



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Virtual prototyping in control engineering

### Course

Field of study

automatic control and robotics

Area of study (specialization)

intelligent automation systems

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1 / 1

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

4

### Lecturers

Responsible for the course/lecturer:

Konrad Urbański Ph.D.

Responsible for the course/lecturer:

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Faculty of Control, Robotics and Electrical

Engineering

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### Prerequisites

A student beginning this course should have knowledge of automation and robotics corresponding to level 6 of the Polish Qualification Framework, in particular knowledge of the basics of automation, the theory of linear dynamic systems and programming skills. They should also understand the need to broaden their competences and be ready to cooperate in a team.

### Course objective

To familiarize students with different programming environments for modeling and simulating dynamic objects in the context of rapid prototyping of control systems. To present the basic functions and capabilities of selected programming environments. Presentation of how to use different object



modeling methods in their own programs. Introduction to selected methods of simulation time optimization and parameter selection methods.

### Course-related learning outcomes

#### Knowledge

has an advanced and in-depth knowledge of methods of analysis and design of control systems;

#### Skills

is able to prepare and present in Polish and in a foreign language an oral presentation on specific issues related to automation and robotics;

#### Social competences

understands the need for and knows the possibilities of continuous learning - improving professional, personal and social competences, is able to inspire and organize the learning process of others;

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: mid-semester and end of semester colloquium

Laboratory: current checking of skills within the framework of realized tasks in the field of creating models of objects and control structures and the ability to select object parameters as a function of quality criterion

### Programme content

Basic and advanced calculation and performance analysis functions of the Matlab environment

Selected methods of shortening simulation time in Matlab environment

Optimization tools in Matlab

Data dimensional reduction - principal component analysis (PCA)

Using specialized toolboxes in Matlab

Implementation of artificial neural network calculations in various environments, transfer of ANN structures, shallow and deep networks

Basic operations and Python packages in modeling and simulation

Isolated virtualenv/virtualenvwrapper environment for Python

### Teaching methods

Lecture with multimedia presentation (including: drawings, photos, animations, sound, films) supplemented by examples given on the board

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

### Bibliography

Basic

1. Online tutorials and the knowledge base of MathWorks ®
2. Modelowanie i symulacja układów i procesów dynamicznych, Stanisław Osowski, Warszawa 2007
3. Ćwiczenia z automatyki w Matlabie i simulinku, Jerzy Brzózka, Wydawnictwo EDU-MIKOM, Warszawa 1997
4. Online tutorials for the current version of python 3.x
5. Documentation of selected Python packages for version 3.x

Additional

1. Modelowanie Matematyczne Systemów, J. Gutenbaum, Wyd. 3 rozsz. i popr. Warszawa: Exit 2003
2. Język ANSI C, Kernighan B.W., Ritchie D.M., WNT, Warszawa, 2004
3. MATLAB The Language of Technical Computing, The Math Works, Inc., (wydanie od 2008r.)
4. Automate the Boring Stuff with Python, A. Sweigart, latest edition
5. Python: wprowadzenie, M. Lutz, Helion, wydanie jak najnowsze
6. Python dla każdego. Podstawy programowania, M. Dawson, wydanie jak najnowsze

### Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,0
Classes requiring direct contact with the teacher	60	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) <sup>1</sup>	60	2,0

<sup>1</sup> delete or add other activities as appropriate