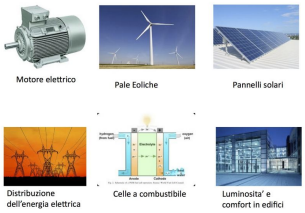
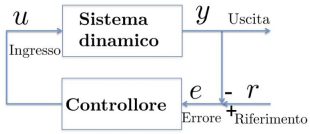


AUTOMATIC CONTROL SYSTEMS

a.y. 2016-2017
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
- Linearization around working points
- Relevant signal models, convolution, Laplace Transform and Inverse Laplace Transform
- Linear time invariant dynamical systems (LTI): reppresentations, free responce, forced responce
- BIBO stability, Cartesio criterion, Routh's criterion
- Transient and stationary responce to step, impulse and sinuisoidal inputs
- Relevant LTI systems: I and II order systems
- Feedback systems: Nyquist diagram and Nyquist criterion
- Frequency domain control: PID controllers

Lectures

Each lecture references the specific textbook sections

Week	MONDAY (10:30-12:30 classroom M3)	WEDNESDAY (10:30-12:15 classroom M7)	
1 (26-8/09)	Class Introduction (Slides) Motivations [FPE Chapter 1, Examples in Cap 2: example 2.1, 2.5, 2.11]	**no lecture**	
2 (3-5/10)	Mathematical Preliminaries: complex numbers, polynomials, rational functions, delta functions, causal signals, convolution.	Linearization. Laplace Transform and its properties: Part I	
3 (10-12/10)	**MATLAB/SIMULINK Tutorial I**	Laplace Transform and its properties: Part I	
4 (17-19/10)	Fractional representazion of (proper) rational fucntions	Relation between Laplace Transform and LTI dynamical systems: transfer fucntion, natural response, forced response	
5 (24-26/10)	**no lecture**	**no lecture**	**Thursday 12:30-14:15** Examples of transfer fucntions
6 (31/11-2/11)	**no lecture**	Stability for LTI systems: asyptotic and BIBO. Comments on stability determination. Examples.	
7 (7-11/11)	Stable LTI systems: transient response, steady state response. Steady-state reponse for step, sinusoidal, and periodic inputs	Evans and Bode representation of t.f. Introduction to Bode diagrams	**Thursday 12:30-14:15** Bode Diagrams: drawing roles and asymptotic diagrams
8 (14-16/11)	Bode Diagrams: examples	Nyquist diagrams: definition	**Wednesday 14:30-16:00 MATLAB-SIMULINK Tutoria II**
9 (21-23/11)	Nyquist diagrams: examples	II order systems & closed loop systems: time domain vs frequency domain	
10 (28-30/11)	Nyquist criterion: restricted and general	Nyquist criterion: examples	
11 (5-7/12)	PID controller: structure	PID controller: I, P, PI, PD desing	
	PID controller: PID full design & model reduction	PID controller: examples	

12 (12-14/12)			
13 (19-21/01)	**no lecture**	PID controllers: examples	**MATLAB SIMILINK: Tutorial III**
14 (16-19/01)	Preparation for the final exam		

Materiale

Official textbook:

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

Side tectbook:

1. **[BV]** Mauro Bisiacco, Maria Elena Valcher, *Controlli Automatici*, Edizioni Libreria Progetto, Padova 2008

Control Problems

1. TBD