COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced signal processing algorithms [S2EiT1E-TIT>ZMPS]

Course

Field of study
Electronics and Telecommunications

Year/Semester
1/2

Area of study (specialization)
Information and Communication Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

prof. dr hab. inż. Ryszard Stasiński
ryszard.stasinski@put.poznan.pl

Lecturers

Prerequisites

Knowledge from the domain of Mathematical Analysis and lecture "Digital Signal Processing": Linear Time-Invariant Systems, Fourier transform, z-transform, design of digital filters, DFT.

Course objective

Knowledge and understanding of advanced methods of signal analysis and processing: time-varying (adaptive) systems, time-frequency signal analysis.

Course-related learning outcomes

Knowledge:
1. Knowledge about linear prediction, predictor structures, design algorithms, and Wiener filtering.
2. Knowledge about structures and properties of adaptive filters (LMS, RLS, fast RLS)
3. Knowledge about construction of multirate systems, basic structures of such systems, and about time-frequency signal analysis

Skills:
1. Designing and implementing of adaptive filters

2. Doing time-frequency signal analysis
3 Designing of multi-rate signal processing systems

Social competences:
Understands necessity of competent approach to solving technical problems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Exam: Written answers to 8-10 questions covering the subject, passing threshold: 50%.
Exercises: Two colloquia, passing threshold: 50%.

Programme content

Lecture: Prediction and Wiener filtering theory: modeling of stochastic processes, Wiener-Hopf equations and algorithms for their solving, predictor structures. Adaptive filters: their relation to Wiener filters, definitions and properties of gradient and least-squares filters, basic implementations. Multirate systems: principles of changing sampling frequency of a signal, decimators and interpolators, filter banks and their properties, QMF filters and their use to implementation of wavelet transform. Time-frequency signal analysis: short-time Fourier transform (Spectrogram), Gabor transform, wavelet transform. Exercises: modeling of stochastic processes. Parametric methods of spectrum estimation. Optimal Wiener filters in: prediction, damping/amplifying narrow-band signal in the presence of a wide-band one, interference atenuation, identification and modeling of systems, equalizers.

Course topics

Lecture: Prediction and Wiener filtering theory: modeling of stochastic processes, Wiener-Hopf equations and algorithms for their solving, predictor structures. Adaptive filters: their relation to Wiener filters, definitions and properties of gradient and least-squares filters, basic implementations. Multirate systems: principles of changing sampling frequency of a signal, decimators and interpolators, filter banks and their properties, QMF filters and their use to implementation of wavelet transform. Time-frequency signal analysis: short-time Fourier transform (Spectrogram), Gabor transform, wavelet transform. Exercises: modeling of stochastic processes. Parametric methods of spectrum estimation. Optimal Wiener filters in: prediction, damping/amplifying narrow-band signal in the presence of a wide-band one, interference atenuation, identification and modeling of systems, equalizers.

Teaching methods

Lecture: Multimedia presentaion plus explanation of details on a blackboard.
Exercises: Short presentation showing context of provided exercises, then solving the exercises on blackboard by students with the hep of a teacher.

Bibliography

Basic
Digital Signal Processing, J.G. Proakis, D.G. Manolakis, Pearson – Prentice-Hall, ed. 4
Additional

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	70	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00