COURSE DESCRIPTION CARD - SYLLABUS

Course name
Analysis of control systems

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 studies

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	Projects/seminars	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Konrad Urbanski

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Wydział Automatyki, Robotyki i Elektrotechniki

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Responsible for the course/lecturer:
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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

The graduate has elementary knowledge in the field of operation and use of IT tools for rapid prototyping and design. The graduate is familiar with the current state and the latest development trends in the field of automation and robotics. The graduate knows and understands the fundamental dilemmas of modern civilization connected with the development of automation and robotics. The graduate knows and understands the basic processes occurring in the life cycle of devices and selected security systems used in automation and robotics.

Skills

Is able to document and present the results of an engineering task. Is able to communicate using specialized terminology. Can take part in a debate - present, assess and discuss various opinions and positions. Can design simple mechanical components and electrical and electronic systems for a variety of applications. The graduate is able to design and practically use simple diagnostic and decision-making systems dedicated to automation and robotics systems.

Social competences

The graduate is aware of the need for a professional approach to technical issues.

Methods for verifying learning outcomes and assessment criteria

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	5,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	60	2,5

[1] delete or add other activities as appropriate