Sensors and industrial measurements - course description

General information

Course name	Sensors and industrial measurements
Course ID	06.0-WE-AutD-SensIndMeasur.-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Automatic Control and Robotics / Computer Control Systems
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2022/2023

Course information

Semester	1
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Ryszard Rybski

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	15	1	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- familiarize students with the parameters of sensors and methods of description of their static and dynamic properties
- familiarize students with the basic functional blocks of measurement signal processing paths
- familiarize students with the structure, principle of operation and properties of measuring transducers of non-electric quantities and areas of their application
- making students aware of the requirements for sensors and transducers

Prerequisites

Fundamentals of electrical engineering, Fundamentals of electronics, Metrology

Scope

Introduction. Measurement sensors properties in metrology. Sensors typology. Sensors manufacturing technologies.

Sensors and converters in measurement systems. Analogue, digital-analogue and analogue-digital converters. Sensors output signal transmission. Sensors and measurement converters interfaces. Inteligent sensors. Wireless sensory networks.

Temperature measurements. Resistance based thermometers. Thermoelectric thermometers. Semiconductor based temperature sensors. Pyrometers.

Pressure measurements. Piezoresistive sensors. Piezoresistive sensor error compensation. Strain gages. Capacitive sensors.

Liquid velocity and flow measurements. Liquid velocity measurements with anemometric method. Doppler velocimeters. Turbine flow meters.

Measurements of movement. Inductive and capacitive movement sensors. Proximity sensors. Fiber optic movement sensors. Ultrasonic converters in movement measurements. Motion parameters measurement. Rotational speed measurements. Vibrations and quakes measurements. Piezoelectric accelerometers. Capacitive accelerometers.

Force and mass measurements. Strain gages. Strain gages measurement systems. Piezoelectric force sensors.

Teaching methods

- lecture: conventional/traditional lecture
- 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 able to plan and carry out measurements of the characteristics of sensors, transducers and elements of the signal processing path measurement		• a quiz • an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory
Is able to replace the basic functional blocks of the modern measurement signal processing path		• an evaluation test	• Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
Is aware of the requirements for sensors in industrial measurements		• an evaluation test	• Lecture
The student knows the parameters and methods used to describe and evaluate static and dynamic properties of the measuring sensors		• an evaluation test	• Lecture

Assignment conditions

Lecture – the passing condition is to obtain a positive mark from the final test.

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

Calculation of the final grade: lecture 50% + laboratory 50%.

Recommended reading

1.Fraden J.: Handbook of modern sensors. Springer, 2010

2. Nawrocki W.: Measurement Systems and Sensors. Artech House Publishers, 2005

3. Pallas-Areny R., Webster J.G.: *Sensors and signal conditioning*. John Willey& Sons, Inc., 2001

4. Zakrzewski J, Kampik M.: Czujniki i przetworniki pomiarowe. Podręcznik problemowy. Wydawnictwo Politechniki Śląskiej, Gliwice, 2013

5. Miłek M.: Metrologia elektryczna wielkości nieelektrycznych. Oficyna Wydawnicza Uniwersytetu Zielonogórskiego, Zielona Góra, 2006

Further reading

1. Tumanski S.: Principles of electrical measurement. Taylor & Francis, 2006

2. Horowitz P., Hill W.: The art electronics. Cambridge University Press, 2017

3. Kester W.: Przetworniki A/C i C/A. Teoria i praktyka. Wydawnictwo BTC, Legionowo, 2012

Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 11-04-2022 09:05)