SAPIENZA
UNIVERSITÀ DI ROMA

Model Checking Lab

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Computer Science Department
Sapienza University of Rome, Italy

http://mclab.di.uniroma1.it

Sapienza University of Rome

- Founded in **1303**
- The **largest** university in Europe
  - **115K** students
  - **7K** foreign students
  - **1K** incoming Erasmus students / year
- Steadily within **top 3%** world universities
  [Shangai Ranking]
- **250** Bachelor & Master Programmes
- **11** Faculties
- **63** Departments

Computer Science Dept. @ Sapienza

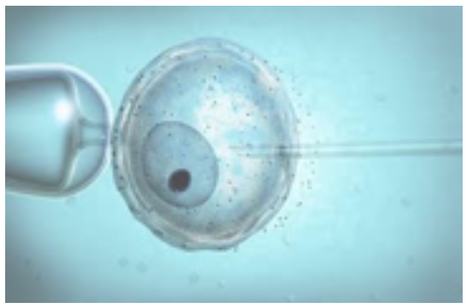
- **45** Faculty Members
- **23** Post-Doc Researchers
- **20** PhD Students

- Internationally active in most of the major CS **research areas**:

- ✦ Algorithms & Data Structures
- ✦ **Artificial Intelligence**
- ✦ Combinatorics
- ✦ Computational Complexity
- ✦ **Computer Architectures**
- ✦ Computer Networks
- ✦ Computer Security
- ✦ **Database Systems**
- ✦ Web Information Retrieval
- ✦ **Formal Methods**
- ✦ Human-Computer Interaction
- ✦ Computer Graphics
- ✦ Information Theory
- ✦ **Software Engineering**

Model Checking Lab @ Sapienza

- Research group within the Computer Science Department
- **6** faculty members, **1** post-docs, **3** PhD students,
  1 research fellow, **10** graduate students
- **Research focus**: design and development of software tools for **model-based** verification, validation and synthesis of **mission-** and **safety-critical embedded control systems**:
  - aerospace
  - critical infrastructures
  - transportation
  - medicine
  - smart grids



MClab

Model-Based System Verification @ MCLab

Disturbance Model (formal model of operational scenarios)

SyLVer

System Level Formal Verifier

https://bitbucket.org/mclab/sylver-simulink-driver

LOAD - RUN - FREE -STORE

Optimised Simulation Campaign

Simulator Driver

Parallel (cluster)

Optimised Simulation Campaign

Simulator Driver

Simulation Based Verification

Simulator

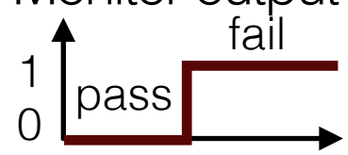
CPS Model + Monitor

Simulator

CPS Model + Monitor

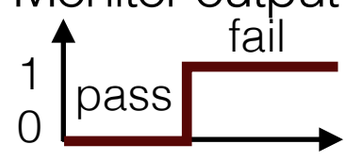
Omission Probability

Monitor output



Omission Probability

Monitor output



Model-Based Control SW Synthesis @ MCLab

Desired Controllable Region

Goal Region

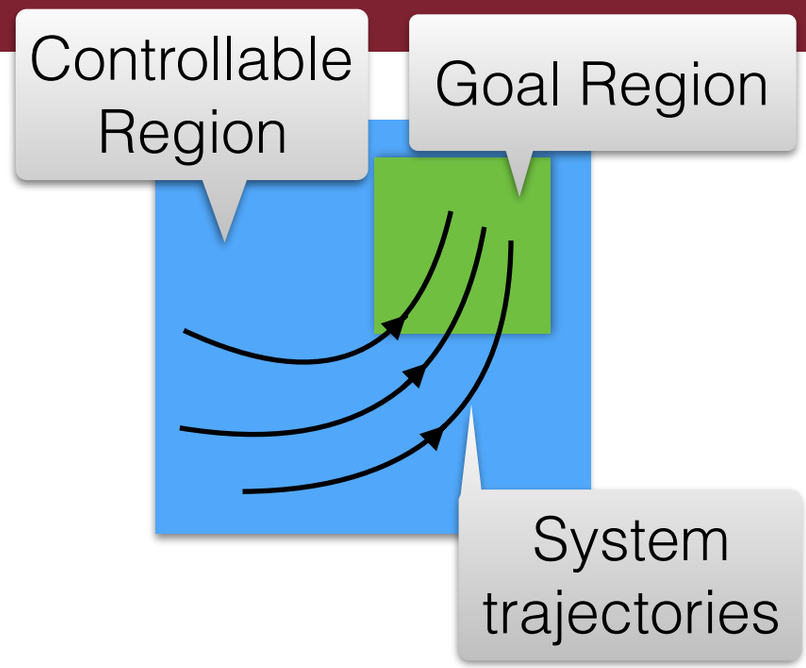
AD/DA n. of bits

Plant Model

QKS

Quantized Controller Software Generator

https://bitbucket.org/mclab/qks

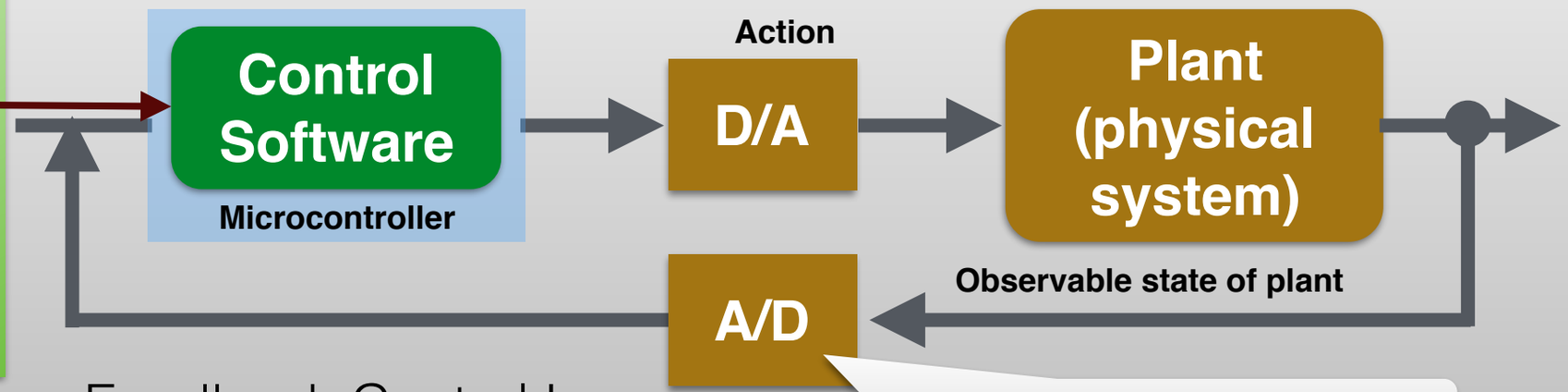


NoSol

Unknown

SOL

Control Software
Actual Controllable Region
Robustness by Construction
Guaranteed WCET



Feedback Control Loop

MCLab in Aerospace

EC FP7 Ulisse (4.8 M€)
Verification & Validation of mission planning and on-board procedures

ESA ITI Verifying Satellite Operational Procedures (150 k€)
Verification & Validation of ground segment satellite operational procedures

ESA ITT System & Software Functional Requirements Technique (200 k€)
Verification & Validation of system level design for satellite and avionics vehicles

MCLab in Transportation

MIUR Tramp, Setram, Interception (3.5 M€)
Optimal management of intermodal transportation of dangerous goods, guaranteeing security standards

Safety verification of communication protocols and control policies for the control center

FILAS Sintesi (100 k€)
Sense and response system for critical resource management

MCLab in Critical Infrastructures

SAPP, IRRIIS, Safeguard, SafeTunnel, Icaro (10 M€)
Design and safety verification of control and communication systems for critical infrastructures

LOG.IN

ENEA

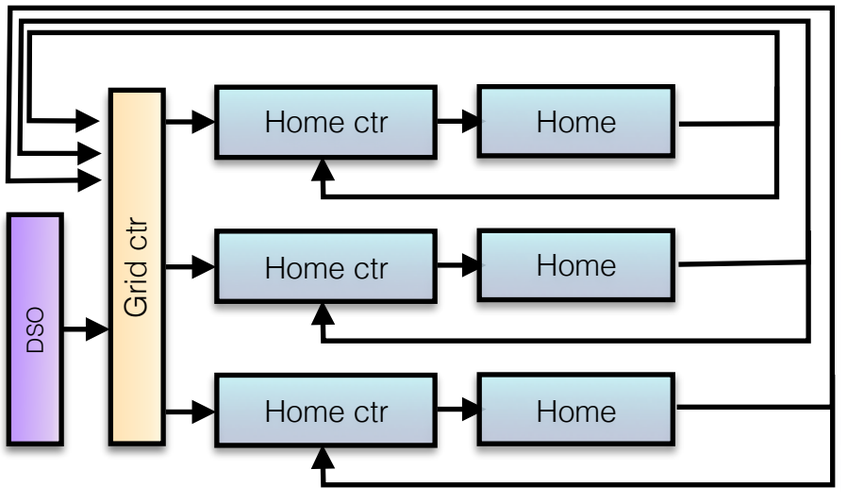
MCLab in Smart Grids

EC FP7 SmartHG (3.5 M€)
Energy Demand Aware Open Services for Smart Grid Intelligent Automation

Coordinator: MCLab

Design and formal verification of hierarchical control policies for the Smart Grid

SmartHG benefits: optimisation of grid management, minimisation of energy cost and CO2 emissions



MCLab in Medicine

EC FP7 Paeon (2.5 M€)
Model Driven Computation of Treatments for Infertility Related Endocrinological Diseases

Coordinator: MCLab

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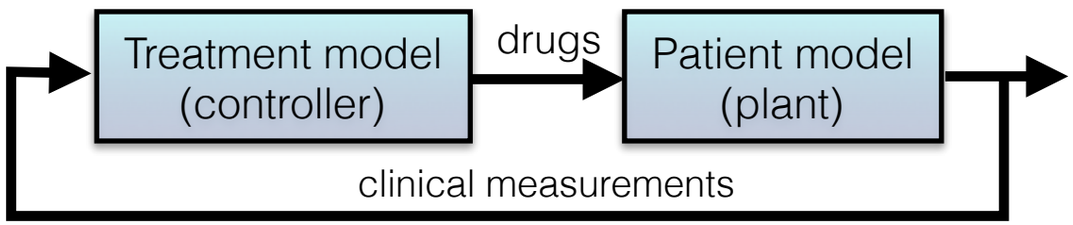

Modelling of human physiology (virtual physiological human)

Model based automatic verification and synthesis of personalised clinical treatments

UniversitätsSpital Zürich

HOCHSCHULE LUZERN

Hannover Medical School

Contacts

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