

COM-202

Signal processing

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Cursus	Sem.	Type
Communication systems minor	H	Opt.
Communication systems	BA3	Obl.
Computer science	BA3	Opt.
HES - IC	H	Opt.

Language of teaching	English
Credits	8
Session	Winter
Semester	Fall
Exam	Written
Workload	240h
Weeks	14
Hours	8 weekly
Lecture	4 weekly
Exercises	2 weekly
Practical work	2 weekly
Number of positions	

Summary

Signal processing theory and applications: discrete and continuous time signals; Fourier analysis, DFT, DTFT, CTFT, FFT, STFT; linear time invariant systems; filter design and adaptive filtering; sampling; interpolation and quantization; image processing, data communication and control systems.

Content

Signal processing is an engineering discipline that studies how to analyze, modify, and transmit information using mathematical models, practical devices, and numerical algorithms.

The class will cover the following topics:

1. Basic discrete- and continuous-time signals and systems: signal classes and operations on signals, signals as vectors in a vector space
2. Fourier Analysis: properties of Fourier transforms, DFT, DTFT, CTFT; practical Fourier analysis (FFT, STFT)
3. LTI systems: properties and composition, convolution, application of Fourier analysis to LTI System, Laplace and z-Transforms.
4. Analog vs Digital: sampling, interpolation and quantization.
5. Applications: adaptive filtering; image processing, data communication and control systems.

Learning Prerequisites**Required courses**

Linear Algebra, Programming (Python), Analysis II

Recommended courses

Analyse III (concurrently), Probability theory (concurrently)

Important concepts to start the course

Vectors and vector space, functions and sequences, infinite series

Learning Outcomes

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

- Identify signals and signal types
- Describe properties of LTI systems
- Analyze LTI systems by spectral analysis

- Recognize signal processing problems
- Apply the correct analysis tools to specific signals
- Implement signal processing algorithms
- Design digital filters
- Interpret complex signal processing systems

Teaching methods

This course will weave together theoretical analysis in course lectures with practical hands-on labs using Python (via Jupyter notebooks) and more traditional exercise sessions.

Expected student activities

Study class material; complete weekly homework sets (with solutions discussed in subsequent exercise sessions) and participate in Python applied labs.

Assessment methods

The final grade will be almost fully determined by the final exam, with a small grade component based on compilation of weekly laboratory and homework assignments.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Moodle Link

- <https://go.epfl.ch/COM-202>