UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

MECHATRONICS

Anno immatricolazione	2019/2020
Anno offerta	2020/2021
Normativa	DM270
SSD	ING-INF/05 (SISTEMI DI ELABORAZIONE DELLE INFORMAZIONI)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	INDUSTRIAL AUTOMATION ENGINEERING - INGEGNERIA DELL'AUTOMAZIONE INDUSTRIALE
Curriculum	Industrial Technologies and Management
Anno di corso	2°
Periodo didattico	Secondo Semestre (08/03/2021 - 14/06/2021)
Crediti	6
Ore	50 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO
Docente	LEPORATI FRANCESCO (titolare) - 5 CFU PEIXOTO MACHADO DA SILVA JOSE' ALBERTO - 1 CFU
Prerequisiti	
Obiettivi formativi	Understanding the topics of the course presupposes knowledge of the concepts addressed in the courses of electronics, controls, electronic calculators and fundamentals of computer science.
Programma e contenuti	The Mechatronics course aims to provide students with a theoretical and practical vision of a digital system that allows the acquisition and processing of environmental physical quantities such as temperature, force, acceleration, etc. applying concepts and techniques largely already addressed in the courses of Physics, Electronics and Calculators.

At the end of the course the student will have acquired the notions that will allow him to identify and choose the main components making up a chain of measurement acquisition of the conditions of an industrial process, intervene on the process by means of an electromechanical actuator to maintain the stability of the process, that is operation within desired minimum conditions.
All this through microprocessor control identified within a series of known algorithms and techniques.

Metodi didattici

Introduction to the course
Measurement systems. Electronic chain of acquisition and control. Analog and digital signals. Fourier analysis (outline). Frequency spectrum. Low-pass, high-pass, band-pass filters. Bode diagrams. Step response analysis.
Transducers
General information on transducers. Transducers for measuring linear and angular position, linear and angular velocity, acceleration, pressure, temperature, flow rate, level and acidity.
Conditioning networks
Voltage-current and current-voltage, charge-voltage, frequency-voltage converters. Bridge circuits. The use of operational amplifiers in measurement chains: amplification with diode and single and double half-wave AC-DC converter. Synchronous rectifier. Instrumentation amplifier. Sampling problems: Shannon's theorem. Interfacing to the microprocessor. Creation of a circuit for the analog-digital set point. Visualization on LCD display.
Actuators
SCR, Triac and Unijunction Transistor. Direct current motor. Stepper motor.
Control algorithms
Resumption of proportional, proportional-integral and proportional-integral-derivative control. Cascade and feed-forward control. Numerical controllers. Speed control. Smith predictor. Compensation for a pure delay. Numerical techniques and optimal controllers.
Industrial processes
Examples of process acquisition and control chains in typical applications of the automation world
The course is organized in lectures, where the characteristics of the transducers used for the measurements will be illustrated, the signal conditioning circuits to bring the signal itself to be read by a microprocessor, some actuators that allow you to influence the evolution of the process (typically industrial) and control algorithms that influence the generation of the input signal to the actuator so that the process evolves towards conditions of stability (i.e. the Process Variable that is measured does not diverge towards values considered unacceptable for the process or oscillating) . Between the lessons and at the end of the course, exercises will follow where the 'problem solving' approach will be used, aimed at applying the theoretical concepts presented to experimental data sets and at the interpretation / understanding of the problems proposed by typical processes encountered in the world automation.

Testi di riferimento

Francesco Leporati. Slides and notes from the lessons (look at the web site of the course http://mclab.unipv.it/eleind/Mechatronics/).

Modalità verifica apprendimento

The student's preparation will be evaluated through a written test.
It will contain an example of an industrial process in which it will be necessary to identify the correct transducer to measure the variable Process, the transfer function of the process in question and the control algorithm needed for stabilization.
The process will have characteristics similar to those faced in the exercises with some differentiations aimed at developing and refining the students' design and critical skills.
The second part of the test focuses on the description of a transducer and the relative conditioning electronics towards the microprocessor or an actuator among those explained in lessons.
The test ends with some short questions that require you to identify the reason for the behavior of transducers, electronic circuits, control techniques and actuators seen in class with the intent of favoring, instead of a mnemonic study, the understanding of the basic mechanisms that can then constitute valuable knowledge even in situations other than those seen in lessons but equally frequent in the world of industrial automation

Altre informazioni

It is possible to write to the course lecturer for explanations and clarifications by writing at his own mail address.

Obiettivi Agenda 2030 per lo sviluppo sostenibile

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