EE-206

Measuring systems

Kis Andras

Cursus	Sem.	Type
Electrical and Electronical Engineering	BA3	Obl.
HES - EL	H	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Measuring physical quantities lies at the heart of how engineers and scientists interact with the world around us. This course introduces most common approaches to measuring and reporting quantities such as temperature, humidity, force, acceleration, strain etc. using modern types of sensors.

Content

Sensors and conditioning ciruits. Introduction to transducers, sensors and actuators. Active and passive sensors and their conditioning.
Modeling a measuring system. Measurands and functional components of a measuring system, interfering and modifying inputs, static and dynamic characteristics, identification of transfer function, loading effects.
Noise estimation and reduction. Extrinsic noise, capacitive coupling, magnetic coupling, common mode voltage. Intrinsic noise and noise specifications. Noise reduction, connecting, asymmetric and differential amplifiers, instrumentation amplifiers. Modulation-demodulation, lock-in amplifier.
Analysis of Measurement results. Error attributes, rules of errors composition. Sources and measuring devices. Data presentation. Analog and digital multlimeters specifications.
Comparing measured data. Statistical measuring parameters and their estimation. Random variable and realization, population and sampling. Main distribution, confidence interval, estimation of systematic and random errors by hypothesis tests. Test; retest and reliability of measurement.
Data acquisition. General specification. Sampling, coding, quantication, data conversion (D/A and A/D), multiplexing.

Learning Prerequisites

Required courses

Electrotechnics I and II

Learning Outcomes

By the end of the course, the student must be able to:

- Describe the generic measurement chain
- Choose the appropriate sensor for a given measurement
- Work out / Determine sources of noise in the measurement setup
- Interpret measurement results
- Compare measurement results
- specification sheets for sensors

Teaching methods

Ex cathedra, with exercices

Expected student activities

Attending lectures
Attending exercises
Completing exercises at home

Assessment methods

Written exam at end of the semester.
One test during the semester resulting in maximal bonus of +1 for the final grade.

Resources

Bibliography

- Course notes and slides
- Acquisition de données : du capteur à l'ordinateur / Georges Asch ... [et al.]". Year:2003. ISBN:2-10-006310-3
- Systèmes de mesure / par Pierre-André Paratte et Philippe Robert". Year:1996. ISBN:2-88074-321-4

Ressources en bibliothèque

- Systèmes de mesure / Paratte
- Ajouter au Panier Acquisition de données : du capteur à l'ordinateur / Asch

Prerequisite for

EE-207 Measuring systems laboratory