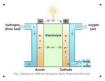

Motore elettrico


Pale Eoliche


Pannelli solari

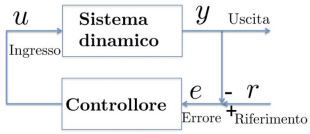

Distribuzione dell'energia elettrica


Celle a combustibile


Luminosita' e comfort in edifici

MODERN CONTROL FOR ENERGY SYSTEMS

a.y. 2017-2018
Laurea Magistrale in Ingegneria Energetica



Instructor

Prof. Luca Schenato
Phone: 049 827 7925
Office: 315 DEI/A
E-mail: schenato@dei.unipd.it (**NO luca.schenato@dei.unipd.it !!!!)**
Webpage: http://automatica.dei.unipd.it/people/schenato.html
Office hours: appointment by email or phone

Description

- Mathematical modeling of dynamical systems
- Definitions and mathematical model classes for dynamical systems
- Representation in State Space
- Linear Systems
- Stability and Lyapunov theory
- Linearization around working points
- Transient and stationary responce to step, impulse and sinuisoidal inputs
- Relevant LTI systems: I and II order systems
- Laplace transform
- Frequency domain control: PID controllers

Lectures

Each lecture references the specific textbook sections

Week	MONDAY (10:30-12:30 classroom M4)	THURSDAY (12:30-14:15 classroom M3)
1 (25-28/09)	Class Introduction (Slides) Water Tank, Car on inclined plane	DC Motor, Heat-Trasfer, Building temperature dynamics, Hydraulic piston, Temperature regulator
2 (2-5/10)	Water level regulator, electronic circuit (Astrom-Murray, exercise 3.4). Recup in Linear Algebra: determinant, rank, image, kernel,etc..	Jordan form. Exponential of a matrix. Solution of LTI systems. (Chaper 5 of Astrom-Murray)
3 (9-12/10)	Modes of LTI systems, free evolution of the output, stability **(Wednesday 10/10 Room Fe)**	Equilibrium confuguration for stable LTI systems. Examples.
4 (16-19/10)	More example on LTI systems.	The value of control. Nominal control and integral control. Pole placement: examples and naive approach.
5 (23-26/10)	Reachability definition and matrix. Reachable canonical form. Pole placement problem. Ackerman formula.	Example of desing of state-feedback control
6 (30/10-2/11)	INTRODUCTION TO SIMULINK (Room Te)	MATLAB/SIMULINK: the water-tank model (Room Te)
7 (6-9/11)	Stability of linearized systems via Lyapunov Theory. Observability and observers	Stability of Observers and examples. Robustness to parameter uncertainty
8 (13-16/11)	MATLAB/SIMULINK: nominal and robust control of the water-tank model (Room Te)	Laplace Transform, Transfer Fucntions, Mapping from state-space to transfer function and vice-versa. Definition zeros and poles, Bode Diagrams
9 (20-23/11)	Example of LTI representations, Steady-state behaviour to impulse, step and sinusoidal input	**NO LECTURE**
10 (27-30/11)	Bode Dyagrams;	**(Wednesday 29/11 8:45-10:30 Room Fe)** Nyquist plots
11 (4-7/12)	Nyquist criterion for stability	Stability margins.
12 (11-	Frequency domain design of PIDs	PID desing

14/12)			
13 (18-21/12)	**24**		
14 (15-18/01)			

Materiale

Official textbook:

1. K.J. Astrom, R.M. Murray, Feedback Systems: An introduction for Scientists and Engineers, Princeton University Press, 2008

Optional textbook:

1. G.F. Franklin, J.D. Powell, Emami-Naeini, F*eedback Control of Dynamical Systems*, Pearson, Prentice Hall, Fifth Edition, 2006

Control Problems

1. TBD