Smart measurement transducers - course description

General information

Course name	Smart measurement transducers
Course ID	06.5-WE-ELEKTP-SMT-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	5
ECTS credits to win	5
Course type	optional
Teaching language	english
Author of syllabus	• dr hab. inż. Wiesław Miczulski, 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	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- acquaint students with the metrological properties of the smart measurement transducers (IMT) and error correction methods,
- developing the practical skills in the range of analysing the metrological properties of the IMT.

Prerequisites

Fundamentals of metrology, Metrology, Fundamentals of electronics and power electronics, Computer-aided design.

Scope

General characteristics of intelligent measurement transducers. Definition and classification of intelligent measurement transducers. Structure, basic function blocks and operation algorithms. Basic properties of intelligent measurement transducers.

Metrological properties of selected transducer function blocks. Metrological properties of: input circuits of electrical transducers, selected sensors and conditioners, function operators (averaging circuits, analog filters, multipliers, RMS converters, analogue switches and multiplexers, sample and hold (S/H) analog circuits and others).

Methods of error correction. Factors affecting the value of measurement errors. Methods of zero error, sensitivity and nonlinearity correction. Methods of adaptation of the measuring transducers to the parameters of the processed signals. Classical (programmatic) and neural realization of the reproduction process. Selected examples of intelligent measurement transducers.

Teaching methods

- Lecture: conventional/traditional lecture with elements of discussion.
- laboratory: work in the groups, practical excersises.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Is open to new technical solutions within the area of construction of smart transducers.		• an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory
Experimentally verifies metrological properties of intelligent measurement converters		• an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory
Can indicate in the life cycle of a measurement converter the activities leading to the improvement of its accuracy		• egzamin pisemny	• Lecture
Describes the examples of the implementation of smart measurement converters.		• egzamin pisemny	• Lecture
Can characterize metrological characteristics of basic function blocks of measuring transducers.		• egzamin pisemny	• Lecture

Assignment conditions

Lecture - passing condition is obtaining positive grade from the exam

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 50% + laboratory 50%

Recommended reading

1. Bhargawa S.C: Electrical measuring instruments and measurements. CRC Press, 2012.
2. Bolikowski J. (red): *Essentials of designing of smart measurement transducers of electrical quantities*, Monograph Nr 68, WSI, Zielona Gora 1993 (in Polish).
3. Fraden J.: Handbook of modern sensors. Springer, 2010.
4. Rutkowski L.: Computational Intelligence: Methods and Techniques, Springer-Verlag Berlin Heidelberg, 2008.
5. Vetelino J., Reghu A.: Introduction to sensors. CRC Press, 2010.

Further reading

1. Horowitz P., Hill W.: The art of electronics. Cambridge University Press, 2010
2. Miczulski W., Krajewski M., Sienkowski S., A New Autocalibration Procedure in Intelligent Temperature Transducer, IEEE Transactions on Instrumentation and Measurement, 2019, Vol. 68, iss. 3, s. 895--902.

Notes

Modified by dr hab. inż. Wiesław Miczulski, prof. UZ (last modification: 29-10-2019 19:22)