POLITECNICO DI MILANO





Automatic Control

Introduction

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Aim and organization

Course aim

- Fundamentals of systems theory
- Fundamentals of frequency domain and time domain design
- Fundamentals of digital control systems
- Software and hardware technologies for automation
- A classical mechatronic case study: motion control systems

Course organization

- lectures
- exercises
- 5 laboratories
- homework project

Evaluation and teachers

Course evaluation

- written examination
- homework project (max 3 points)
- oral examination (upon teacher's request only)

Teachers

- course teacher

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Via G. Ponzio 34/5 (Leonardo Campus)
Tel. 3440

- teaching assistant

Ing. Marco Baur (marco.baur@polimi.it)

Other information

Course web page

bascetta.deib.polimi.it/index.php/AutCont-Mec

Thesis proposals

Unmanned Autonomous Vehicles

Robotics

Teacher's web page

bascetta.deib.polimi.it

Teaching material

1. Lecture slides and notes (on the website)

2. Paolo Bolzern, Riccardo Scattolini, Nicola Schiavoni
   Fondamenti di controlli automatici

3. Norman S. Nise
   Control systems engineering

4. Gene F. Franklin, J. Da Powell, Abbas Emami-Naeini
   Feedback control of dynamic systems

5. GianAntonio Magnani, Gianni Ferretti, Paolo Rocco
   Tecnologie dei sistemi di controllo

Course program (I)

- Systems theory overview (continuous time systems)
  - Linear and nonlinear dynamical systems
  - Linear systems: stability, controllability, observability
  - Laplace transforms and transfer functions
  - State space realization of a transfer function
- Frequency domain design
  - Frequency response, Bode and Nyquist plots
  - Control system design
  - Industrial regulators (PID)
- Root locus
  - Stability analysis of a closed-loop system
  - Design using root locus

Course program (II)

- State space design
  - Pole placement
  - State estimator design

- Systems theory overview (discrete time systems)
  - Linear and nonlinear dynamical systems
  - Linear systems: equilibria, trajectories, stability analysis
  - Z transforms and transfer functions

- Digital control systems
  - Analog-to-digital and digital-to-analog converters
  - Introduction of the sample-and-hold in a closed-loop system
  - Digital control system design

Automatic Control B ends here!

Course program (III)

- Motion control
  - Motion planning
  - Rigid and elastic model of a servomechanism
  - Classical and advanced motion control techniques
  - A case study: industrial robotics

- Control system technologies for automation
  - Hardware technologies (conditioning, filtering, A/D and D/A conversion)
  - Software technologies (control system design, communication systems, Programmable Logic Controllers)