UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

AUTOMATIC CONTROL

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	ING-INF/04 (AUTOMATICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRONIC AND COMPUTER ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	1st semester (27/09/2021 - 21/01/2022)
ECTS	12
Lesson hours	154 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	TOFFANIN CHIARA (titolare) - 2 ECTS MAGNI LALO - 10 ECTS
Prerequisites	Knowledge acquired in the courses of Mathematics, Geometry and Algebra, Mathematical Methods, Theory of circuits, Physics I.
Learning outcomes	The course aims to provide students with the basic elements for the analysis and control of dynamic systems. After an introduction in which highlights the fundamental problems of the automatic control and the importance of mathematical models for the study of dynamical systems, the main results concerning dynamic systems in continuous time are introduced. Particular attention is given to "state concepts, stability, controllability, observability". The study of linear time invariant dynamic systems is then conducted in the domain of the Laplace transform, by introducing the concepts of "transfer function, block diagrams, frequency response". In the second part of the course it is introduce the problem of how to act on the input variables of a system, suitably

	described by a mathematical model, to achieve a particular behavior of the process. The main criteria for analysis and control synthesis for linear systems with a single input and a single output are introduced. It is given special attention to stability, noise attenuation and reference tracking. At the end of the course the student will be able to formulate and solve a control problem for systems with one input and one output using the techniques developed in the frequency domain. The course is complemented by a series of physical exercises during which various systems (electrical, mechanical, hydraulic, etc.) are described in precise mathematical terms and analyzed by applying methods learned in class.
Course contents	Continuous time dynamic systems. Classification of dynamic systems, equilibrium, linear systems, linearization, stability. Continuous time invariant linear systems. Equilibrium, stability of nonlinear systems. Reachability, observability and canonical decomposition. Transfer Functions Definition and properties, representation and parameters, step response, realization. Block diagrams. Frequency response. Identification of the frequency response, Bode diagrams. Analysis of continuous-time control systems Control in the neighbourhood of an equilibrium. General feedback control diagram. Control system nominal and robust stability. Bode criterion. Polar and Nyquist diagrams. Nyquist criterion, gain margin and margin phase, sensitivity analyzes. Summary of continuous-time control systems Requirements and specifications, methods of synthesis, stabilizing networks. Root locus. Industrial controllers Model and industrial implementation of PID controllers (Proportional-Integral-Derivatives). Simulation and control with the help of Matlab / Simulink.
Teaching methods	Theoretical face-to-face lectures, blackboard exercises, Matlab exercises on the computer, and an exercise conducted on a laboratory process are provided.
Reccomended or required readings	P. Bolzern, R. Scattolini, N. Schiavoni. Fondamenti di controlli automatici. McGraw Hill Italia.
Assessment methods	The written exam consists of two parts. The first part deals with the analysis of dynamic systems, while the second concerns the analysis of closed-loop dynamic systems and controller synthesis. It is necessary to obtain an evaluation of at least 18/30 on both parties. The overall evaluation is obtained by averaging the votes obtained in the two parts; the two parts can also be supported in different appeals; You can also add up to 3 points to be achieved during the Matlab exercises. In any case, it is possible to achieve the maximum of votes even only with the script.

Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile