Dipartimento di Ingegneria dell'Informazione
e Scienze Matematiche

Thesis and Research opportunities in the System and Control Group

Systems and Control in Siena

Systems and Control research group @Unisi founded in 1993 by prof. Antonio Vicino

Faculty Members:

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+ 15/20 Research Associates and PhD Students

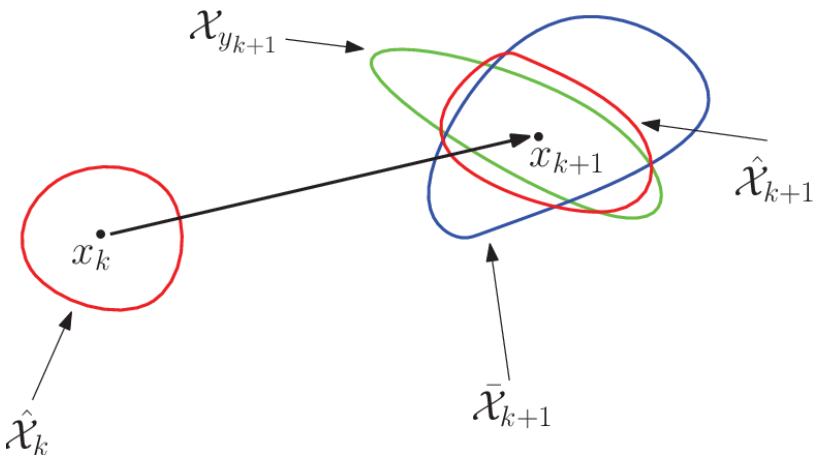
Research topics

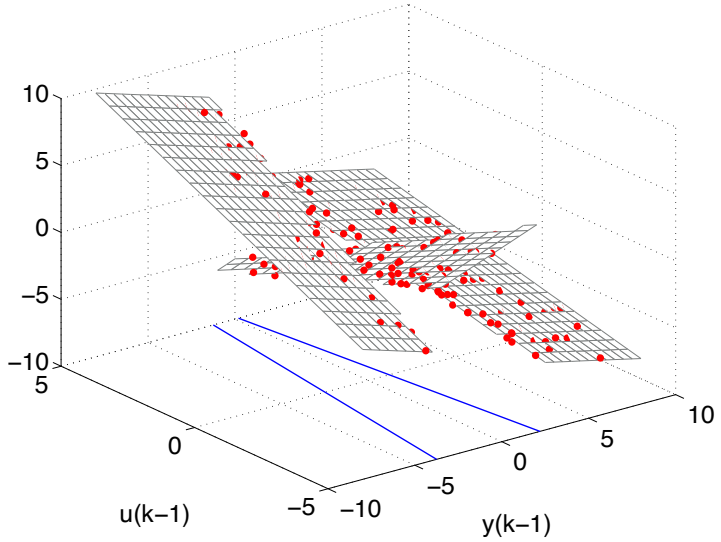
The research activities of the Systems and Control group mainly concern the development of methodologies and applications on:

- ◊ Modeling, identification and control
- ◊ Robotics and Mechatronics
- ◊ Wearable Robotics and Healthcare
- ◊ Smart Grids
- ◊ Complex Systems
- ◊ Multi-Agent Systems
- ◊ Aerospace Control

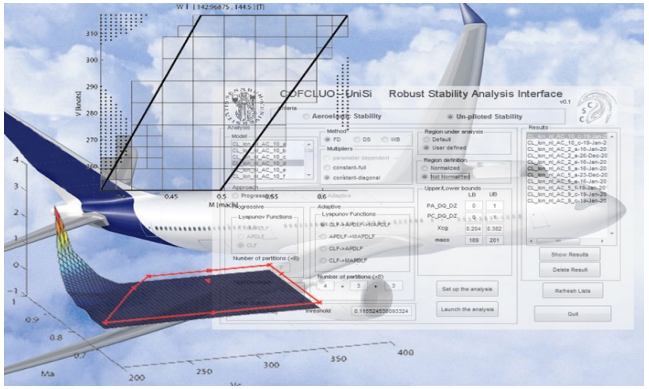
Topics in this presentation (for the others: http://control.diism.unisi.it)

Modeling, identification and control



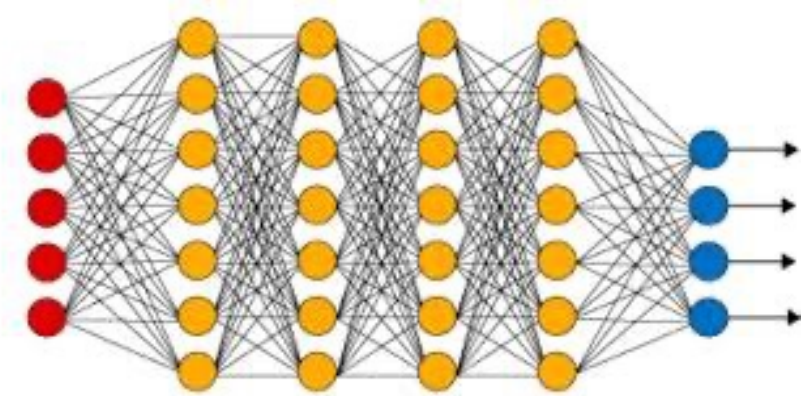


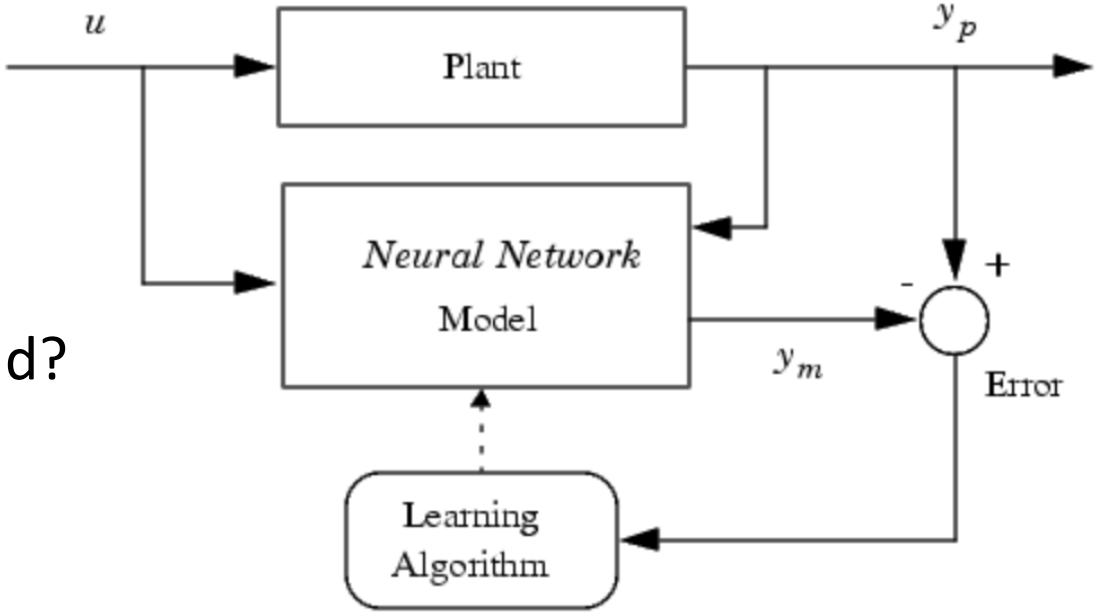
- Set-membership system identification and estimation techniques
- Robust control of uncertain systems
- Convex optimization for analysis and control of nonlinear systems
- Identification of piecewise affine models for nonlinear systems



System Identification or Machine Learning?

- Machine learning has received great impulse by increased computational power ("deep learning")
- Neural networks have been intensively used for identification of nonlinear systems
- Is SysId just ML? What can we gain by using ML tools in SysId?





Reinforcement Learning Control

Use machine learning to train feedback control laws

Controller: map from measures to input (ex.: neural net)

No need for explicit model (just simulations!)

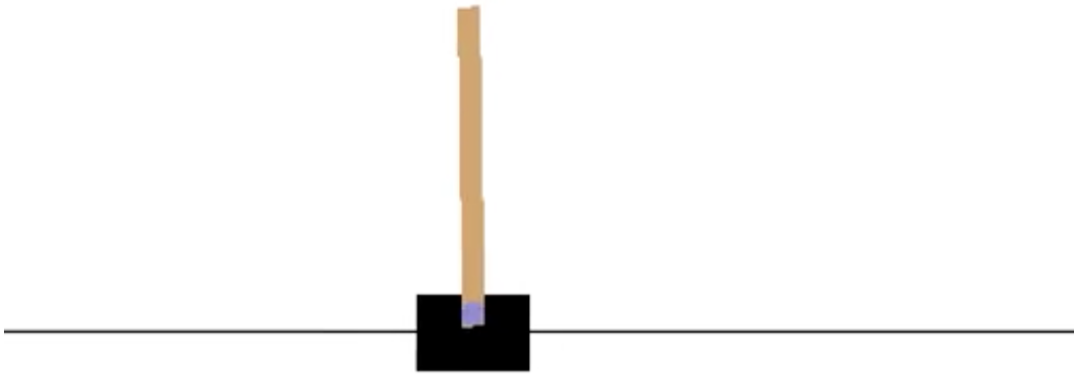
Cart-pole system (OpenAI Gym)

Objective: keep the pole in vertical position

Observations: cart position and velocity, pole angle and angular velocity

Binary input: push the cart left or right

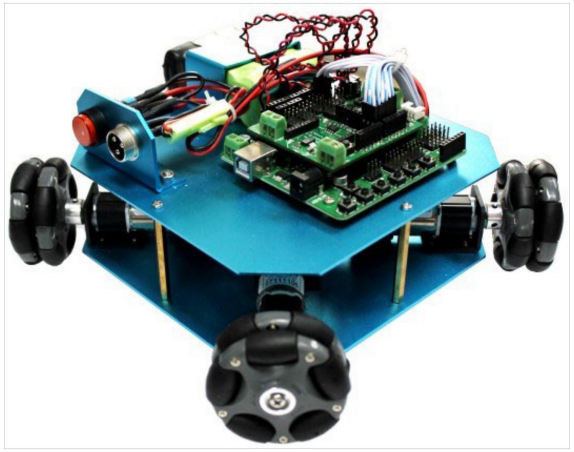
Episode ends when: (|pole angle| > 12 deg) or (cart at the end of the rail)



Multi-agent Systems

- Simultaneous localization and map-building
- Collective motion of multi-agent systems
- Pursuit-evasion games
- Opinion dynamics and consensus
- Distributed estimation and optimization

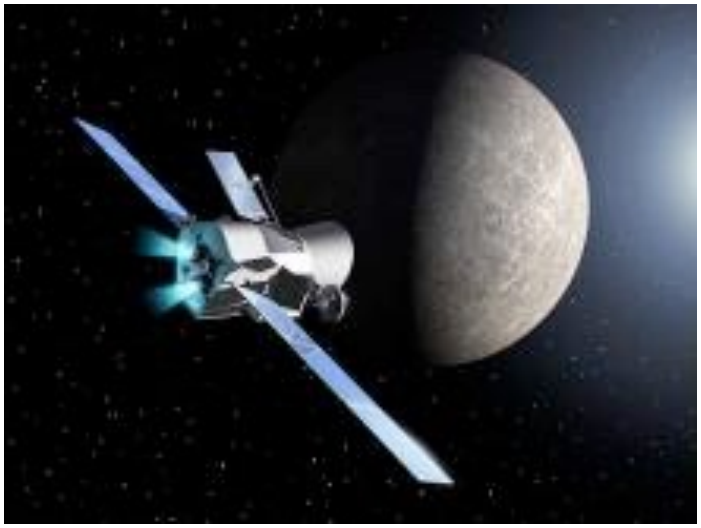
A new experimental testbed for teams of heterogeneous robots



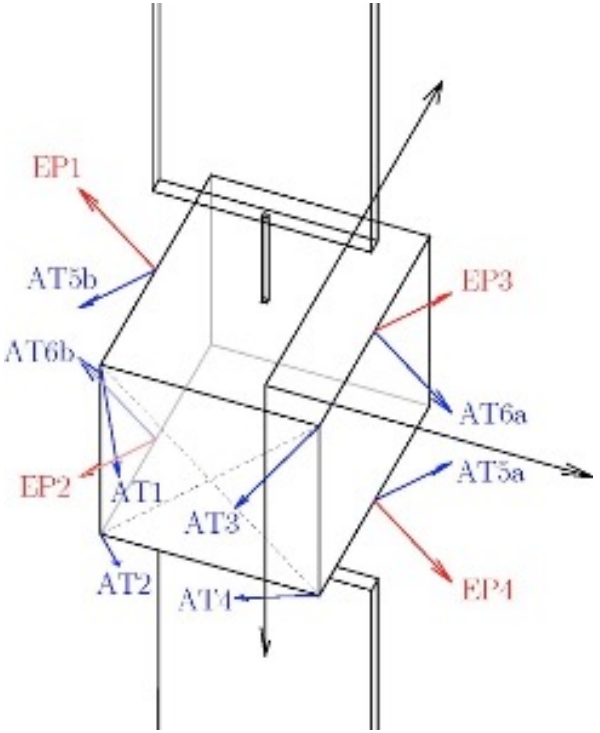
More info at:

http://control.dii.unisi.it/MAS/

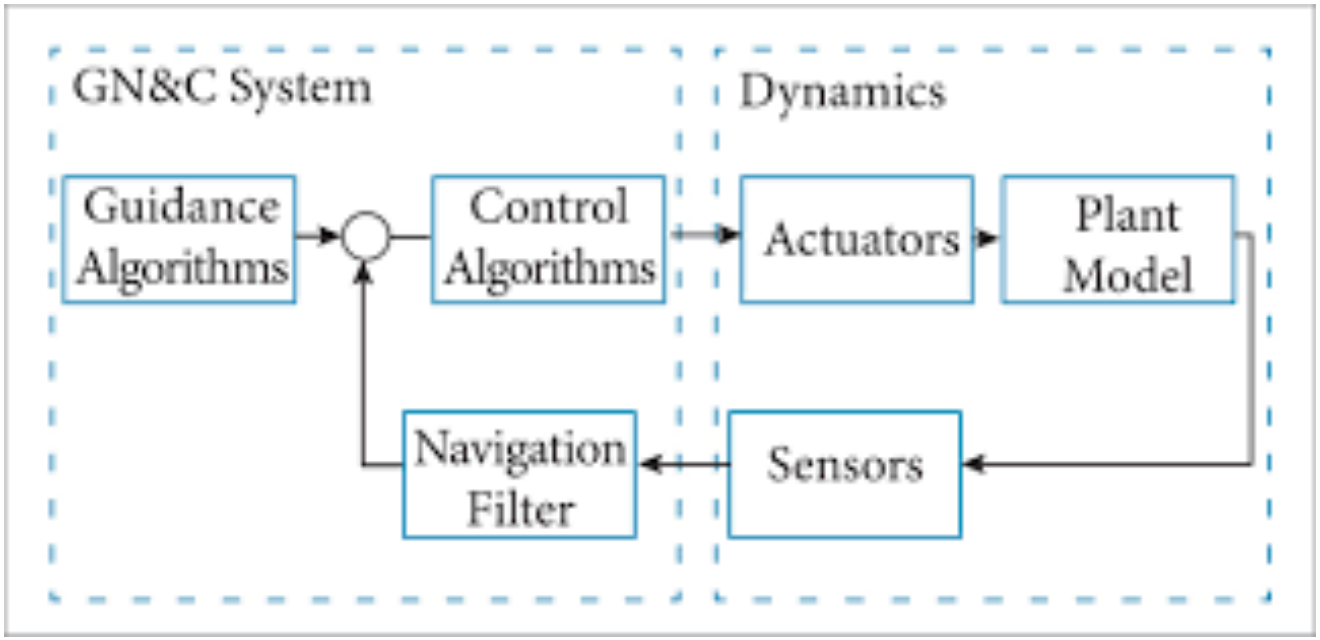
Aerospace Control



- Attitude and orbit control
- Autonomous navigation
- Space simulation



Guidance, navigation and control systems



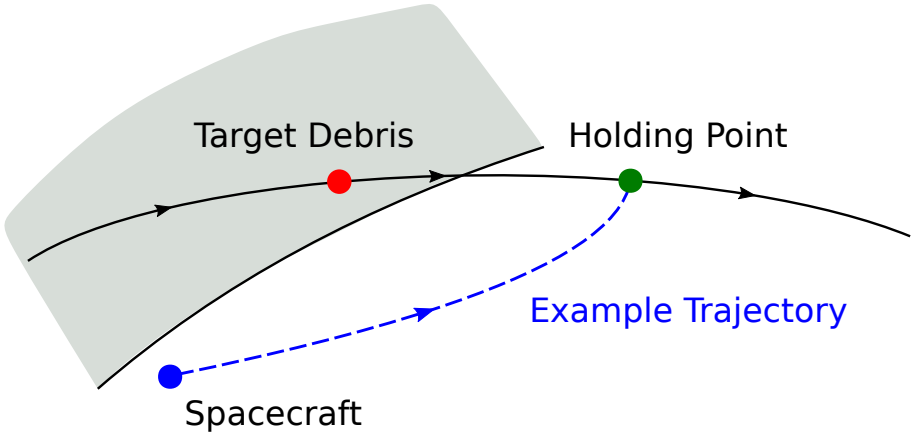
Navigation filter → state estimation

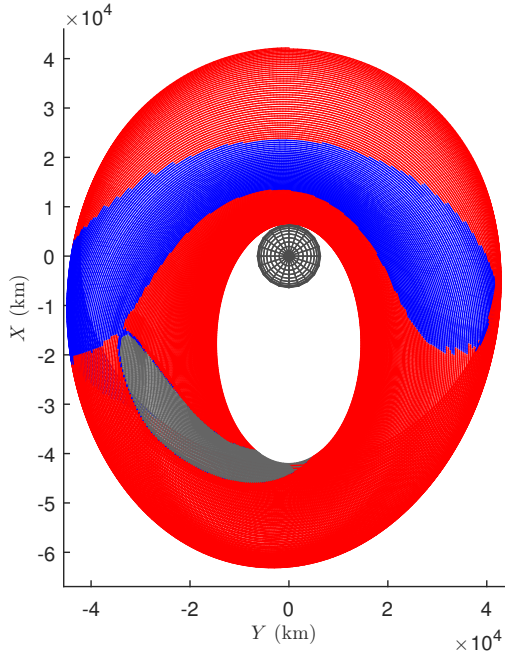
Guidance algorithms → trajectory planning

Control algorithms → reference tracking

Mission analysis and design

- Optimal orbit transfer
- Rendezvous and docking
- Debris removal





More info at:
http://control.dii.unisi.it/Aerospace/

Other material at:

http://control.diism.unisi.it

Send your questions to:

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