UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

PROCESS CONTROL AND ROBOTICS

Anno immatricolazione	2019/2020
Anno offerta	2019/2020
Normativa	DM270
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	INDUSTRIAL AUTOMATION ENGINEERING - INGEGNERIA DELL'AUTOMAZIONE INDUSTRIALE
Curriculum	PERCORSO COMUNE
Anno di corso	1°
Periodo didattico	Annualità Singola (30/09/2019 - 12/06/2020)
Crediti	12
Lingua insegnamento	English
Prerequisiti	Knowledge acquired in previous courses in Automatic Control and Mathematical Methods in Engineering.
Obiettivi formativi	The course describes and analyzes control schemes which are frequently used at industrial level. It also provides the basics for the design of digital control systems.
Programma e contenuti	Industrial control schemes: Cascade control, open loop control, filtering of the reference signal, compensation of measurable disturbances, two degrees of freedom control schemes, Smith Predictor, decentralized control, relative gain array, decoupling schemes. PID controllers Features and properties. Rules for the empirical calibration. Wind-up and anti wind-up schemes. Digital control: Discrete-time systems. The concept of equilibrium for discrete-time systems. Stability. Stability of linear time-invariant discrete-time systems. Jury test. Digital control schemes. Sampling problem. Choice of the sampling time. Discretization of continuous-time controllers. Euler and

	Tustin methods.
Metodi didattici	Lectures (hours/year in lecture theatre): 90 Practical class (hours/year in lecture theatre): 0 Practicals / Workshops (hours/year in lecture theatre): 0
Testi di riferimento	Lecture notes Paolo Bolzern, Riccardo Scattolini, Nicola Schiavoni. Fondamenti di controlli automatici. McGraw-Hill, Milano. (In Italian). Carlos A. Smith, Armando B. Corripio. Principles and Practices of Automatic Process Control. John Wiley and Sons.
Modalità verifica apprendimento	Closed-book, closed-notes, 2 hour written exam consisting of 1-2 sections assessing knwoledge and understanding of the course topics and ability to apply them in a problem solving context. Each section will be independently graded. Threshold to pass is 18/30 an maximum mark is 30/30 cum laude. The final mark is obtained as the weighted mean of marks given to each section of the written exam. Example of a written exam: http://sisdin.unipv.it/labsisdin/teaching/courses/procon/files/Process_Control_Exam_Example.pdf

L'insegnamento è suddiviso

504462 - **PROCESS CONTROL**

504463 - **ROBOT CONTROL**

UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

PROCESS CONTROL

Anno immatricolazione	2019/2020
Anno offerta	2019/2020
Normativa	DM270
SSD	ING-INF/04 (AUTOMATICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	INDUSTRIAL AUTOMATION ENGINEERING - INGEGNERIA DELL'AUTOMAZIONE INDUSTRIALE
Curriculum	PERCORSO COMUNE
Anno di corso	1°
Periodo didattico	Primo Semestre (30/09/2019 - 20/01/2020)
Crediti	6
Ore	45 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO
Docente	FERRARA ANTONELLA (titolare) - 6 CFU
Prerequisiti	Knowledge acquired in previous courses in Automatic Control and Mathematical Methods in Engineering.
Obiettivi formativi	The course describes and analyzes control schemes which are frequently used at industrial level. It also provides the basics for the design of digital control systems.
Programma e contenuti	Industrial control schemes: Cascade control, open loop control, filtering of the reference signal, compensation of measurable disturbances, two degrees of freedom control schemes, Smith Predictor, decentralized control, relative gain array, decoupling schemes. PID controllers

	Features and properties. Rules for the empirical calibration. Wind-up and anti wind-up schemes. Digital control: Discrete-time systems. The concept of equilibrium for discrete-time systems. Stability. Stability of linear time-invariant discrete-time systems. Jury test. Digital control schemes. Sampling problem. Choice of the sampling time. Discretization of continuous-time controllers. Euler and Tustin methods.
Metodi didattici	Lectures (hours/year in lecture theatre): 45 Practical class (hours/year in lecture theatre): 0 Practicals / Workshops (hours/year in lecture theatre): 0
Testi di riferimento	Lecture notes Paolo Bolzern, Riccardo Scattolini, Nicola Schiavoni. Fondamenti di controlli automatici. McGraw-Hill, Milano. (In Italian). Carlos A. Smith, Armando B. Corripio. Principles and Practices of Automatic Process Control. John Wiley and Sons.
Modalità verifica apprendimento	Closed-book, closed-notes, 2 hour written exam consisting of 1-2 sections assessing knwoledge and understanding of the course topics and ability to apply them in a problem solving context. Each section will be independently graded. Threshold to pass is 18/30 an maximum mark is 30/30 cum laude. The final mark is obtained as the weighted mean of marks given to each section of the written exam. Example of a written exam: http://sisdin.unipv.it/labsisdin/teaching/courses/procon/files/Process_Control_Exam_Example.pdf
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile

UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

ROBOT CONTROL

Anno immatricolazione	2019/2020
Anno offerta	2019/2020
Normativa	DM270
SSD	ING-INF/04 (AUTOMATICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	INDUSTRIAL AUTOMATION ENGINEERING - INGEGNERIA DELL'AUTOMAZIONE INDUSTRIALE
Curriculum	PERCORSO COMUNE
Anno di corso	1°
Periodo didattico	Secondo Semestre (02/03/2020 - 12/06/2020)
Crediti	6
Ore	45 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO
Docente	FERRARA ANTONELLA (titolare) - 6 CFU
Prerequisiti	Knowledge acquired in previous courses in Automatic Control and Mathematical Methods in Engineering.
Obiettivi formativi	The course provides the basic methodological tools to model and control industrial robots.
Programma e contenuti	Modelling of robotic systems: Structure of robotic manipulators. Classification. The joint space and the operational space. Direct kinematics. Inverse kinematics. Differential kinematics. Euler angles. Relationship between geometrical and analytical Jacobian. Dynamic modeling. Robot control: Planning. Motion control in the joint space (decentralized and

	centralized) and in the operational space (inverse dynamics). Interaction control: force control, hybrid force/position control.
Metodi didattici	Lectures (hours/year in lecture theatre): 45 Practical class (hours/year in lecture theatre): 0 Practicals / Workshops (hours/year in lecture theatre): 0
Testi di riferimento	Lecture notes Robotics: Modelling, Planning and Control (Advanced Textbooks in Control and Signal Processing). Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo. Springer.
Modalità verifica apprendimento	Closed-book, closed-notes, 2 hour written exam consisting of 3 sections assessing knwoledge and understanding of the course topics and ability to apply them in a problem solving context. Each section will be independently graded. Threshold to pass is 18/30 an maximum mark is 30/30 cum laude. The final mark is obtained as the weighted mean of marks given to each section of the written exam. Example of a written exam: http://sisdin.unipv.it/labsisdin/teaching/courses/robcon/files/Robot_Control_Exam_Example.pdf
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile