COURSE DESCRIPTION CARD - SYLLABUS

Course name
System identification

Course

Field of study
Automatic control and robotics

Year/Semester
3/5

Area of study (specialization)
-

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
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tel: +48 616 652 367

Responsible for the course/lecturer:

Prerequisites

Every student attending the subject is expected to have basic knowledge of mathematical statistics, signal processing and automatic control (mathematical models in continous-time and discrete-time domain, discretisation methods). Every student should also be able to implement algorithms in Matlab code, implement and simulate block schemmes in Simulink and be able to acquire information from specified sources. Student should also be ready to cooperate in a team.

Course objective

To provide students with the knowledge and skills regarding construction of mathematical models of static and dynamic processes using experimental methods (creation of models based on measured data); to familiarise students with the chosen methods of parametric and nonparametric system identification, verification of models, developing the ability to implement obtained models and their practice use; developing the skills of cooperation in a small group.

Course-related learning outcomes

Knowledge

1. Has extended knowledge of linear models and their analysis from the perspective of system identification problem

2. Knows the principles of identification experiment designing and methods of model validation

3. Knows the main parametric and nonparametric system identification methods with linear models

4. Has the basic knowledge of multivariable and nonlinear system identification

Skills

1. Can plan, prepare and perform simulation of basic control systems, as well as, prepare and perform an identification experiment

2. Is able to determine models using system identification methods, use them and analyse regarding control systems with the identified plant

Social competences

1. Understands the necessity of continuous learning and critical evaluation of the own state of knowledge

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows: The knowledge gained during lectures is verified by means of final written examination. It is composed of 15-30 questions, single or multiple choise with four answers, and 2-5 open questions. The proper ansfer for closed question provides 1 point, open question - 2 points. To obtain positive grade, the number of points has to exceed the half of the maximum number of points.

The skills acquired during laboratory classes are verified by current tests of students knowledge (preparation for classes and verification of the knowledge from earlier classes) and the assessments of reports written by students.

Programme content

Problems that are discussed during lectures and laboratory classes include: system identification as alternative approach to analitical modelling, structures of models in continuous-time and discrete-time domain and with disturbance, planning of system identification experiment, problem of persistent excitation, nonparametric and parametric system identification methods (including least-squares and instrumental variables methods), problem of identifiability, parameter estimator as random number and its qualities, closed-loop system identification, model order estimation, recursive identification methods, multivariable and nonlinear system identification.

Lectures: The theory of above issues and examples of computing problems

Laboratory excercises: Matlab commands and Simulink simulations necessary for the subject. Implementation of simulations and system identification - nonparametric methods, parametric off-line methods for deterministic and stochastic processes, parametric on-line methods, closed-loop system identification.

Teaching methods

Lectures with a multimedia presentation supplemented with examples given on the blackboard, theory presented in connection with current knowledge, new content preceded by a reminder of related content known to students from other subjects.

Laboratory classes - working in teams, computational experiments and programming within teams

Bibliography

Basic

1. T. Soderstrom, P. Stoica, System identification, Prentice Hall, 1989

2. A. Królikowski, D. Horla, J. Ziętkiewicz, System identification, discrete-time parametric methods, Publishing House of Poznan University of Technology, 2020

3. J. Ziętkiewicz, Identyfikacja obiektów sterowania. Ćwiczenia laboratoryjne, Wyd. Politechniki Poznańskiej, 2018

4. J. Schoukens, R. Pintelon, Y. Rolain, Mastering System Identification in 100 Exercises, Wiley, 2012

Additional

1. Horla D., Control Basics. Exercises. Part 2, Wyd. Politechniki Poznańskiej 2017

2. J. Kasprzyk [red] Identyfikacja procesów, Wyd. Politechniki Śląskiej, 1995

3. L. Ljung System Identification. Theory for the user, 2nd ed. Prentice Hall, 1999

Breakdown of average student's workload

	Hours	ECTS
Total workload	135	5,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1]	65	2,0

[1] delete or add other activities as appropriate