COURSE DESCRIPTION CARD - SYLLABUS

Course name
Analysis of control systems [S1AiR1E>PO5-ASysSter]

Course

Field of study
Automatic Control and Robotics

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
english

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Knows and understands to an advanced level theories of AC and DC electric circuits (including three-phase electrical engineering). Knows and understands to an advanced level the theory and methods of principles of operation of basic electronic devices, analog and digital components, selected electronic circuits and systems, knows and understands to an advanced level the basic criteria of synthesis and tuning methods of controllers, tools and techniques of automatic selection of controllers settings and identification of control objects.

Course objective

Teaching students the methods of programming, simulating and analyzing control systems in selected operating systems and programming environments. To teach the configuration methods and basic functions and capabilities of the system and programming environment.

Course-related learning outcomes

Knowledge:
Knows and understands typical engineering technologies, principles and techniques of construction of simple automation and robotics systems; knows and understands the principles of selection of executive

systems, computational units and measurement and control elements and devices [K1_W20 (P6S_WG)].
Is familiar with the current status and latest development trends of the field of automation and robotics [K1_W21 (P6S_WG)].
Knows and understands the fundamental dilemmas of modern civilisation related to the development of automation and robotics [K1_W28 (P6S_WK)].
Skills:
Is able to plan, prepare and simulate the operation of simple automation and robotics systems [K1_U10 (P6S_UW)].
Is able to select the type and parameters of the measurement system, control unit and peripheral and communication modules for the selected application and integrate them in the form of the resulting measurement and control system [K1_U22 (P6S_UW)].
Is able to develop a solution to a simple engineering task and implement, test and run it in a selected programming environment on a PC for selected operating systems [K1_U26 (P6S_UW)].
Social competences:
Is aware of the importance and understands the non-technical aspects and consequences of engineering activities, including their impact on the environment and the related responsibility for decisions; is ready to care for the achievements and traditions of the profession [K1_K2 (P6S_KR)].
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Knowledge acquired during the lecture is verified by the colloquium carried out at the last lecture. Students will have access to a list of issues in force at the colloquium. Skills acquired as part of the laboratory are verified on an ongoing basis during the classes.

Programme content

1. Python programming tools and environments.
2. Numerical modeling of the delay.
3. Modeling of the delay during model linearization.
4. Numerical modeling of a first and second order system.
5. 2DOF control structures.
6. Control structures with the Smith predictor.
7. IMC control structures (internal model control).
8. Structure, principle of operation and applications of the Kalman filter.
9. MPC control structures (model predictive control).
10. Artificial neural networks as a controller.
11. Discretization of models.
12. Selected methods of numerical integration.
13. The influence of delays in the main and measurement control path.
14. Basic functions of opencv (computer vision library).
15. Linux + Python: serial port access procedure.
16. Haar-like cascade classifiers.
17. Parallel computing and GPU based calculations.

Teaching methods

The training methods used:
- a lecture with a multimedia presentation (including: drawings, photographs, animations, sound, films) supplemented by examples given on the board
- a lecture conducted in an interactive way with formulation of questions to a group of students
- presentation of a new topic preceded by a reminder of related content known to students from other subjects
laboratories:
- working in teams

- computational experiments and performance of the tasks given by the instructor.

Bibliography

Basic
1. Internet tutorials for Python 3.x
2. Python packages documentation
3. Opencv documentation
Additional
1. Automate the boring stuff with python, A. Sweigart
2. Python: wprowadzenie, M. Lutz, Helion, wydanie jak najnowsze
3. Python Programming for the Absolute Beginner , M. Dawson
4. Control system design guide, G. Ellis, Elsevier 2004

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	5,00
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)	60	2,50