SYLLABUS

Estimation in Control 7.5 credits R7011E

Estimering i reglersystem

Course syllabus admitted: Spring 2017 Sp 3 - Spring 2017 Sp 4

DECISION DATE
2016-11-07

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LULEÅ TEKNISKA UNIVERSITET

Estimation in Control 7.5 credits R7011E

Estimering i reglersystem

Second cycle, R7011E

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

Entry requirements

* (prerequisite for the course R7003E) intermediate level knowledge in the subject of Automatic control, specifically regarding frequency response, state-space form, and state feedback;

* (prerequisite for the course R7003E) experience with using Matlab for analysis of control systems;

* documented skills in English language;

* (suggested) basic level knowledge about Probability and Statistics.

Selection

The selection is based on 30-285 credits

Examiner

Damiano Varagnolo

Course Aim

The student should be able to:

- formulate and implement algorithms for system identification, i.e. estimation of mathematical models of a dynamic system from input-output data
- formulate and implement algorithms for state estimation, i.e. to infer the status of the internal variables of a dynamic system using measurements of other quantities and some knowledge of the system dynamics
- solve simple instances of system identification and estimation problems by hand
- analyze and prove properties of system identification and estimation algorithms
- apply the above described techniques on real-world processes, and report on this work both orally and in writing.

Contents

The course covers the essentials of two interconnected topics: system identification and state estimation.

System identification is the science dealing with how to model systems starting from collected evidence. Among the statistical sciences, this branch is the one most related to automatic control. Indeed developing a control system usually starts with a system identification step: there is a process to be controlled, but there is either no model for it, or an incomplete model where some parameters are unknown, or maybe there is a model, but it is too complicated for developing a controller (for example a finite element simulator of the thermal dynamics of a whole datacenter, and you want to control the temperature of the racks).

State estimation is instead dealing with reconstructing information on the state of a system starting usually from indirect measurements. For example, gyroscopes are usually subject to some bias, but this bias cannot be measured directly. It is nonetheless possible to infer it indirectly combining knowledge of the dynamics of the system and measurements from the sensors. This state information is then useful for performing automatic control tasks, e.g., feedback from the state.

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 consists of lectures and problem seminars. Lab work and project assignments are performed in groups of no more than two students and accounted for with written reports and a demonstration.

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.
Written exam with differentiated grades and approved lab work.

Overlap

The course R7011E is equal to R7015E

Literature. Valid from Spring 2017 Sp 3

Literature:
- L. Ljung, System Identification: Theory for the User, 1999, Prentice Hall;
- lecture notes that will be made electronically available to the students.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Items/credits

Number	Type	Credits	Grade
0001	Written exam	4.5	G U 3 4 5
0002	Laboratory work	3	U G#

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Jonny Johansson, HUL SRT 2016-11-07

Syllabus established

by Jonny Johansson, HUL SRT 2015-02-16