COURSE DESCRIPTION CARD - SYLLABUS

Course name

PO10: Electric individual transport vehicles - Unmanned aerial vehicles

Course

Field of study
Electromobility

Year/Semester
4/7

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

A student should know fundamentals on flying robots, basics of control theory, modeling of control systems and methods for system identification. Moreover, he/she should have skills in Matlab programming, implementation and simulation of block schemes in the Simulink environment; should have skills to acquire knowledge from selected sources, skills in using basic information-communication tools, and should be ready to cooperate in a team.

Course objective

Extension of student's knowledge on control and identification methods for autonomously flying robots; shapingthe skills for cooperation in a small team.

Course-related learning outcomes

Knowledge

1. Knows and understands to an advanced level the theory of linear dynamic systems, including selected methods of modelling and stability theory.

2. The graduate knows and understands to an advanced level the basic criteria of synthesis and tuning methods of regulators.

3. Deepen knowledge on selected computational techniques and mathematical methods needed for solving specialized tasks of system identification.

4. Knowledge on methods used to get an initial (a priori) information on system properties for modeling purposes; validation of experimental models and their assessment in the context of flexibility and parsimony.

Skills

1. Planning and preparation of an identification experiment and an identification procedure using either synthetic or real data taken from a system/plant; selection of appropriate methods and tools for solving the tasks in system identification.

2. Is able to obtain information from literature, databases and other sources; has the ability to self-educate in order to improve and update professional competences.

Social competences

The graduate is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions taken. The graduate is ready to take care of the achievements and traditions of the profession.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

A) For lectures: Verification of the teaching results during an exam in the form of a final selection test written by students. The test includes 10-20 questions, every one with A,B,C answers, where one of them is correct and other two are false. A student earns 1 point for a question if he/she selects correct answer. No/wrong answer results on 0 point. A positive mark from the test needs earning more than a half of a maximal possible number of points. The result determines the mark OT which, together with a mark OL from laboratory classes, determine (after rounding) the final mark OK computed as follows: OK= OT*0.7 + OL*0.3. The result OK < 3.0 leads to a negative mark from the course.

B) For laboratory classes: Verification of the teaching results is performed by current checks of students' knowledge (preparation to classes and verification of previously learned topics), and also by assessment and 'defending' the final project results (assessment of: obtained results, quality of the written report, and answers to questions formulated by an instructor and related to the given project task).

Programme content

The lectures cover the following topics: introduction to the lecture, historical overview, terminology and classification of unmanned aerial vehicles, introduction to modeling of the dynamics of multi-rotor flying robots, selected alternative models of the dynamics of flying robots, control architecture of multi-rotor UAVs together with the basic types of controllers used in flying robots, advanced systems of UAV position and orientation control, selected methods of numerical tuning of UAV controllers, algorithms of path planning and UAV collision avoidance.

Laboratory classes closely correlate with the content presented in the lecture part. Examples of implementation based on the open source library: Robotics Toolbox. In the second part of the 30-hour cycle of classes, each student team (2-3 people) selects and carries out one of the defined problem / task for controlling the unmanned aerial vehicle model. The students summarize the second part of the course with a written report on the implementation of the task.

Teaching methods

A) Lectures: Presentation of slides illustrated by additional examples provided and analyzed on a blackboard.

B) Laboratory classes: Fifteen 2-hour excercises in a laboratory room, performed by teams of 2-3 students, in a form of programing-computing and simulation tasks of algorithms and methods for identification and control of UAVs flying autonomously.

Bibliography

Basic

1. Giernacki W., Drony i bezzałogowe statki powietrzne, Wydawnictwo Politechniki Poznańskiej, 2018.

2. Giernacki W., Roboty latające - laboratorium, Wydawnictwo Politechniki Poznańskiej, 2017.

Additional

1. Valavanis K., Handbook of unmanned aerial vehicles, Springer, 2015.

2. Bartkiewicz B. , Kruszewski P. , Szczepkowski M., Drony-teoria i praktyka, KaBe, 2016.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for laboratory classes, preparation for exam) [1]	20	0,5

[1] delete or add other activities as appropriate