular institute in western Hungary. At the Faculty of Engineering Sciences we offer MSc and BSc degrees in the education. The electrical engineering education offers at the time BSc degree that is fully compatible with other BSc degrees in the frame of the „Bologna process".
In our new syllabus students in electrical engineering education can choose between specializations in automatization, telecommunication informatics and radio communications. The latest two are maintained by the Department of Telecommunication. Radio communication specialization offers microwave technologies and measurements, antennas and wave propagation, CATV, radio and television engineering and broadcasting, mobile and satellite transmission as well as acoustical and sound engineering basics.

Fig.1. Main building of the University

2. Subjects in radio communication specialization

There are three main subjects students have to acquire. In 'Television and video systems' we offer 4 units/week as classroom presentation and additionally 2 units laboratory practice. The subject includes the basics of seeing, physics of colors, image creation, black-and-white television (interlace mode, synchronization etc.), color television (PAL, NTSC) and extended services such as Teletext and multi-channel audio. Beside the base band signals, modulation and transmission is also discussed and measured. In the second half state-of-the-art digital television broadcast is presented from basic coding techniques (DPCM, JPG, MPEG, dither, motion estimation) to completed systems of DVB-T, DVB-S and DVB-C. Furthermore some recording techniques, cameras, CRT and CCD elements, video recorders and projectors, LCD and plasma screens are introduced.
The related subject is electroacoustics. It has the same 4 units/week class room presentation and 2 units/week laboratory practice. After the backgrounds of physical wave propagation (units, harmonic waves, basics of hearing) we get know some special measurement signals, linear and non-linear distortions, monopole and dipole radiators, directional characteristics, plane wave and spherical wave equations. The transducers are handled by mechanical and electroacoustical parameters (electro-dynamic and capacitive transducers and equivalents) and basic calculations are made on loudspeakers, headphones and microphones. The final part introduces sound level measurement, equipment, time and frequency weightings, definitions of L_{eq}, dB(A), SEL, 1/1 and 1/3 octave analysis. Some room acoustics background (calculation and measurement of reverberation time, sound insulation, RASTI) is also given.
The third subject is Studiotechnologies that uses all the knowledge given in the former subjects and makes an overview in practice. It includes basic DSP methods (oversampling, noise shaping, dither), recoding equipments from analog and digital magnetic tapes (A-DAT,

R-DAT, DASH, multi-channel tapes) to non-linear editors and optical storage (CD, DVD, MOD). Furthermore, detailed explanation is given to DVD-Audio, SACD/DSD (HD audio) and to lossless multi-channel formats such as Dolby Digital, dts, SDDS, THX qualification both in the movie theater and home. MP3 and ATRAC are discussed detailed. Finally, basic sound engineering methods of MS/XY microphoning, level control, filters and limiters, effects, reverberation, chorus, flange, aural exciter etc. show the variety of sound engineering skills.

3. Laboratory and measurement equipment

The subjects Electroacoustics and Studiotechnologies share the same room for practice and measurement. It was restored in 2004 with the help of the Telekom Hungary (former MATÁV). There are two computers, one for video editing and one for multi-channel sound recording. We use the Matrox RT100 card, Adobe Premier Pro, Audition and DVD Encore. It offers real-time MPEG1 and MPEG2 encoding and decoding, direct time-line editing and import to DVD burners (double layer) and built-in plug-ins for 2.0 and 5.1 Dolby Digital encoding. The sound recording equipment includes a DMR sound card with 8 I/O channels in 96 kHz/24 bit resolution connected to the microphone preamp and 5 Sennheiser microphones. The playback system has 6.1 channels and JM Lab/Focal speakers.
Furthermore, we have SACD/DVD-Audio players, HDD-based DVD-Video/RAM recorders, S-VHS video, professional DV camera and a monitoring system of 5 monitors. The final result is then projected by a beamer.
Acoustical measurement are made by the Brüel & Kjaer 2260 Observer with built-in 1/1 and 1/3 octave analysis, room acoustics software for measuring the reverberation time and the noise explorer software.
During classes students have to measure transfer and directional characteristics of radiators, reverberation time and SPLs. They record in multi-channel, make mixing and mastering, DVD authoring and bit-budgeting including multi-angle captures, subtitles and multiple soundtracks.

Fig.2. The laboratory

4. Final thesis and research

The laboratory offers material for final thesis and research. Students are welcome from all around the world for practice semester, BSc or MSc thesis, even for PhD research. Recent thesis of our students include sound insulation and reverberation control of the laboratory room, building of omni-directional sound source or subjective evaluation of lossy coded sound samples with musicians.

We welcome student from abroad from our partner universities in Leipzig, Lille, Valencia or Sofia (English or German language is required). We are about to create a transparent structure with them to make it possible for students and staff to change institutions, study plans or specialization curses (in frame of the Bologna process).

Recent research (toward MSc and PhD degrees) include virtual audio synthesis through headphone playback, simulation methods, listening tests and the role of additional signal processing methods in these topics.

Fig.3. Omni-directional loudspeaker for measurements built by a student.

5. Summary

A brief overview was given about the education in electrical engineering at the Széchenyi István University, Győr, Hungary. Based on three main subjects, students learn about television systems, radio communication, acoustic and sound engineering basics. The laboratory is equipped with the latest equipment for study and research as well. Students are welcome from all over the world making practice semester or final thesis. For further information please contact me or visit the homepage of the laboratory.

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