UNIWERSYTET IM. ADAMA MICKIEWICZA W POZNANIU

Fundamentals of control engineering

Educational subject description sheet

Basic information

Study programme
Fizyka (Physics of Advanced Materials for Energy Processing)

Speciality
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Organizational unit
Faculty of Physics and Astronomy

Study level
Second-cycle programme

Study form
Full-time

Education profile
General academic

Didactic cycle
2024/25

Subject code
04FENS.22S.03259.24

Lecture languages
English

Course type
Elective

Block
specialty subjects

Subject coordinator	Jarosław Kłos
Lecturer	Jarosław Kłos

Period	**Activities and hours**	**Number of ECTS points**
Semester 2	• Laboratories: 15, Graded credit	2

Goals

Code	Goal
C1	Providing knowledge on: (i) time- and frequency-domain description of the linear system, (ii) relation between transfer function and state-space representation.
C2	Introducing students to time-domain characteristics in control theory: (i) numerical calculations of the impulse response and the step response for the system defined by state-space representation or transfer function, (ii) determining step response for basic functional blocks in control theory.
C3	Introducing students to frequency-domain characteristics in control theory: (i) numerical calculations numerically Bode plots for the system described by the transfer function, (ii) interpreting the Bode plot for low-pass and high-pass filters.
C4	Developing the skills of students in browsing the English literature and technical manuals in the field of control theory.

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge – Student:			
W1	(i) formulates state-space representation for the linear system of one or two degrees of freedom, (ii) describes the relation between the transfer function and state-space representation.	FEN_K2_W02, FEN_K2_W03	Test
Skills – Student:			
U1	derives transfer function from state-space representation.	FEN_K2_U01, FEN_K2_U03, FEN_K2_U05	Test, Project
U2	(i) calculates numerically the impulse response and the step response for the system defined by state-space representation or transfer function, (ii) predicts the step response for integrator or differentiator.	FEN_K2_U01, FEN_K2_U03, FEN_K2_U05	Test, Project
U3	(i) calculates numerically Bode plots for the system described by the transfer function, (ii) interprets the Bode plot for low-pass and high-pass filters.	FEN_K2_U01, FEN_K2_U03, FEN_K2_U05	Test, Project
Social competences – Student:			
K1	browses the English literature and technical manuals to realize the project concerning the simulation analog and/or digital systems using dedicated software.	FEN_K2_K01, FEN_K2_K02	Project

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Dynamical systems	W1, K1	Laboratories
2.	State-space representation and transfer function for linear dynamical systems	W1, U1, U2, U3, K1	Laboratories
3.	Time and frequency characteristics of linear systems	U1, U2, U3, K1	Laboratories

Additional information

Activities	Teaching and learning methods and activities
Laboratories	Laboratory method, Project method

Activities	Credit conditions
Laboratories	The final score (0-100%) consists of two components: (i) results of written test - 40% contribution to final score (ii) evaluation of the project - 60% contribution to final score. • Very good (bdb; 5,0): 90-100% of final score • Good plus (+db; 4,5): 80-89% of final score • Good (db; 4,0): 60-79% of final score • Satisfactory plus (+dst; 3,5): 60-69% of final score • Satisfactory (dst; 3,0): 50-59% of final score • Unsatisfactory (ndst; 2,0): 0-49% of final score

Literature

Obligatory

1. Control System Engineering, N.S. Nise , Willey&Sons, Inc. (2011)
2. Linear Control System Analysis and Design with MATLAB, C.H. Houpis and S.N. Sheldon, CRS Press (2014)

Calculation of ECTS points

Activities	Activity hours*
Laboratories	15
Preparation for classes	10
Preparation of a project	25
Student workload	**Hours** 50
Number of ECTS points	**ECTS** 2

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
FEN_K2_K01	The graduate is ready to critically evaluate own knowledge and received content
FEN_K2_K02	The graduate is ready to recognize the importance of knowledge in solving cognitive and practical problems and seeking expert opinion (also from other scientific disciplines) to overcome difficulties during independent problem solving
FEN_K2_U01	The graduate can use their knowledge to formulate and solve complex and unusual problems in the field of physical sciences; select and apply appropriate methods and tools necessary to solve a given problem (including advanced IT techniques), as well as adapt existing methods and tools or develop completely new ones
FEN_K2_U03	The graduate can formulate and test hypotheses related to simple research problems in physics (plan and perform observations, experiments, theoretical calculations or computer simulations and critically evaluate and discuss the results obtained)
FEN_K2_U05	The graduate can use English in accordance with the requirements set out for level B2+ of the Common European Framework of Reference for Languages, as well as specialist English terminology in the field of physical sciences
FEN_K2_W02	The graduate knows and understands in-depth selected research methods and tools as well as mathematical models used in physics
FEN_K2_W03	The graduate knows and understands in-depth selected computational methods and information technology tools and techniques used to solve complex problems in physics