

TC Robust Control

Focuses on modeling of systems affected by **uncertainty** and the development of **computational techniques** for analysis, optimal controller synthesis and implementation.

Chair: Carsten Scherer

Co-chair: Roberto Tempo

2008-2011: Faryar Jabbari



5th IFAC Symposium on Robust Control Design

5th IFAC Symposium on Robust Control Design ROCOND 2006

Toulouse, France, July 5-7 2006



Manufacture des Tabacs
(Ancient tobacco factory)

Toulouse, France, July 5-7 2006

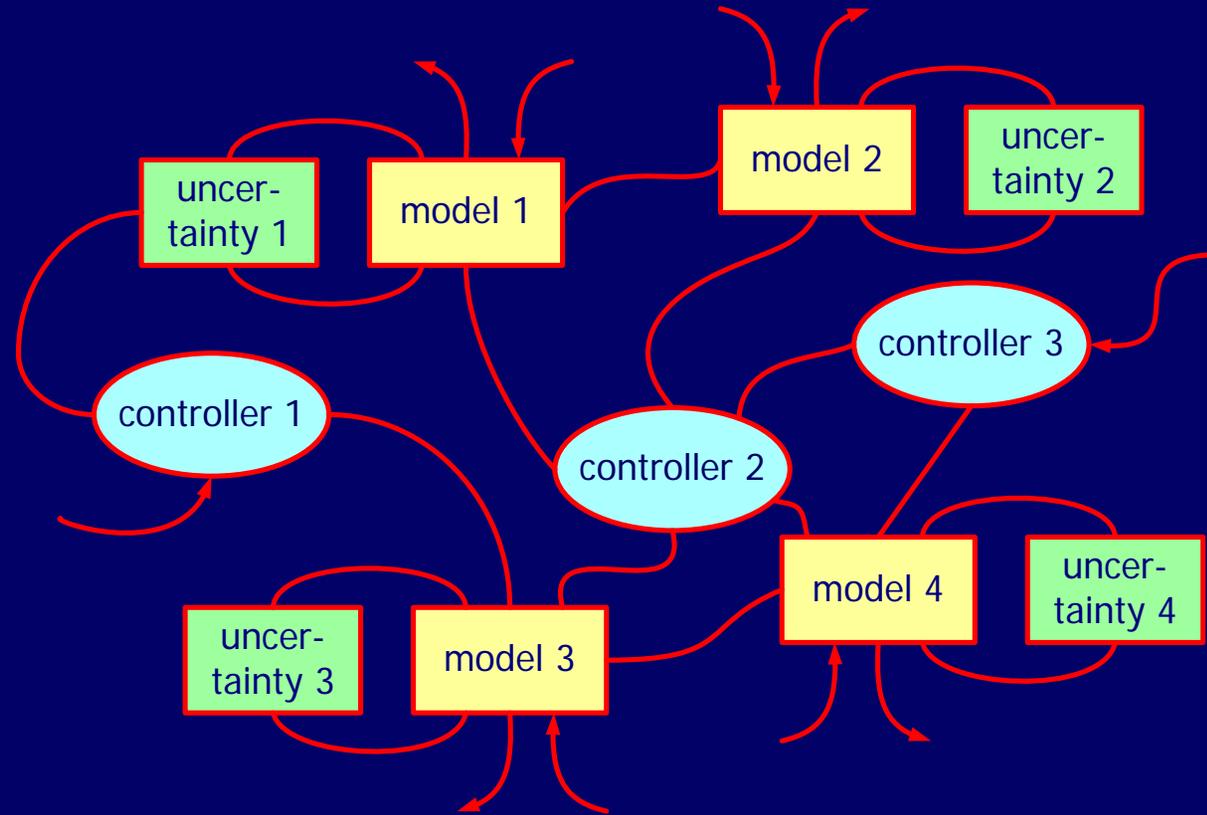
QFT Symposium 2007

- Follow-up on
 - Pamplona, Spain 01
 - Cape Town, South Africa 03
 - Kansas, USA 05
- Organized by
 - Per-Olof Gutman in Rehovot, Israel

Workshop on Uncertain Dynamical Systems 2008

- Follow-up on
 - Hongkong 99
 - Lisbon, Portugal 02
 - Delft, The Netherlands 05
- Organized by
 - Toshiharu Sugie on Awaji Island, Japan

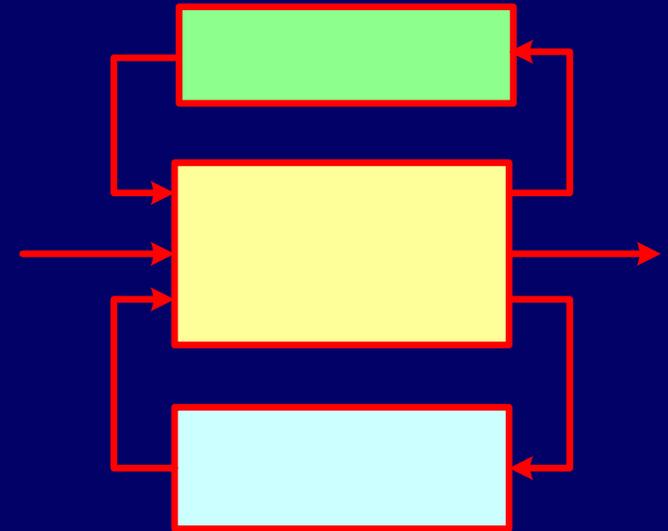
Key Problem



Achieve predictable behavior of interconnection ...
... despite highly uncertain subsystems

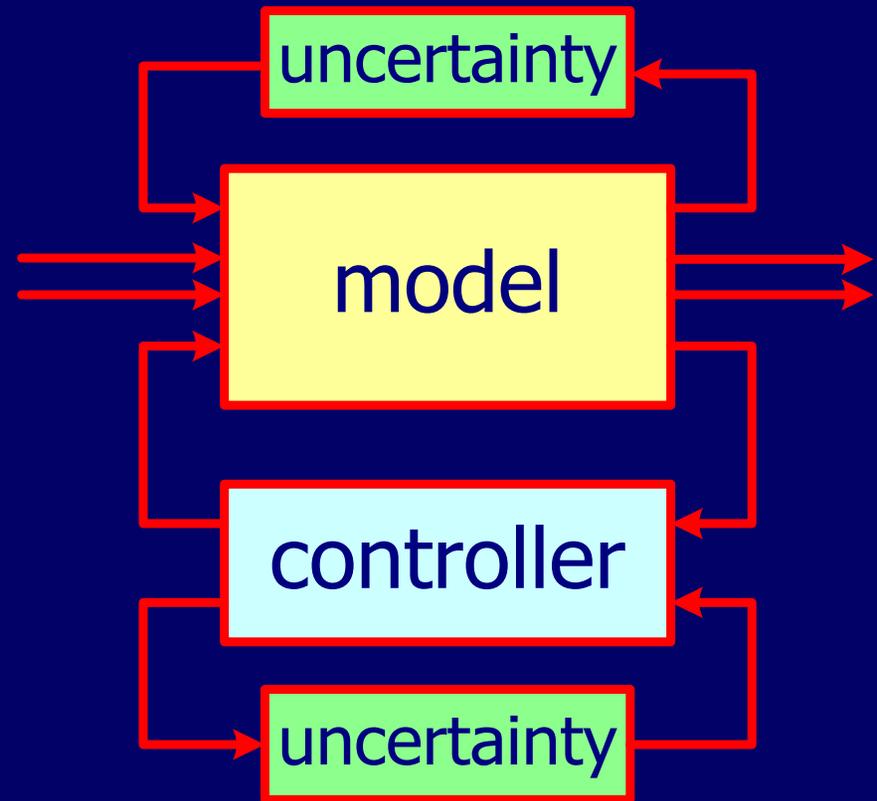
Developments

- Optimal feedback controller synthesis ... generalized plant
- LTI robustness analysis
- Dissipation theory ... Linear matrix inequalities
integral quadratic constraints – synthesis
delays, saturation, quantization, pde's

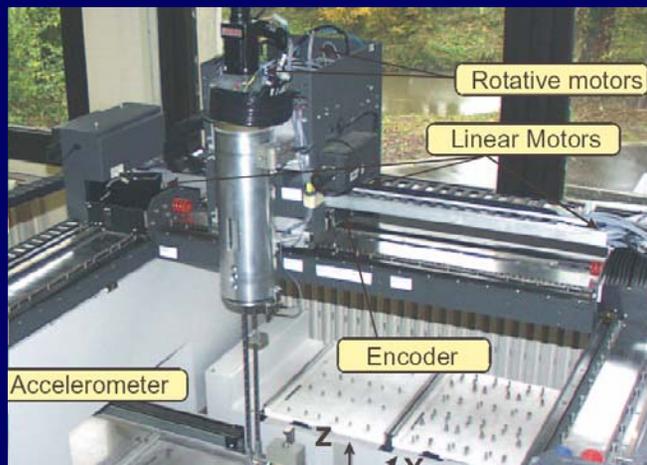


Advances: LPV Systems

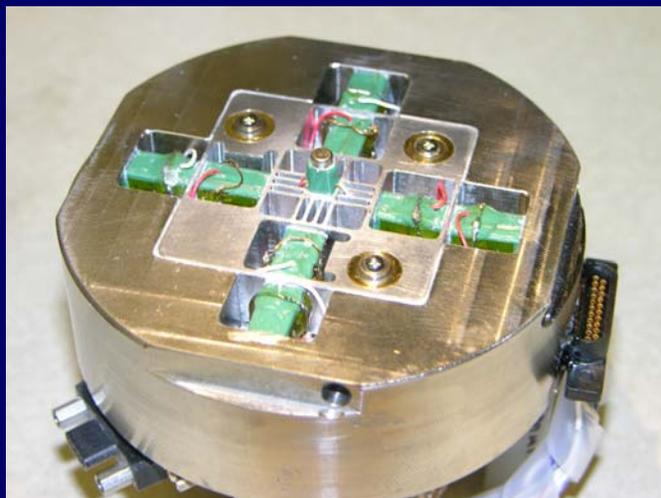
- Robustness analysis
- Gain-scheduling synthesis
- Multiple Objectives
- Extensions to operator uncertainties, IQCs
- HIFOO toolbox



Applications



Symens,
Van Brussel,
Swevers,
KU Leuven

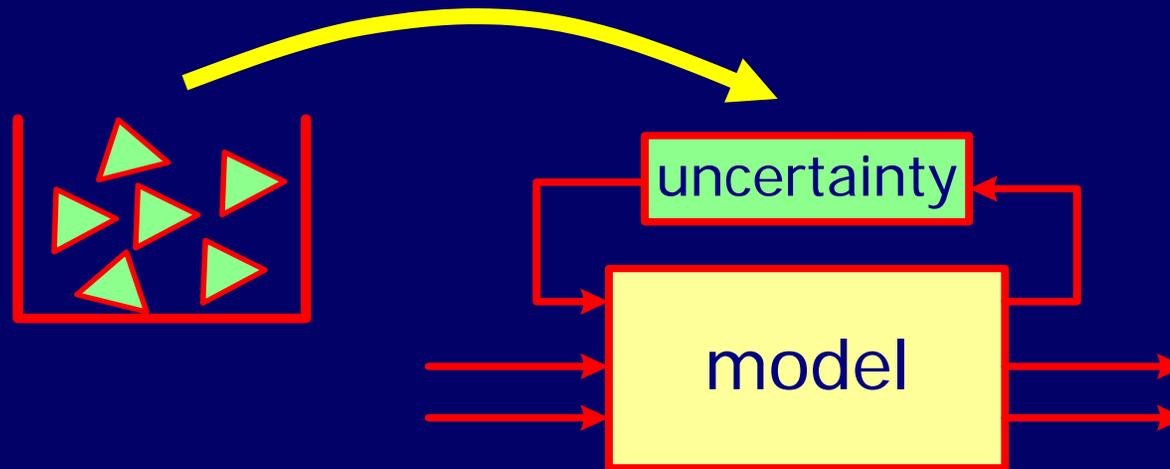


AFM, Schitter, DCSC TU Delft



Dryden Flight Research Center

Advances: Probabilistic Robustness

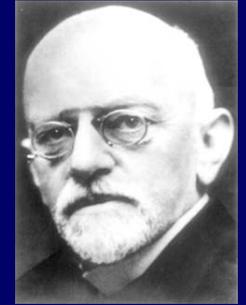


Guarantees with high probability ...

... polynomial sampling complexity!

RACT toolbox

Advances: Relaxations



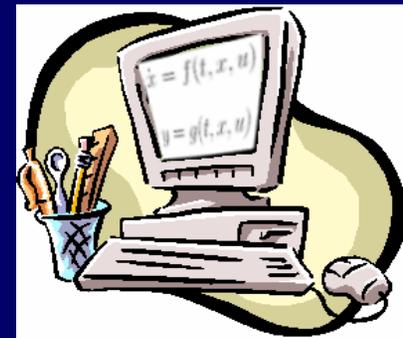
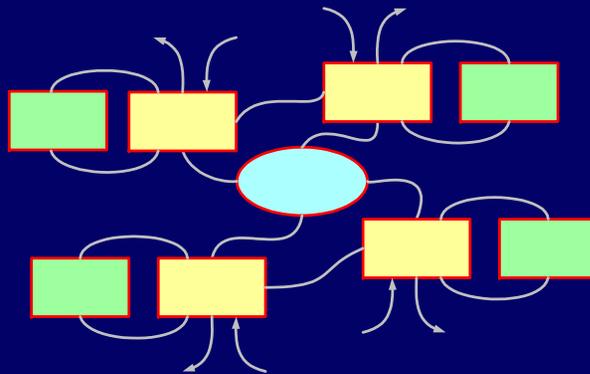
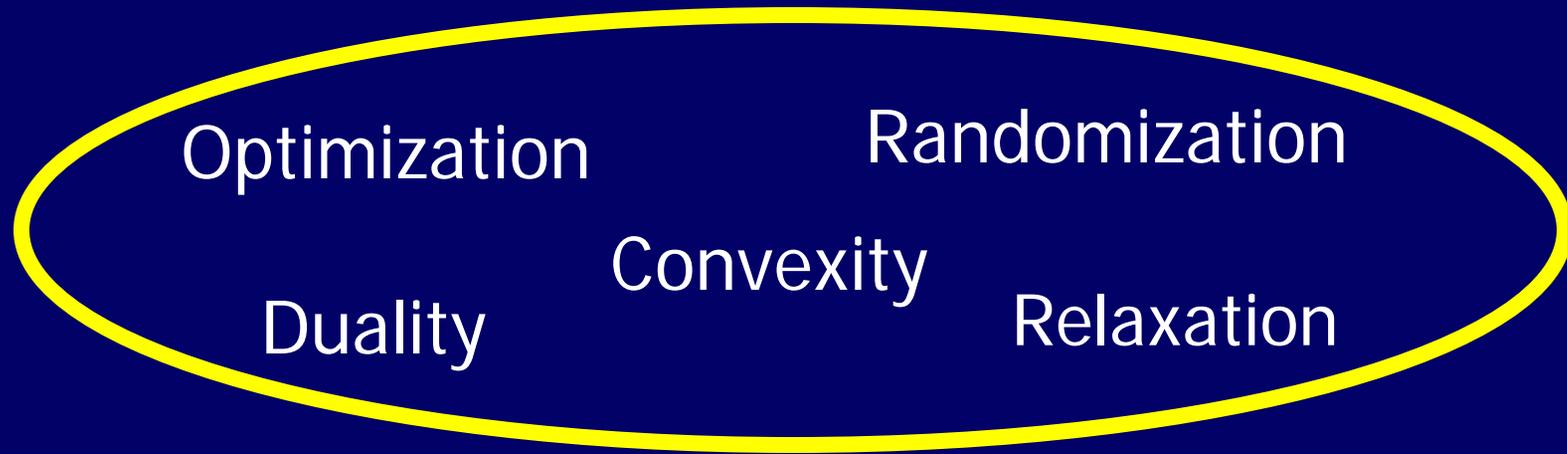
Polynomial SDPs
Polynomial systems
Robust LMIs



SOS / moment
relaxations



Challenges: Reliability

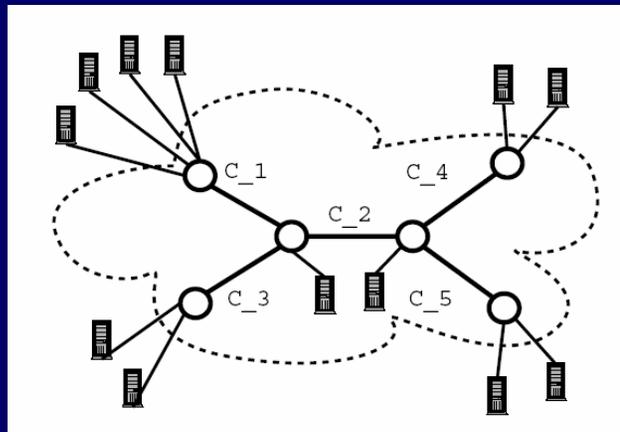
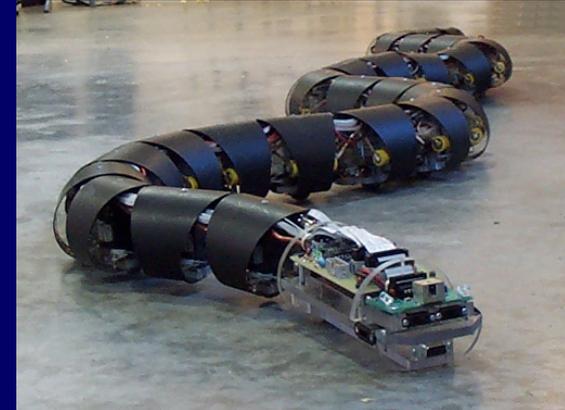


Challenges: **Extension of Paradigm**

Switched systems

Hybrid systems

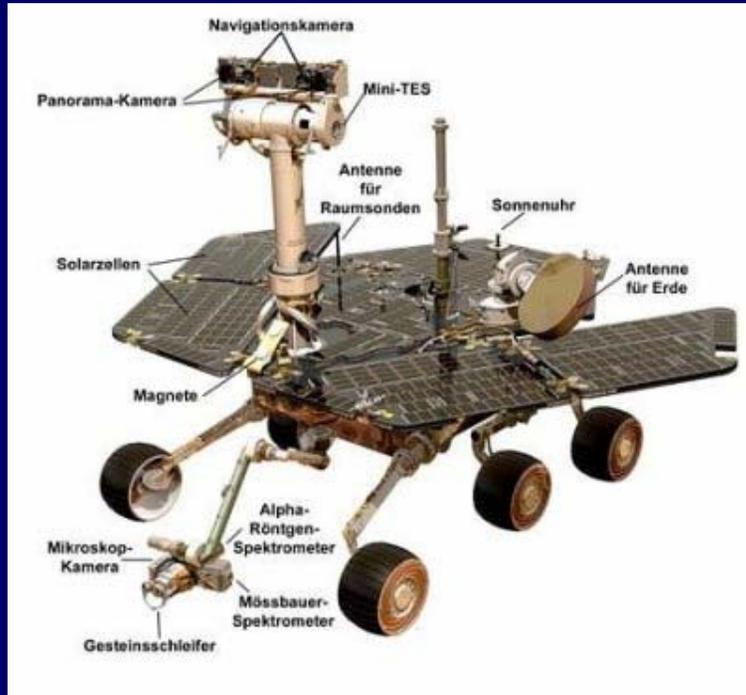
Structured nl systems



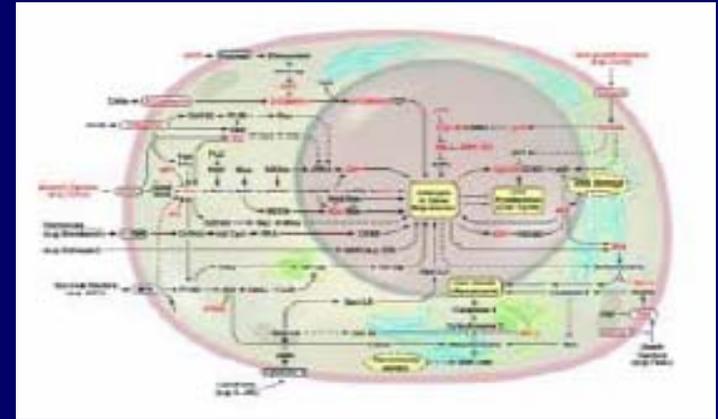
Uncertainty description?

Computational complexity?

Application Areas



Autonomous systems

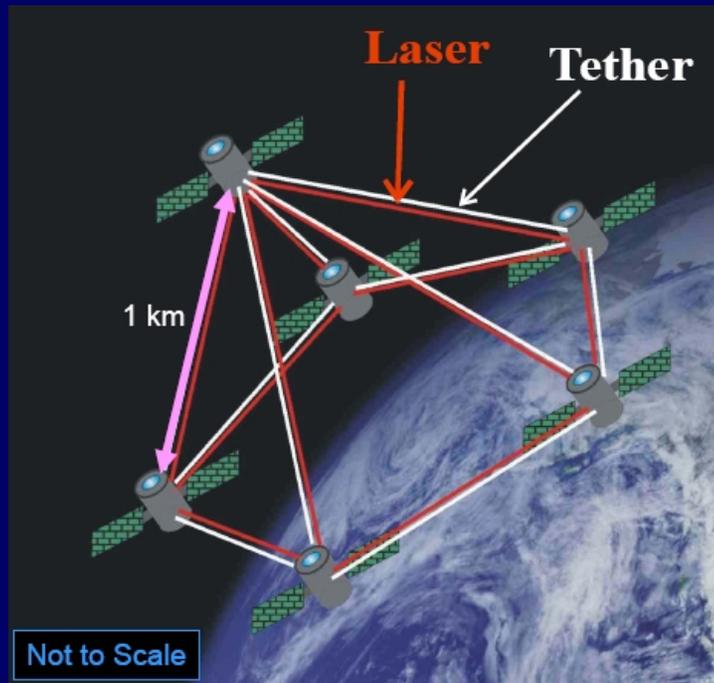


Systems Biology



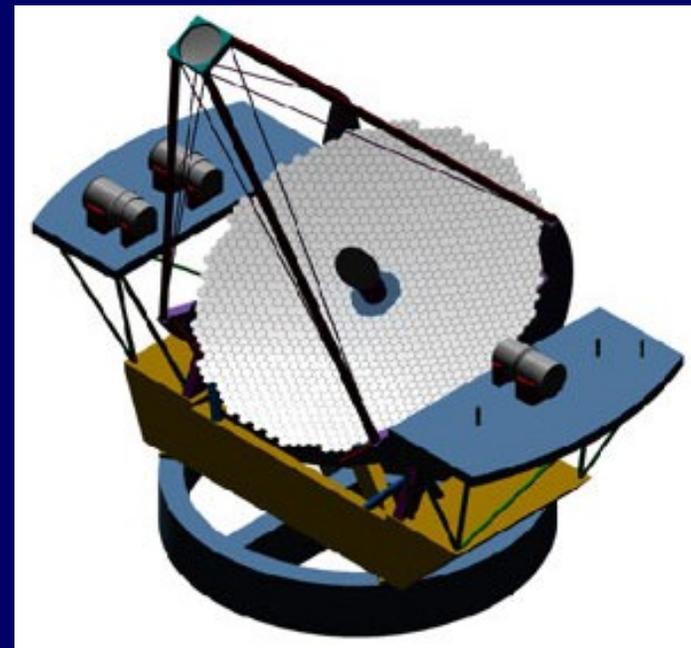
Networks

Challenges: Networked Systems

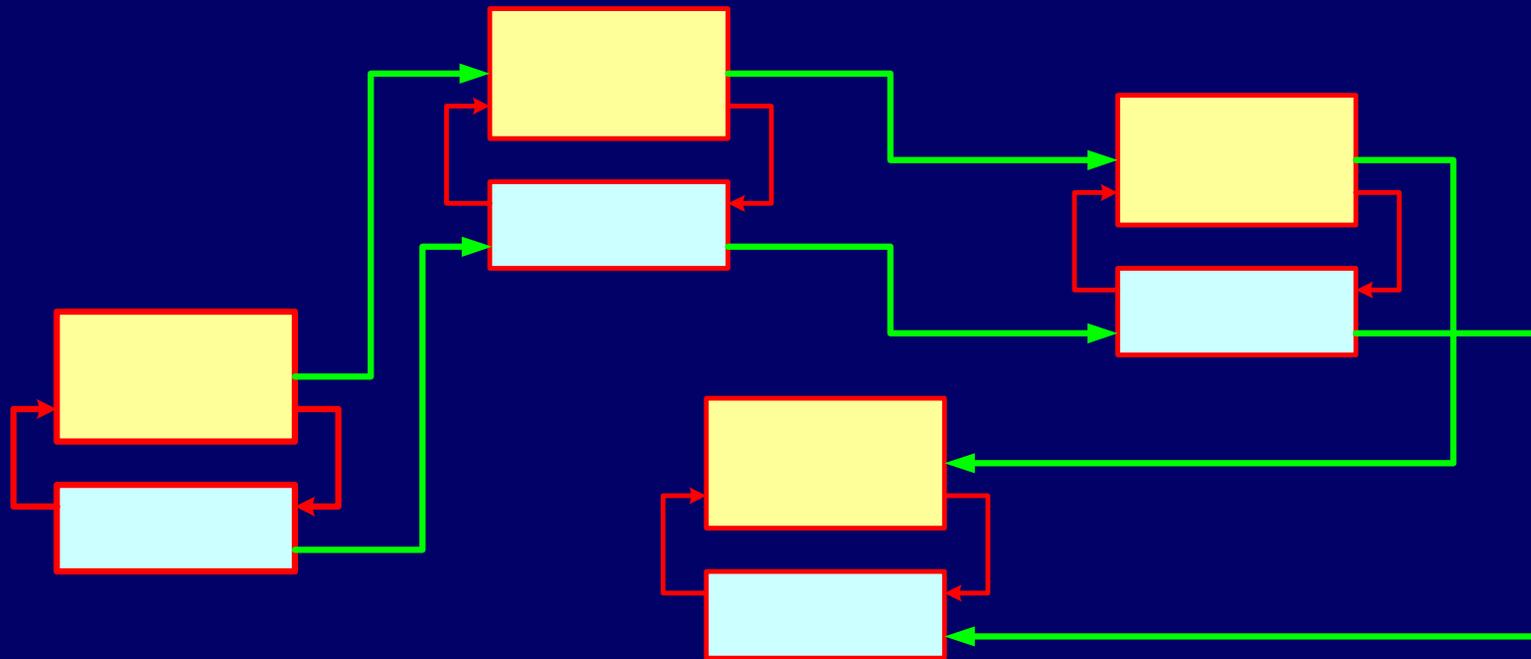


Formation Flying

Distributed Control

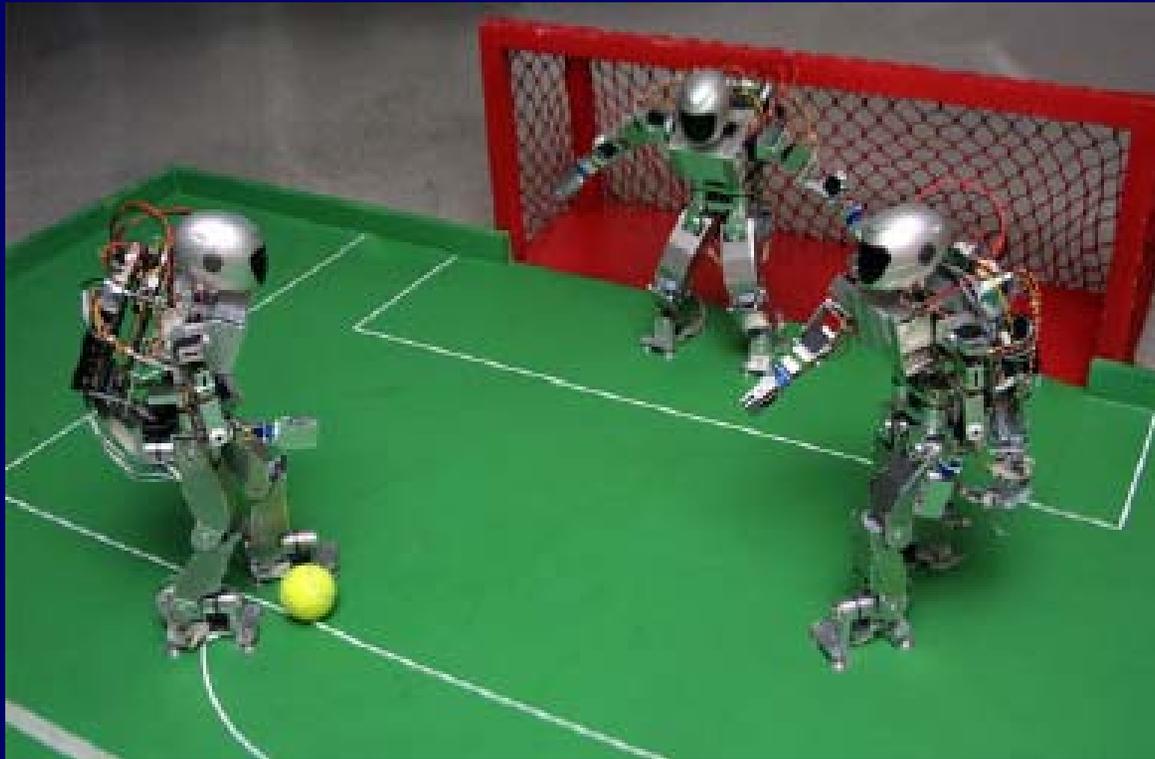


Challenges: **Networked Systems**



Robustness issues at manifold levels

Challenges: **Autonomy**

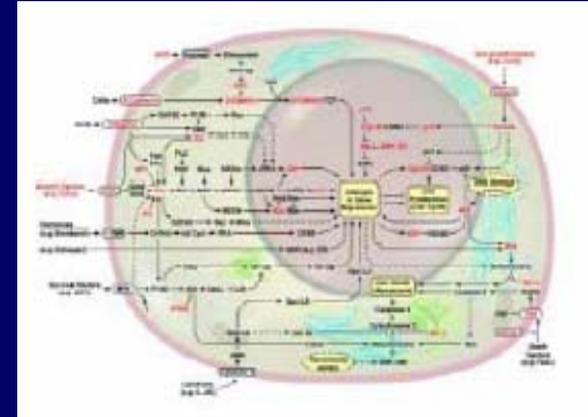


HanSaRam-IV for HuroSot
Final IFAC Program, on Web, p. 30

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Challenges: **Systems Biology**

Living systems ... can maintain performance in face of disturbances or uncertainties



Trade-offs:

Performance – Robustness – Demands
How shaped by system configuration?

ROCOND'09



Haifa, Israel, June 16–18, 2009

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