

Specification for the book of courses

Study program		Electrical Engineering and Computer Science		
Module		Control Systems		
Type and level of studies		Undergraduate Academic Studies		
The name of the course		Nonlinear Control Systems		
Lecturer (for lectures)		Mitić B. Darko, Perić Lj. Staniša		
Lecturer/associate (for exercises)		Spasić D. Miodrag, Perić Lj. Staniša		
Lecturer/associate (for OFE)				
Number of ECTS	5	Course status (obligatory/elective)	Obligatory	
Prerequisites				
Course objectives	Acquiring knowledge of nonlinear control systems. Methods for analysis and synthesis of nonlinear control systems.			
Course outcomes	Theoretical knowledge in nonlinear control systems. Implementation of nonlinear system theory in analysis and synthesis of control systems.			
Course outline				
Theoretical teaching	Nonlinear Control Systems (NCS). Concept, qualification and typical nonlinearities of NCSs. Methods of analysis for NCS. Stability of NCS. Definition of stability, local stability, Lyapunov's indirect method, Lyapunov's direct method. Absolute stability of NCS. Lure's problem. Popov's frequency method. Process stability. Examples of NCS. Systems with natural nonlinearities, systems with deliberately introduced nonlinearities (relay control systems, variable structure control systems). Examples for analysis and synthesis of NCS. Feedback linearization.			
Practical teaching (exercises, OFE, study and research)	Analysis of NCS in phase space. The phase portraits of the second order linear systems. The harmonic linearization method. The application of Mikhail's criteria for determining the parameters of self-oscillations. The first Lyapunov's (indirect) method. The second Lyapunov's (direct) method. Lure's problem. The stability analysis using Popov's frequency method. Relay based controllers. Design of variable structure control systems with sliding mode.			
Textbooks/references				
1	Č. Milosavljević, Fundamentals of Automatic Control - II part: Continuous-time Nonlinear Control Systems, Faculty of Electronic Engineering in Niš, 2003. (in Serbian)			
2	M. Stojić, Control Systems, Faculty of Electronic Engineering in Niš, 2004. (in Serbian)			
3	H.K. Khalil: Nonlinear Systems, Prentice Hall, 1996.			
4	Č. Milosavljević, Fundamentals of Automatic Control - Methodical Workbook, Faculty of Electronic Engineering, Niš, 1995. (in Serbian).			
5	D. Antić, Č. Milosavljević, G. Golo, D. Mitić, P. Vuković, Automatic Control Systems - Exam Exercises, Faculty of Electronic Engineering, Niš, 1995. (in Serbian)			
Number of classes of active education per week during semester/trimester/year				
Lectures	Exercises	OFE	Study and research work	Other classes
2	2	0	0	0
Teaching methods	Lectures; Auditory exercises			
Grade (maximum number of points 100)				
Pre-exam duties	Points	Final exam		Points
Activity during lectures	10	Written exam		10
Exercises		Oral exam		20
Colloquia	60			
Projects				