Control Theory 1 - course description

General information

Course name	Control Theory 1
Course ID	11.1-WK-MATD-TS1-Ć-S14_pNadGenDEYH1
Faculty	Faculty of Mathematics, Computer Science and Econometrics
Field of study	Mathematics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2019/2020

Course information

Semester	4
ECTS credits to win	7
Course type	optional
Teaching language	polish
Author of syllabus	• prof. dr hab. Jerzy Motyl

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Class	30	2	-	-	Credit with grade
Lecture	30	2	-	-	Exam

Aim of the course

After the course of “control theory 1” students should be able to solve themselves practical and theoretical problems on the topic of dynamical linear systems.

Prerequisites

Linear algebra, differential equations.

Scope

Lecture:

1. Dynamical systems – definitions and classification (4 h.).
2. Main theorem on the smooth system (2 h.).
3. Costs functional - problems of Meyer, Lagrange and i Bolza (2 h.).
4. Differential types of controllability (2 h.).
5. Linear dynamical systems, fundamental matrix (2 h.).
6. Gram matrix, its properties and connections with global controllability (2 h.).
7. Theorems of Kalman’s type for discrete and continuous linear dynamical systems (4 h.).
8. Linear-quadratic problem (2 h.).
9. Properties of attainable set, emission zone and the set of attainable controls (2 h.).
10. Theorems on properties of the attainable set: convexity, boundedness, compactness (4 h.).
11. Extremal controls (2 h.).
12. Integral maximum rule (2 h.).

Class

1. Linear equations and their fundamental matrix different methods of solving (4h.).
2. Linear dynamical systems and „0-1” fundamental matrix (2 godz.).
3. Gram matrix solving and its connections with global controllability (2 h.).
4. Solving of global controllability of discrete and continuous linear dynamical systems by Kalman’s methods (6 h.).
5. Solving of linear-quadratic problem (4 h.).
6. Properties of attainable set, emission zone and the set of attainable controls (2 h.).
7. Examples of the nonexistence of optimal controls without convexity or compactness of attainable controls (2 h.).
8. Extremal controls for linear dynamical systems (4 h.).
9. Applicability of the integral maximum rule (2 h.).

Teaching methods

Conventional lecture; problem lecture.

Auditorium exercises – solving standard problems enlightening the significance of the theory, exercises on applications, solving problems.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

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Student is able to formulate opinions on the basic issues of mathematical proofs.	• K_K04	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class
Student has the ability to validate evidence of formal building of proofs.	• K_U03	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class
Student in the selected field can carry out evidence which, if necessary, also the tools from other departments of mathematics.	• K_U14	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class
Student has in-depth knowledge in the chosen field of theoretical mathematics or applied.	• K_W04	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class

Assignment conditions

Final exam and grade.

Recommended reading

1. J. Zabczyk, Zarys matematycznej teorii sterowania, PWN, 1991
2. Z. Wyderka, Teoria sterowania optymalnego, skrypty Uniwersytetu Śląskiego nr 397, Katowice, 1987.

Further reading

1. S. Rolewicz, Analiza funkcjonalna i teoria sterowania, PWN, 1977.

Notes

Modified by dr Robert Dylewski, prof. UZ (last modification: 20-09-2019 11:52)