COURSE DESCRIPTION CARD - SYLLABUS

Course name
FPGA control system algorithm implementation [N2AiR1-ISA>FPGA]

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/3

Area of study (specialization)
Intelligent Control Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
20

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge of the basics of programming in higher-level languages, knowledge of the basics of digital technology and signal processing, knowledge of control methods

Course objective

The aim of the course is to learn about the structure, programming methods and typical applications of Programmable Logic Devices in high-speed control systems. The aim of the lectures is to teach the student to use the hardware description language, on the example of VHDL, to design digital circuits and their use in the control of high-speed automation systems. The basics of the hardware description language are presented as well as complex digital systems. In the laboratory, students will learn about the commercial Intel Quartus and Xilinx Vivado package, which allows you to create a digital circuit design, perform its behavioral and time simulation, as well as synthesize and implement it into a programmable structure. After completing the education, the student should be able to design and program automation systems with digital programmable systems.

Course-related learning outcomes

Knowledge

K2_W4+ understand the methodology of designing specialized analog and digital electronic systems
K2_W7+ has advanced and deepened knowledge of the methods of analysis and design of control systems;
K2_W18+ has an organized and in-depth knowledge of specialized microprocessor systems for control systems as well as control and measurement systems
Skills
K2_U13 + is able to select and integrate elements of a specialized measurement and control system, including: a control unit, an executive system, a measuring system as well as peripheral and communication modules;K2_W7+
K2_U12 + is able to integrate and program specialized robotic systems;
K2_U25 + is able to construct an algorithm for solving a complex and unusual engineering task and a simple research problem and implement, test and run it in a selected programming environment for selected operating systems;
Social competences
K2_K4 + is aware of the need for a professional approach to technical issues, scrupulous reading of documentation and environmental conditions in which devices and their components may function;

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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

Classification and application area of programmable electronic circuits.
Selected programmable components from manufacturers such as Intel, Xilinx.
Component functional elements of PAL, GAL, PLD, CPLD, FPGA circuits.
Methodology of programming digital circuits.
Basic programming of digital circuits in VHDL language.
Complex elements of the VHDL language and libraries.
Elements of fast signal processing at the interface of digital and analog technology (including AD / DA converters, time / delay / phase detectors, transmission lines)
Laboratory exercises illustrate the issues discussed in the lectures, and focus mainly on solving technical and programming problems.

Teaching methods

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

Bibliography

Basic
M. Zwoliński: Projektowanie układów cyfrowych z wykorzystaniem języka VHDL.
K.L.Short, VHDL for engineers
Additional
T . Łuba, B . Zbierzchowski: Komputerowe projektowanie układów cyfrowych.
K.Skahill, VHDL language
J. Kalisz (red.): Język VHDL w praktyce.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00