

MSc topics overview

Hybrid Systems & Transportation Control

MSc info day, Bladel, October 12, 2006

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1. Overview

Hybrid systems & transportation control

- Hybrid systems
- Traffic control & intelligent vehicles
- Transportation networks
(electricity distribution, traffic, logistics, railway, . . .)

→ courses & MSc project proposals

[msc_info.1](#)

2. Recommended courses

- Systems & Control courses:
 - optimization in systems and control (SC4090)
 - modeling and control of hybrid systems (SC4160)
 - model predictive control (SC4060)
 - knowledge based control systems (SC4080)
 - . . .
- Application courses, e.g.:
 - fuzzy logic and engineering applications (SC4150)
 - traffic & transportation, logistics (MSc Transport, Infrastructure & Logistics)
 - electricity distribution (MSc Electrical Engineering)
 - . . .

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3. MSc projects

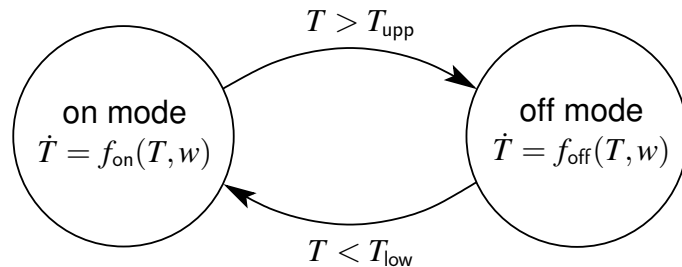
- Content: theory ↔ application
university ↔ company
research ↔ programming ↔ practice
- Selection:
 - via DCSC web site: Education → MSc topics (predefined)
 - via DCSC web site: Research (related to ongoing PhD projects)
 - own proposal

→ ***tailor-made, personalized*** MSc project proposal

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4. Hybrid systems

- Hybrid: combination of continuous and discrete dynamics
- Example: temperature control system:



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4. Hybrid systems (continued)

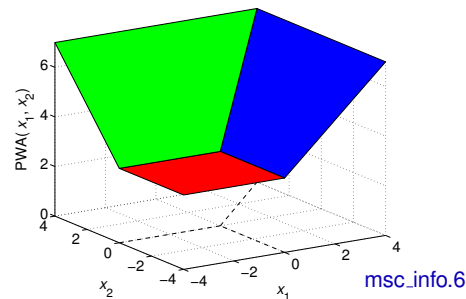
- Applications:
 - electrical networks (switching, diodes)
 - beer production
 - chemical processes (distillation column)
 - flexible manufacturing systems
 - traffic flow control



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4. Hybrid systems (continued)

- MSc project topics:
 - model predictive control of discrete-event systems
 - optimal control of linear hybrid systems
 - design of adaptive cruise controllers using hybrid control methods
 - identification of piecewise-affine systems
 - model predictive control for piecewise-affine systems
 - ...



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5. Traffic control & intelligent vehicles

- Traffic jams & congestion
 - cause time losses, extra costs, more incidents
 - negative impact on economy, environment, society



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5. Traffic control & intelligent vehicles (continued)

- Traffic control measures:
 - variable speed limits
 - on-ramp metering
 - traffic signals
 - route guidance (DRIPs)
 - ...



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5. Traffic control & intelligent vehicles (continued)

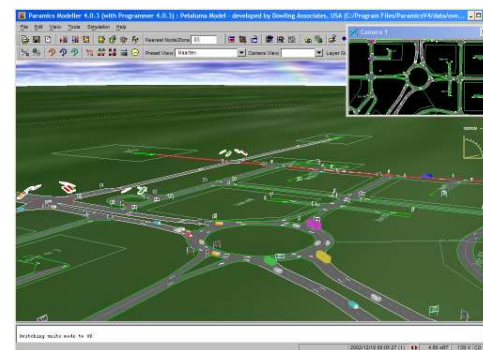
- Increased use of in-car telecommunication and information systems
 - increased possibilities for sensing and control
 - use for traffic management and control purposes
- Examples:
 - automated platooning
 - intelligent speed adaptation
 - adaptive cruise control
 - ...



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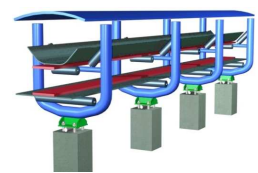
5. Traffic control & intelligent vehicles (continued)

- MSc project topics:
 - model predictive control (MPC) for freeway traffic
 - integrated MPC for mixed urban/freeway networks
 - traffic control in the network around Eindhoven
 - anticipative traffic control
 - optimal off-ramp metering
 - traffic control with intelligent vehicles
 - traffic control and route choice
 - ...



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6. Control of transportation networks

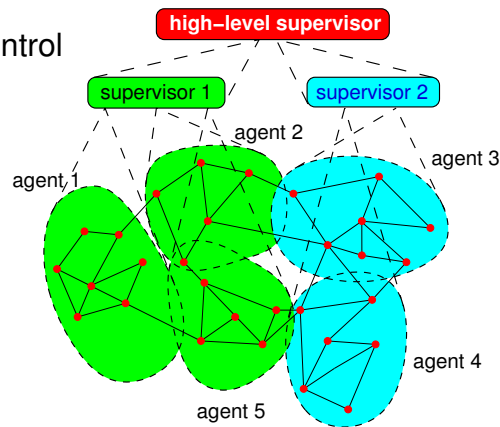


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6. Control of transportation networks (continued)

- Challenges in control of networks:

- large-scale networks
- distributed vs centralized control
- optimality $\leftrightarrow$ computational efficiency/tractability
- global $\leftrightarrow$ local
- scalability
- robustness
- **multi-agent** approach



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6. Control of transportation networks (continued)

- MSc project topics:

- multi-agent learning and coordination
- multi-agent control of large-scale hybrid systems
- cooperating-controllers model predictive control
- multi-agent control of mixed urban/freeway networks
- multi-agent control of electricity distribution networks
- multi-agent traffic signal control
- distributed control for automated sorting machines
- ...

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7. Cooperation with companies

Some companies you can do your MSc project with/at:

- Siemens
- TNO Automotive, TNO Inro
- SKF
- Vialis
- DHV
- Peek Traffic
- Witteveen+Bos
- Ministry of Transportation — AVV

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For more information ...

- See web site: www.dcsc.tudelft.nl/~bdeschutter → MSc project proposals
- Come along (email: b.deschutter@dcsc.tudelft.nl)
- Contact PhD students and other researchers involved:
 - Jelmer van Ast, Lakshmi Dhevi Baskar,
 - Monique van den Berg, Lucian Buşoniu, Daniele Corona,
 - Olaf Gietelink, Andreas Hegyi, Hans Hellendoorn,
 - Ronald van Katwijk, Rudy Negenborn, Alina Tarău

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