Signal processing techniques - course description

General information

Course name	Signal processing techniques
Course ID	11.3-WE-INFP-SigProcTech-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Computer Science
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2019/2020

Course information

Semester	6
ECTS credits to win	5
Course type	optional
Teaching language	english
Author of syllabus	• dr inż. Leszek Furmankiewicz

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

To introduce students to the methods of analog signal processing.

Forming of understanding the operation principles of systems used for signal processing.

Forming of skills to perform simple measurement experiments on the signals and functional blocks of signal processing circuit.

Prerequisites

Experiment methodology I and II, Microprocessor systems

Scope

Signals, signals processing, signal converters-transducers, circuit of signal conversion. Basic definitions. Signals classifications. Structures of signal converters.

Signal description in the time and in the frequency domain. Basic parameters of deterministic signals. Description of stochastic signals. Fourier series development of periodical signals. Spectrum of periodic and aperiodic signals.

Static and dynamic properties of measuring transducers. Static parameters. The methods of description the transducer static and dynamic parameters: transmittance, time characteristics and frequency characteristics. Dynamic properties of ideal and real transducers.

Initial signals conversion Amplifing and filtering. Operational amplifiers in initial signals conversion circuit. Analog filters. Mathematical models of passive and active analog filters.

Characteristic of analog-to-digital conversion process. Sampling. Sampling frequency selection. Quantization. Coding.

Analog- to-digital and digital-to-analog conversion. Properties of basic types of analog-to-digital and digital-to-analog converters. Parameters of analog-to-digital and digital-to-analog converters. Chosen examples of analog-to-digital and digital-to-analog applications.

Basic operation of digital signal processing. Linearization and correction of transducer static characteristics. Discrete Fourier Transformation and its basic properties. Application of Discrete Fourier Transformation to spectral analyses of signals. Digital filtering. Finite impulse response filters (FIR). Infinite impulse response filters (IIR).

Sensors of selected non-electrical quantities. Position, level and displacement sensors. Force, strain and pressure sensors. Temperature sensors. Measurement data acquisition systems for sensors.

Teaching methods

Lecture, laboratory exercises.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Can describe the principles of operation of selected non-electrical quantities sensors.		• an exam - oral, descriptive, test and other	• Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
Can measure basic signals parameters, analogue signal processing path elements and basic sensors.		• carrying out laboratory reports	• Laboratory
Can characterize and describe signals and measurement converters in time and frequency domains		• an exam - oral, descriptive, test and other	• Lecture
Can characterize the properties of functional blocks of a typical signal processing path		• an exam - oral, descriptive, test and other	• Lecture

Assignment conditions

Lecture – scoring sufficient marks for written examination.

Laboratory – the passing condition is to obtain positive marks from all laboratory exercises to be planned during the semester.

Recommended reading

1. Horowitz P., Hill W.: *The Art of Electronics*, Cambridge University Press, New York, 1989.
2. Plassche, R.J. van de,: *Integrated Analog-to-digital and Digital- to-Analog Converters*, Kluwer Academic Publishers, Boston/ Dordrecht/ London, 1994.
3. Sydenham P. H. (Ed.): Handbook of Measurement Science – Vol - 1: Theoretical Fundamentals, John Wiley & Sons, Chichester,1991.
4. Fraden J.: *Handbook of Modren Sensors. Physics, Design, and Applications.* Fifth edition. Springer - Verlag New York, 2015.

Further reading

Notes

Modified by prof. dr hab. inż. Andrzej Obuchowicz (last modification: 27-10-2019 10:47)