RTU Course "Linear and Nonlinear Systems"

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General data

Code	EEI356
Course title	Linear and Nonlinear Systems
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Power and Electrical Engineering
Responsible instructor	Viesturs Bražis
Academic staff	Nadežda Kuņicina
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN
Annotation	Linear and nonlinear control system analysis, stability detection and synthesis. Basic blocks characteristics, stability estimation. Closed-loop system transient processes and quality parameters improvement. Nonlinear control system stability detection and correction. Multi-axle motion control system.
Goals and objectives of the course in terms of competences and skills	To teach students in comprehension of linear and nonlinear control system design, application of substitution schemes, to make basic calculations for evaluation of system static error, stability and transient processes quality.
Structure and tasks of independent studies	Students must calculate 13 tasks, independently providing its design and defending at test. Students must made test in virtual environment www.vu.lv.
Recommended literature	I. Raņķis, V.Bražis Regulēšanas teorijas pamati, Lekciju konspekts, Atkārtots izdevums, Rīgas Tehniskā universitāte Rīga, 2007. Uzdevumi regulēšanas teorijas pamatos, Rīga, 2004. V.Kļimavičius. Automātiskā vadība. - Rīga: RTU, 2002.- 232 lpp. Е.И. Юревич. Теория автоматического управления. – Санкт-Петербург, «БХВ- Петербург», 2007.-560 с. Е.И. Юревич. Основы робототехники. 2-е издание. – Санкт-Петербург, «БХВ- Петербург», 2007.-416 с. Richard C. Dorf, Robert H. Bishop. Modern Control Systems. – New Jersey: PearsonPrentice Hall, 2005. -881 p.
Course prerequisites	Mathematics, power engineering and electronics

Course outline

Theme	Hours
Basic concepts of control system.	2
Concept of transfer function.	2
Frequency research methods.	2
Development and calculation of typical linear control system block circuit.	2
Automated control system basic blocks.	4
PID controller.	2
Lag element, oscillation block.	2
Control system stability criterions.	2
Investigation of control system by algorithm of Rauth, Mihailov method and Naiqvist criteria, examples.	2
Practical realisation of optimization.	2
Analysis of system operation quality parameters.	2
Nonlinear control system analysis.	2
Nonlinear control system stability.	2
Nonlinear control system quality and correction.	2
Multi-axle motion control system.	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
Able to describe basic elements of control system, their features and working principles.	Passed test of tasks Nr.1.-6. Test in virtual environment. Passed an exam.
Able to evaluate stability of automated control.	Passed test of tasks Nr.7.-10. Test in virtual environment. Passed an exam.
Able to calculate the PID controller.	Passed test of tasks Nr. 11. Test in virtual environment. Passed an exam.
Able to analyse the nonlinear control system operation.	Passed test of tasks Nr.12. Passed an exam.

Able to analyse the multi-axle motion control system.	Passed test of tasks Nr.13. Passed an exam.

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	2.0	0.0	0.0		*	