EPFL

EE-442 **Wireless receivers: algorithms and architectures**

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Cursus	Sem.	Type
Electrical Engineering		Opt.
Electrical and Electronical Engineering	MA1, MA3	Obl.
MNIS	MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The students will learn about the basic principles of wireless communication systems, including transmission and modulation schemes as well as the basic components and algorithms of a wireless receiver. They develop an understanding for the wireless channel and system performance and limitations.

Content

Fundamentals
Baseband and passband signals, digital modulation, vector-space representation, matched filtering, maximum-likelihood estimation, performance metrics

Synchronized receiver
Carrier frequency and sampling frequency offset, time- and frequency synchronization, interpolation, equalization, diversity receiver

The wireless channel
Basic AWGN channel, signal propagation and attenuation, fading channels, multipath propagation, Doppler shift

Wideband modulation
Multicarrier communication, orthogonal frequency division multiplexing (OFDM), training based channel estimation and equalization for OFDM, synchronization, tracking, some OFDM based communication standards

Final PROJECT: Accoustic OFDM transceiver
We built an accoustic communication system based on OFDM as final project.

Keywords

Wireless, Communications, Wireless Channel, Digital Receiver, OFDM

Learning Prerequisites

Important concepts to start the course

Fundamentals of signal processing (FFT, LTS, filters, linear algebra, basic probability calculus)

Learning Outcomes

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

- Construct a basic wireless transmitter
- Explain the performance limitations of a wireless system
- Derive basic optimum receiver structures
- Develop a simulation model of a wireless system

- Develop a basic OFDM communication systems

Transversal skills

- Make an oral presentation.
- Use a work methodology appropriate to the task.

Teaching methods

Ex-cathedra lectures, computer labs using MATLAB, a final hands-on project

Assessment methods

Mid-term exam (theory and MATLAB) & Final Project (accoustic OFDM transceiver)

Resources

Moodle Link

- https://go.epfl.ch/EE-442

Prerequisite for

EE-543 Advanced Wireless Receivers