



Subject card

Subject name and code	Actuators in in Automatic Control, PG_00067425						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		1.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Signals and Systems -> Faculty of Electronics Telecommunications and Informatics -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Jan Schmidt				
	Teachers		dr inż. Jan Schmidt				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	15		1.0		9.0	25
Subject objectives	The aim is to familiarize the student with the principles of operation, purpose, and properties of executive elements commonly used in automatic control systems. The knowledge acquired prepares the student for later work in an industrial environment. The knowledge acquired also prepares the student for taking up Msc studies.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Thanks to the acquired theoretical knowledge on the executive elements of automation, in particular controllers, actuators and power amplifiers, the student has acquired knowledge on the construction and principles of operation of components used in the implementation of automatic control systems.	[SW2] Assessment of knowledge contained in presentation
	[K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study	The student has the ability to optimally design automatic control systems.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
	[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	The student understands and knows which physical phenomena are used in the functioning of executive elements. The student knows the operating principles of actuators.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
	[K6_W21] knows and understands the basic methods of decision making as well as methods and techniques of design and operation of automatic regulation and control systems, computer applications for controlling and monitoring dynamic systems.	The student knows the methods of design and operation of automation systems using actuators.	[SW1] Assessment of factual knowledge

Subject contents	<p>Lectures:</p> <ol style="list-style-type: none">1. Functions of actuators in automation systems: concepts of actuator, servomotor and power amplifier2. Types, matching and sample actuator designs3. Division of actuators in relation to the type of energy used4. Sample design solutions for pneumatic and hydraulic actuators. Groups and types of electric actuators. Power amplifiers for actuators5. Method of operation and types of electric motors6. Brush DC motors. Disc motors7. Brushless DC motors (BLDC)8. Characteristics of DC motors9. Losses occurring in DC motors10. Rotating magnetic field of three-phase motors. Three-Phase AC Induction Motors Operation11. Types and Characteristics of Three-Phase AC Induction Motors12. Synchronous AC Motors13. Starting Methods and Properties of Single-Phase Motors14. Stepper Motors Characteristics and Classification15. Reluctance Rotor Stepper Motors16. Permanent Magnet and Hybrid Stepper Motors17. Stepper Motor Voltage Excitation Methods18. Dynamic Characteristics of Stepper Motors19. DC Motor Controllers, Direction of Rotation and Torque Control Methods20. Converter Topologies in DC Motor Controllers21. Brushless DC Motor Controllers22. Open Stepper Motor Control System and Closed Stepper Motor Control System23. Microstepping control <p>Laboratories:</p> <ol style="list-style-type: none">1. Methodology of measuring characteristics describing electric motors.2. Study of dynamic characteristics of an actuator with a DC electric motor.3. Study and interpretation of the basic properties of electromechanical and contactless switching devices.4. Checking the characteristics of discrete drive parameters with a stepper motor (controllers, full-step and microstep operation).5. Testing and evaluation of the rotational speed control system using an electric motor.6. Testing the parameters and characteristics of signal amplifiers.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	60.0%	100.0%
Recommended reading	Basic literature	<ol style="list-style-type: none">1. Ryszard Białek, Andrzej Budziłowicz "Elektrotechnika i elektronika okrętowa"2. Austin Hughes, Bill Drury "Electric Motors and Drivers- Fundamentals, Types, and Applications"3. Sang-Hoon Kim "Electric Motor Control DC, AC, BLDC Motors"	
	Supplementary literature	<ol style="list-style-type: none">1. Takashi Kenjo, "Electric Motors and Their Control : An Introduction"2. Jacek Przepiórkowski "Silniki Elektryczne w praktyce elektronika"3. Krzysztof Krykowski "Silniki PM BLDC właściwości, sterowanie, aplikacje"	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none">1. Types, rules of selection and exemplary constructions of the controllers.2. Classification of the actuators according to the kind of used energy and examples of construction solutions.3. Types of DC motors and their characteristics.4. Construction, principle of operation and properties of the disc-armature motor.5. The construction and operation of the brushless DC motor.6. Principle of operation, types and characteristics of three-phase induction motors.7. Methods for start-up and properties of the single-phase motors.8. The main differences in the construction, principle of operation and properties between induction and synchronous AC motors.9. The construction and principle of operation of the variable reluctance stepping motor.10. The essential differences in the construction of rotors for VR, PM and HB stepping motors. What are magnetic properties of materials that are used for these rotors?11. Give the waveforms of currents in the monofilar-wound three-phase VR motor for single-phase and two-phase excitation.12. The main construction features of the typical two-phase 1.8 ° hybrid motor.13. Differences between unipolar and bipolar exciting drivers.14. What is the half-step excitation, and how it is achieved in the 2-phase, and as a 5-phase hybrid motors?15. What are the differences: single-phase and two-phase excitation operation of the stepper motor?16. Purpose of microstep operation and features of the driver for this mode.		
Work placement	Not applicable		

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