COURSE DESCRIPTION CARD - SYLLABUS

Course name
Sensorless systems [S2AiR2-ISA>SB]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/1

Area of study (specialization)
Intelligent Control Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

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

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge of the basics of automation, control methods. Knowledge of mathematics in the field of solving differential equations and set theory. Basic knowledge of digital technology and signal processing.

Course objective

The aim of the course is to introduce to the existing known solutions of control systems of internal variable estimation systems. The aim of the lectures is to teach the student to use the existing level of knowledge in the field of control systems. The methods resulting directly from the theory of estimation are presented, as well as practical issues related to them. The course presents an introduction to the theory of estimation - its purposefulness and possibilities. Further, several methods, including those based on quadrature optimalon estimators, from simple Kalman filters to particle filters, are thoroughly presented.

Course-related learning outcomes

Knowledge:
K2_W7 + has advanced and deepened knowledge of methods of analysis and design of control systems;
K2_W5 + has an organized and in-depth knowledge of the modeling and identification of linear and nonlinear systems;

K2_W12 + has knowledge of development trends and the most important new achievements in the field of automation and robotics and related scientific disciplinesK2_W12+

Skills:
K2_U9 + is able to simulate and analyze the operation of complex automation and robotics systems as well as plan and carry out experimental verification;
K2_U10 + can designate models of simple systems and processes, and use them for the purposes of analysis and design of automation and robotics systems;
K2_U11 + can use advanced methods of signal processing and analysis, including video signal, and can extract information from the analyzed signals;

Social competences:
K2_K1 + understands the need and knows the possibilities of continuous training - improving professional, personal and social competences, can inspire and organize the learning process of other people;

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Final exam in the form of presenting the solution to the problem implemented in the laboratory classes, additional assessment of the progress in the laboratory classes

Programme content

Introduction to the mathematics of sets, statistics and estimation theory
Mathematical modeling of objects focused on building an observer
Prediction in control
Optimal-quadratic estimators - introduction.
The problem and the idea of filtration
Kalman filter
Family of nonlinear Kalman filters
Particle filters
Laboratory exercises illustrate the issues discussed in the lectures, and focus mainly on solving technical and programming problems.

Course topics

none

Teaching methods

Lecture: blackboard and multimedia with elements of hardware experiments
Laboratory: Simulation experiments on laboratory stands, final evaluation of the selected problem

Bibliography

Basic:
Andrew H. Jazwinski, Stochastic Processes and Filtering Theory, 1970,
Brown, Robert Grover, Hwang, Patrick Y.C., Introduction to Random Signals and Applied Kalman Filtering with MATLAB Exercises, 4th Edition, 2012, John Wiley & Sons, Inc.
Haug, Anton J., Bayesian Estimation and Tracking: A Practical Guide, 2012, John Wiley & Sons, Inc.
Lewis, Frank L., Optimal Estimation with an Introduction to Stochastic Control Theory, 1986, John Wiley & Sons, Inc.

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50