Filtration and separation in electric systems - course description

General information

Course name	Filtration and separation in electric systems
Course ID	06.2-WE-ELEKTP-FSinES-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Electrical Engineering
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2019/2020

Course information

Semester	6
ECTS credits to win	4
Course type	optional
Teaching language	english
Author of syllabus	• dr hab. inż. Krzysztof Sozański, prof. UZ

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	-	-	Credit with grade
Laboratory	15	1	-	-	Credit with grade

Aim of the course

Basic knowledge of: analog passive filters and active analog filters understanding and designing.

Understanding and designing of galvanic isolation in power electronics circuits.

Prerequisites

Circuit Theory

Scope

Analog signal processing. Analog circuits, linear two-port network. Continuous-time filters. Filter parameters. Introduction to analog filter design. Properties of electrical filters. Continuous-time (analog) filters. Active and passive circuits. Designing of passive RLC filters: Butterworth, Chebyshev, Bessel, elliptic (Cauer). Sensitivity to filter parts tolerance. Active analog filters. Digital filters: linear and nonlinear filters. Properties of digital filters: finite impulse response filter (FIR), infinite response filter (IIR). Design of digital filters. Round off effects in digital filters. Implementation of digital filters using digital signal processors. Switched Capacitor (SC) filters. Design of analog filters for power electronics circuit. Model of passive parts used in power electronics circuits. Capacitors for high pulse stressing value and high currents. Capacitor models. Resistors. Magnetic materials: ferrite, amorphous alloy, powder, classical iron, air. Properties of winding and magnetic core. Eddy current losses in magnetic core. Inductor and transformer design. Eddy currents in conductors. Signal separation in power electronics circuits. Voltage and current measurements. Parameters: input-output momentary withstand voltage, common mode transient immunity, input-output capacitance, isolation class. Galvanic isolation: magnetic, capacitance, optic, piezoelectric. Galvanic isolation of analog and digital signals. Review of specialized integrated circuit used for galvanic isolation. Coupling power parts with control circuit. High common mode transient immunity. Galvanic isolated power supply sources. Design and simulation of analog filters using program Matlab. Energy measurements integrated circuits. Parameters. Single-phase and tree-phase circuits. Review of integrated circuits.

Teaching methods

Lecture – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Has an elementary knowledge on the analog and digital filters		• a pass - oral, descriptive, test and other • carrying out laboratory reports	• Lecture • Laboratory
Can design simple analog and digital filters		• carrying out laboratory reports	• Laboratory
Has an elementary knowledge on the application areas of signal separation		• an evaluation test	• Lecture

Assignment conditions

Lecture – in order to get a credit it is necessary to pass all of the required tests (oral or written).

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Calculation of the final grade: lecture 60% + laboratory 40% .

Recommended reading

1. Proakis J. G., Manolakis D. M., Digital Signal processing, Principles, Algorithms, and Applications, Third Edition, Prentice Hall Inc., Engelwood Cliffs, New Jersey 1996

2. Kazmierkowski M. P., Kishnan R., Blaabjerg F., Control in Power Electronics, Academic Press, 2002

3. Sozański K. Digital Signal Processing in Power Electronics Control Circuircuit, second edition, Springer Verlag, 2017

4. Mohan N., Undeland, T. M., Robbins W. P., Power electronics, John Wiley & Sons, Inc., 1995

5. Van den Bossche A., Valchev V. C., Inductors and Transformers for Power Electronics, CRC Press, Taylor & Francis Group, 2005

6. Attia J. O., Electronics and Circuit Analysis using Matlab, CRC Press, 1999

7. Paarmann L. D., Design and Analysis of Analog filters, a Signal Processing Perspective, with Matlab Examples, Kluwer Academic Publishers, 2001

Further reading

Notes

Modified by dr hab. inż. Krzysztof Sozański, prof. UZ (last modification: 04-11-2019 16:23)