

SYLLABUS

Measurement systems: design, modeling and computational methods 7.5 credits S7013E

Mätsystem: design, modellering och beräkningsmetoder

Course syllabus admitted: Autumn 2023 Sp 1 - Present

**DECISION DATE
2022-01-14**

Measurement systems: design, modeling and computational methods 7.5 credits S7013E

Mätssystem: design, modellering och beräkningsmetoder

Second cycle, S7013E

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Datateknik	Computer Technology

Entry requirements

Upper secondary education and documented skills in English language Basic circuit theory (E0003E Circuit Theory); Mathematical statistics, including probability density functions, expectation and variance (S0001M Mathematical Statistics); Mathematical analysis, linear algebra, multivariable analysis, Laplace- and Fourier transforms (M0018M Linear Analysis).

Good knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

After completion of the course, the students shall be able to:

- Construct basic circuits for measurement of electrical quantities.
- Use and evaluate numerical computational methods for linear and non-linear systems of equations, and to apply these methods for estimating parameters of models of measurement systems.
- Build empirical models of a system and estimate parameters of these.
- Evaluate models with respect to functionality, reliability, and computational complexity.
- Motivate and present the results orally and in written reports.

The students should also be able to judge:

- The possibilities and limitations of a given measurement system.

Contents

Measurement technology is a wide area, spanning from modeling of the physical process being studied, through construction of measurement systems, parameter estimation and system identification, to a detailed analysis of data and error sources.

This course focuses primarily on the problem of modeling a process and then identifying model parameters and analysis of the results.

A major part of the course therefore deals with the analysis, since an understanding of how error sources (measurement noise, model errors, etc.) affect the system as a whole.

The course modules cover:

- Fundamental physical and mathematical principles of a selection of measurement systems.
- Mathematical and statistical principles necessary for conducting a detailed uncertainty analysis of a specific measurement system, given uncertainties of the system's components.
- Methods for design of experiments targeted at the construction of empirical and/or physical models of measurement systems.
- Fundamental principles of numerical computations for linear and non-linear systems of equations.

The practical experience will be given by laborations, where both sensors and basic electronics are assembled and connected to a physical process. The theoretical analysis is then performed using MATLAB, and the results are summarized in written reports.

Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

The teaching is divided in lectures, problem demonstrations, and practical laborations.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.

Mandatory laboratory assignment with written report in English, approved participation in seminars, and written exam with differentiated grades.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Remarks

The course can be offered in English. This course can not be combined with E7021E.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0003	Written exam	G U 3 4 5	3	Mandatory	S17	
0004	Laboratory work	G U 3 4 5	3	Mandatory	S17	
0005	Seminars	U G#	1.5	Mandatory	S17	

Last revised

by Jonny Johansson, HUL SRT 2022-01-14

Syllabus established

by Jonny Johansson, HUL SRT 2016-02-15