



Subject card

Subject name and code	Modelling and Basics of Identification, PG_00058307						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2025/2026		
Education level	first-cycle studies		Subject group		Optional subject group 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	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Michał Grochowski				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		8.0		32.0	100
Subject objectives	Presentation of modern methods of systems modeling and estimation of their parameters. Analytical, fuzzy and neural technology will be presented						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U07] can build and analyze models of systems and systems in the field related to control systems and automation		Student potrafi zaplanować przygotować i przeprowadzić eksperymenty, pomiary i symulacje komputerowe do oceny realizacji zadań z zakresu modelowania i identyfikacji systemów		[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K6_W07] has basic knowledge related to control and automation systems		- Students is able to build mathematical models of objects and dynamic processes - The student is able to study simulation and experimentally behaviour of of dynamic objects. - The student formulates and solves optimization problems with constraints.		[SW1] Assessment of factual knowledge		

Subject contents	LECTURES		
	<div>1. Deterministic signals - parametric and non parametric models of deterministic signals. Multiplexing, demultiplexing, sampling and extrapolating, A/C and C/A processing. Selected models of deterministic signals. Random signals.</div> <div>2. System theory in modelling and identification: categories of the systems. Static and dynamic models. Linear and nonlinear models. Continuous and discrete models. Kinds of description. Linearization.</div> <div>3. Parametric and nonparametric models. Fenomenological modelling, behavioral modelling and mixed modelling grey box modelling. Steps of modeling.</div> <div>4. Phenomenological modelling: example of models - continuous and discrete, linear and nonlinear, stationary and nonstationary, deterministic and stochastic. Uncertainty modelling. Modelling with usage of fuzzy technology. Fuzzy reasoning systems. Structures of fuzzy models - Mamdani, Larsen, Takagi-Sugeno and Tsukamoto models.</div> <div>5. Optimisation methods In identification: optimisation problems for parametric models. Criteria of optimisation. Optimisation methods with and without constraints. Fundamentals of usage of the genetic algorithms.</div> <div>6. Behavioural models and identification: System identification - problems. Linear and nonlinear models considering the parameters. Least squares method. Modelling with usage of neural technologies; training of neural models.</div> <div>7. Modelling with usage of hybrid techniques; example of advanced applications: neural - fuzzy models and their tuning. Examples of hybrid models .</div>		
	EXERCISE		
	<div>• Continuous systems - building of phenomenological models based on principle rules of conservation - Designing of analogue diagrams.</div> <div>• Linearization.</div> <div>• Continuous/discrete signals - differences, ways of conversions.</div> <div>• Discrete systems - definitions, analysis.</div> <div>• Selected optimisation problems.</div> <div>• Fuzzy systems - definitions, properties, fuzzy reasoning.</div>		
	LABORATORY		
	<div>• Continuous systems - building of phenomenological models based on principle rules of conservation.</div> <div>• Linearization.</div> <div>• Modelling of discrete systems.</div> <div>• Model parameter estimations, Least squares method.</div> <div>• Fuzzy logic - fundamentals of reasoning.</div>		
	Prerequisites and co-requisites		
	There are no requirements		
Assessment methods and criteria	Subject passing criteria		
	Exam		
	Exercises		
	Laboratory		
Recommended reading	Basic literature		
	Supplementary literature		
	eResources addresses		
Example issues/ example questions/ tasks being completed	<div>• building a complex dynamic plant model in Matlab/Simulink software;</div> <div>• dynamic model parameter estimation;</div> <div>• process modeling using fuzzy sets;</div> <div>• introduction to artificial neural networks.</div>		
Work placement	Not applicable		