Student Profiles @ S&C

July 2023

Introduction student profiles S&C

The four sections/research groups (Control Systems, Electromechanics and Power Electronics group, Dynamics and Control and Control Systems Technology) involved in the S&C Master's program have created a number of profiles.

These profiles provide students with more detailed information on the relation between their specialization; individual course program and internship- and MSc project opportunities. Furthermore, the profiles help students with their choices. Students should be able to follow different paths and develop different expertise profiles.

These profiles are created to guide and assist students and do not form any formal tracks within the S&C program. They are suggestions and not mandatory.

S&C - core program (30 EC)

Q1	Q2	Q3	Q4
Control Engineering	Multi-body and Non-linear Dynamics	System Identification	Integration Project SC
System theory for control	Stochastic processes, filtering and estimation	Supervisory Control of Cyber Physical Systems	specialization/ elective
Modeling Dynamics	specialization/elective	specialization/ elective	specialization/ elective
Homologation/elective			

- **Students choose 5 out of 7 core courses (25 EC)**
- **Mandatory CBL team project (5 EC)**
- The modeling courses 5CSA0 and 4DM10 cannot both be included in the program of examinations. There is overlap.

Overview student profiles S&C

Nr.	Name profile	Key phrase about profile	Section (department)
1	Estimation & Control of Energy Storage and Conversion Systems	Digital Twinning, constrained control, and estimation for energy storage and conversion systems	Control Systems (EE)
2	Control of Autonomous and Connected Systems	Intelligent control and decision making in autonomous and connected systems	
3	Digital Twinning and Data-Driven Learning	Modelling dynamic systems and data-driven learning for decision and control	
4	Control and Learning of High-Tech Systems	Performance enhancement through control and learning	
5	Energy Processing Control	Digital Twinning, constrained control, and estimation for energy storage and conversion systems	Electromechanics and Power Electronics (EE)
6	Control of High-Tech Systems & Mechatronics	Advanced modeling and control of complex high-tech mechatronic systems	Dynamics and Control (ME)
7	Cyber-Physical and Networked Systems	Modeling, diagnostics and control of cyber-physical systems	
8	Data-based Learning in Systems and Control	Using data and learning techniques to solve modeling, diagnostics, and control problems	
9	Robotics and Perception	Advanced Control, Modeling, Planning, and Perception for Manipulation	
10	Learning, Identification, and Control for High-Tech Systems	Data-driven control, robustness, learning, control performance optimization, motion control, for high-tech systems.	Control Systems Technology (ME)
11	Design for Precision Engineering	Design of mechatronic systems, construction principles, Opto-mechatronics, high-tech systems design	
12	Cyber-physical systems A. Cyber-physical systems: B. Supervisory control and model-based systems engineering	Hybrid systems and control, Networked systems, Security, safety & privacy, Event-triggered control, Supervisory control, Model-based systems engineering	
13	Robotics for Care, Cure, Agro-food & Trucks	Decision-making, perception, path planning, optimal state estimation, localization, world modelling, energy efficient control	
14	Automotive Powertrains & Smart Mobility	Optimal design and control of sustainable powertrains Autonomous Mobility-on-Demand.	
15	Process Control of Energy Systems	System identification & control for distributed parameter systems, model predictive control, supervisory control, (distributed) hybrid control	

Overview core courses versus profiles S&C

Core course	Q	1	2	3	4	5	6	7	8	9	10	11	12 A.	12 B.	13	14	15
Control Engineering	1				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
System theory for control	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Modeling Dynamics	1	✓	✓	✓	✓	✓		✓					✓		✓	✓	✓
Multi-body and Non-linear Dynamics	2					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stochastic processes, filtering and estimation	2	✓	✓	✓	✓				✓	✓	✓		✓	✓	✓		✓
Supervisory Control of Cyber Physical Systems	3	✓	✓								✓	✓	✓	✓	✓		✓
System Identification	3	✓		✓	✓	✓			✓		✓			✓			✓

Profiles:

1. CS-EE: Estimation & Control of Energy Storage & Conversion Systems
2. CS-EE: Control of Autonomous and Connected Systems
3. CS-EE: Digital Twinning and Data-Driven Learning
4. CS-EE: Control and Learning of High-Tech Systems
5. EPE-EE: Energy Processing Control
6. D&C-ME: Control of High-Tech Systems & Mechatronics
7. D&C-ME: Cyber-Physical and Networked Systems
8. D&C-ME: Data-based Learning in Systems and Control
9. D&C-ME: Robotics and Perception
10. CST-ME: Learning, identification and control for high-tech systems
11. CST-ME: Design for Precision Engineering
12. CST-ME: Cyber-Physical Systems
    A. Cyber-Physical Systems
    B. Supervisory control and model-based systems engineering
13. CST-ME: Robotics for Care, Cure, Agro-food & Trucks
14. CST-ME: Automotive Powertrains & Smart Mobility
15. CST-ME: Process Control of Energy Systems

TU/e

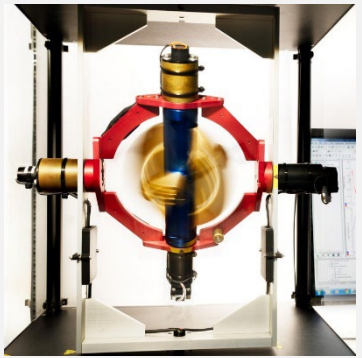
Control Systems
Department EE

Estimation & Control of Energy Storage and Conversion Systems

Digital Twinning, constrained control, and estimation for energy storage and conversion systems

Control of Autonomous and Connected Systems

Intelligent control and decision making in autonomous and connected systems



Digital Twinning and Data-Driven Learning

Modelling dynamic systems and data-driven learning for decision and control

Control and Learning of High-Tech Systems

Performance enhancement through control and learning

TU/e

CS: Estimation & Control of Energy Storage & Conversion Systems

Digital twinning, constrained control, and estimation for energy storage and conversion Systems

Core courses

- Control engineering (Q1/Q3 – Witvoet)
- ☑ System theory for control (Q1 – Heemels)
- ☑ Modelling dynamics (Q1 – Weiland)
- Multibody and non-linear dynamics (Q2 – vd Wouw)
- ☑ Stochastic processes, filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

- **Nonlinear Optimization** (Q1 – Keijsper) **(or any other optimization course)**
- **Model Reduction** (Q2 – Weiland)
- **Model Predictive Control** (Q3 – Lazar)
- Energy Management (Q2 – Donkers)
- Advanced Process Control (Q3 – Özkan)
- Physical and Data-Driven Modelling (Q3 – Tiels)
- Machine Learning (Q4 – Schoukens)

Keywords: Data and Information Driven Dynamic Modeling and Digital Twinning, Control, Estimation, Optimization methods, Model and Data-driven Predictive Control

Key applications & domains: Battery management systems, complete vehicle energy management, Flexible and Autonomous Model based Operation Support Technology

CS: Control of Autonomous and Connected Systems

Intelligent control and decision making in autonomous and connected systems

Core courses

- Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- ☑ Modelling dynamics (Q1 – Weiland)
- Multi-body and nonlinear dynamics (Q2 – vd Wouw)
- ☑ Stochastic processes, filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- System identification (Q3 – Schoukens)

Specialization & elective courses

Control Principles for Engineering Systems (Q2 – Haesaert)

Robust Control (Q3 – Das)

Analysis and design of Networked Systems (Q4 – Steur)

Hybrid Systems (Q4 – Heemels)

Model Predictive Control (Q3 – Lazar)

Optimal Control and Reinforcement Learning (Q2 - Guerreiro Tomé Antunes)

Keywords: Intelligent motion control; Formal methods; Model predictive and learning control; Distributed autonomous systems; Networked dynamic (control) systems; Distributed autonomy; Swarm intelligence; Hybrid systems;

Key application domain & examples: Cyber-physical systems; autonomous driving and platooning; distributed renewable energy systems; multi-robot platforms; multi-robot motion planning; networked robotics and drones; networked formation and flocking; sampled-data control

CS: Digital Twinning and Data-Driven Learning

Modelling dynamic systems and data-driven learning for decision and control

Core courses

- Control engineering (Q1/Q3 – Witvoet)
- ☑ System theory for control (Q1 – Heemels)
- ☑ Modelling dynamics (Q1 – Weiland)
- Multibody and non-linear dynamics (Q2 – vd Wouw)
- ☑ Stochastic processes, filtering and estimation (Q2 – Breschi)
- Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

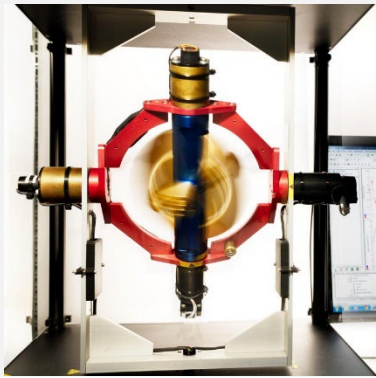
Machine Learning for Systems and Control

Model Reduction (Q2 – Weiland)

Bayesian Machine Learning and Inf. Proc. (Q2 – de Vries)

Physical and Data-Driven Modelling (Q3 – Tiels)

Optimal Control and Reinforcement Learning (Q2 - Antunes)



Keywords: Machine Learning, Data-Driven Modelling and Control, Modelling, Reinforcement Learning, Digital Twinning, Modelling Dynamics, Diagnostic

Key applications & domains: High-Tech, Autonomous Vehicles, Power Electronics, Power and Distribution Networks, Industrial Processes

CS: Control and Learning of High-Tech Systems

Performance enhancement through control and learning

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ System theory for control (Q1 – Heemels)
- ☑ Modelling dynamics (Q1 – Weiland)
- Multibody and non-linear dynamics (Q2 – vd Wouw)
- ☑ Stochastic processes, filtering and estimation (Q2 – Breschi)
- Supervisory Control of Cyber-Physical Systems(Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

Robust Control (Q3 – Das)

Model Reduction (Q2 – Weiland)

Machine Learning for Systems and Control (Q4 – Schoukens)

Physical and Data-Driven Modelling (Q3 – Tiels)

Advanced Motion Control (Q2 – Oomen)

Model Predictive Control (Q3 – Lazar)

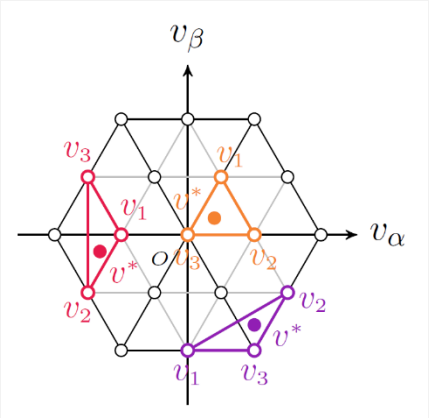
Keywords: Mechatronic systems, multi-physical modeling, manufacturing systems, dealing with/managing complexity of spatial-temporal and nonlinear systems, parameter-varying systems.

Key applications & domains: high-precision motion systems, additive manufacturing, applications on integrated mechanical, electrical, thermo-dynamical, optical, acoustic phenomena (lithography, electron microscopy, aerospace applications). Piezo actuation/sensing, learning control.

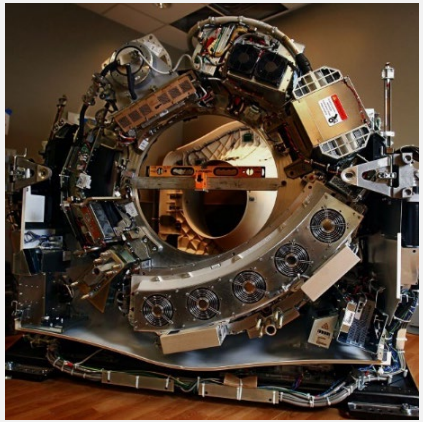
Electromechanics and Power Electronics
Department EE

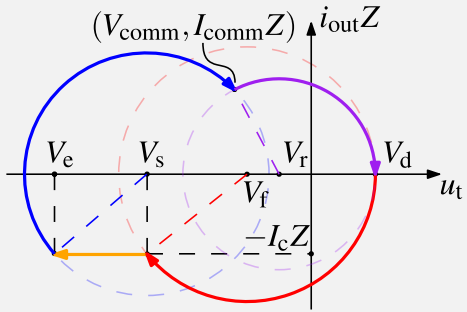
Estimation & Control of Energy Storage and Conversion Systems

Digital Twinning, constrained control, and estimation
for energy storage and conversion systems



Direct-drive system of CT-scanner





EPE: Energy Processing Control

Control for high-tech energy processing systems

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ System theory for control (Q1 – Heemels)
- ☑ Modelling dynamics (Q1 – Weiland)

OR Multibody and non-linear dynamics (Q2 – vd Wouw)

Stochastic processes, filtering and estimation (Q2 – Breschi)

Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)

- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

Control of rotating field machines (Q1 - 5LWE0)

Modelling & Control of power converters (Q1 - 5LWH0)

Linear & planar motors for high-precision systems (Q2 - 5SWC0)

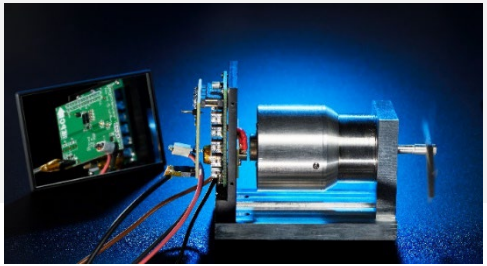
Robust Control (Q3 - 5LMC0)

Model predictive Control (Q3 5LMB0)

Power Electronics for high-precision applications (Q4 - 5LWG0)

Advanced actuator design (Q4 - 5LWC0)

High speed motor with wireless energy transfer



Keywords: High-precision electromechanics – Computational control of Power Electronics systems

Dynamics and Control Department ME

Control of High-tech Systems & Mechatronics

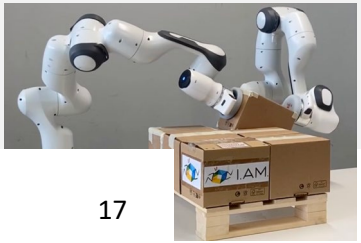
Digital Twinning, Modeling of Complex High-Tech Systems, Motion control, Data-Based Control, Complexity Reduction, Diagnostics

Cyber-Physical and Networked Systems

Networked Dynamic Control Systems, Security and Privacy of Cyber-Physical systems, Diagnostics and Fault Tolerant Control, Autonomous Systems, Digital Twinning, Hybrid systems

Data-based Learning in Systems and Control

Digital Twinning, AI, Machine Learning, Data-Based Modeling, Data-Based Control, Hybrid Modeling, Combining Physics and Data



Robotics and Perception

Contact-Rich and Impact-Aware Manipulation, Soft Robotics and Haptics, Task and Motion Planning for Manipulation

D&C: Control of High-Tech Systems & Mechatronics

Advanced modeling and control of complex high-tech mechatronic systems

Core courses

- [x] Control engineering (Q1/Q3 – Witvoet)
- [x] Systems theory (Q1 – Heemels)
- [ ] Modeling dynamics (Q1 – Weiland)
- [x] Multi-body & nonlinear dynamics (Q2 – v/d Wouw**)**
- [ ] Stochastic filtering and estimation (Q2 – Breschi)
- [ ] Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- [ ] System identification (Q3 – Schoukens)

Specialization & elective courses

Engineering optimization

Structural Dynamics and vibro-acoustics

Performance of Nonlinear Control Systems

Extremum Seeking Control for Performance Opt.

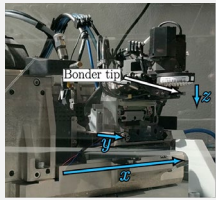
Nonlinear Control

Model Reduction

Advanced Motion Control

Machine Learning for systems and control

Fault Detection and Isolation in High-Tech Systems



Keywords: Digital Twinning, Modeling of complex high-tech systems, Motion control, data-based control, complexity reduction, diagnostics.

Key applications & domains: Semi-conductor equipment, industrial printers, electron microscopy, high-precision motion stages, Electron microscopy.

D&C: Cyber-Physical and Networked Systems

Modeling, diagnostics and control of cyber-physical systems

Core courses

- Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- ☑ Modeling dynamics (Q1 – Weiland)
- **OR** Multi-body & nonlinear dynamics (Q2 – v/d Wouw)
- Stochastic filtering and estimation (Q2 – Breschi)
- Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- System identification (Q3 – Schoukens)

Specialization & elective courses

Engineering optimization

Analysis and Design of Networked Dynamical Systems

Nonlinear Control

Modelling and control of manufacturing networks

Hybrid systems

Optimal control and reinforcement learning

Extremum seeking control for performance opt.

Fault Detection and Isolation in High-Tech Systems, Q4

Keywords: Networked dynamic (control) systems, Security and privacy of control systems, Fault detection and estimation, Distributed autonomous systems, Digital Twinning, Hybrid systems, Sensor networks, Multirobot Systems, Distributed optimization, Distributed learning

Key application domain & examples: Cyber-physical systems, cooperative autonomous driving, distributed renewable energy systems, networked robotics and drones, smart manufacturing systems, Internet of things, vehicle-to-everything communication.

D&C: Data-based Learning in Systems and Control

Using data and learning techniques to solve modeling, diagnostics, and control problems

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- Modeling dynamics (Q1 – Weiland)
- ☑ Multi-body & nonlinear dynamics (Q2 – v/d Wouw)
- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

Extremum seeking control for performance opt.

Learning control

Physical and Data-driven Modeling

Machine Learning for Systems and Control

Machine learning for modelling and design

Optimal control and reinforcement learning

Keywords: AI, Machine learning, data-based modelling, data-based control, hybrid modeling. combining physics and data, digital twinning.

Key applications & domains: high-precision motion systems, robotics, health applications (mechanical ventilation), high-tech systems, industrial printers, electron microscopy,

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D&C: Robotics and Perception

Advanced Control, Modeling, Planning, and Perception for Manipulation

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- Modeling dynamics (Q1 – Weiland)
- ☑ Multi-body & nonlinear dynamics (Q2 – v/d Wouw)
- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- Supervisory control(Q3 - Reniers)
- System identification (Q3 – Schoukens)

Specialization & elective courses

Optimal Control and Reinforcement Learning

Model Predictive Control

Haptics - perception and technology

Computer vision and 3D image processing

Convolutional Neural Networks for Computer Vision

Machine Learning for Systems and Control

Nonlinear Control

Physical and Data-driven Modeling

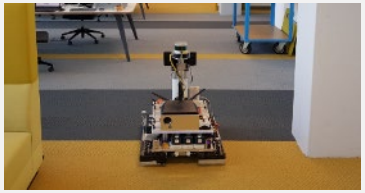
Applications of Design Principles

Keywords: Robotics, Robot control, planning, optimization, Robot perception, active perception, manipulation, soft robotics, nonlinear and geometric control, robot learning, visual and tactile perception, nonsmooth mechanics

Key applications & domains: human-robot interaction, robotic assistance for elderly/patient care, prosthetics, healthcare, robotic assembly, quality control, inspection and maintenance, recycling, logistics, construction, service industry

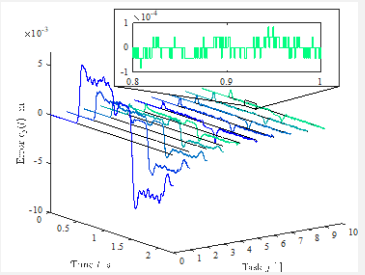
Control Systems Technology

Department ME



Learning, Identification, and Control for High-Tech Systems

Data-driven control, robustness, learning, control performance optimization, motion control, for high-tech systems

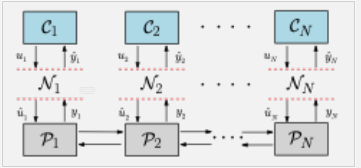


Design for Precision Engineering

Design of mechatronic systems, construction principles, Opto-mechatronics, high-tech systems design

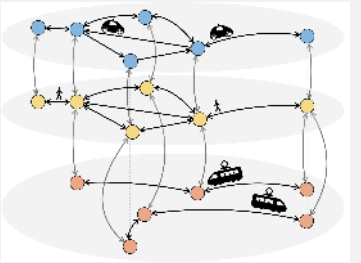
Cyber-physical systems/Supervisory control and model-based systems engineering

Hybrid systems and control, Networked systems, Security, safety & privacy, Event-triggered control, Supervisory control, Model-based systems engineering



Robotics for Care, Cure, Agro-food & Trucks

Decision-making, perception, path planning, optimal state estimation, localization, world modelling, energy efficient control



Automotive Powertrains & Smart Mobility

Optimal design and control of sustainable powertrains Autonomous Mobility-on-Demand

Process Control of Energy Systems

System identification & control for distributed parameter systems, model predictive control, supervisory control, (distributed) hybrid control

TU/e

CST: Learning, identification and control for high-tech systems

Data-driven control, robustness, learning, control performance optimization, motion control, for high-tech systems

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- Modeling dynamics (Q1 – Weiland)
- ☑ Multi-body & nonlinear dynamics (Q2 – v/d Wouw)
- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

Advanced motion control

Optimal control & reinforcement learning

Learning control

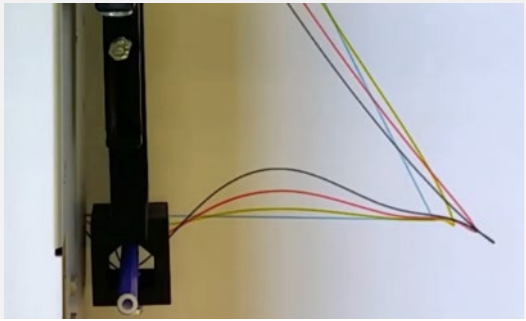
Physical and data-driven modeling

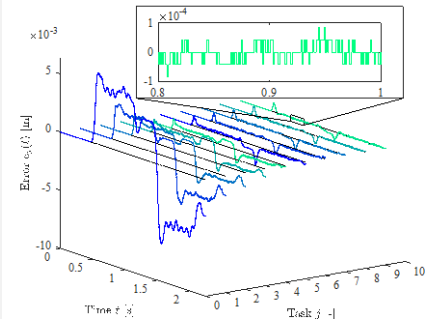
Robust control

Performance of nonlinear control systems

Keywords: data-driven control, robustness, learning, control performance optimization

Key application domain & examples: learning in machines, advanced motion control, motion control tuning for high-tech systems





CST: Design for precision engineering

Design of mechatronic systems, construction principles, Opto-mechatronics, high-tech systems design

Core courses

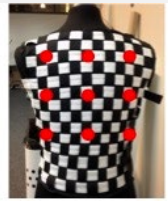
- [x] Control engineering (Q1/Q3 – Witvoet)
- [x] Systems theory (Q1 – Heemels)
- [ ] Modeling dynamics (Q1 – Weiland)
- [x] Multi-body & nonlinear dynamics (Q2 – v/d Wouw)
- [ ] Stochastic filtering and estimation (Q2 – Breschi)
- [x] Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- [ ] System identification (Q3 – Schoukens)

Specialization & elective courses

4CM50 Applications of Design Principles

Advanced motion control

4SC040 - Haptics - perception and technology



Communication via vibration motors

Teleoperation

Keywords: design of mechatronic systems, construction principles, Opto-mechatronics, high-tech systems design

Key application domain & examples: mechatronic systems design

CST: Cyber-Physical Systems (a)

Hybrid systems and control, Networked systems, Security, safety & privacy, Event-triggered control, Supervisory control, Model-based systems engineering

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- ☑ Modeling dynamics (Q1 – Weiland)

OR Multi-body & nonlinear dynamics (Q2 – v/d Wouw)

- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)

System identification (Q3 – Schoukens)

Specialization & elective courses

Hybrid Systems and Control

Optimal control & reinforcement learning

Advanced motion control

Analysis and design of networked dynamical systems

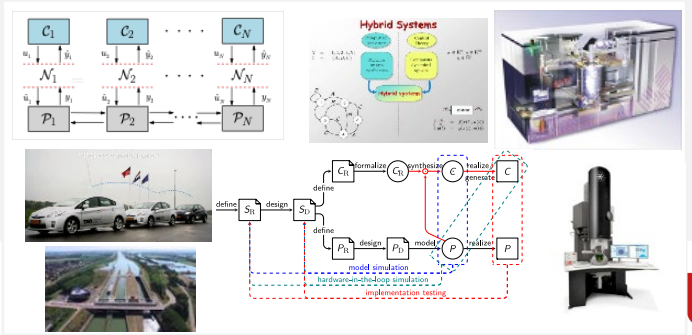
Model Predictive Control

Fault detection and isolation for control systems

Non-linear control

Keywords: Hybrid Systems & Control, Networked Systems, Control of Large-scale Systems, Supervisory Control, Security, Safety & Privacy

Key application domains & examples: High-tech manufacturing machines, Cooperative driving, Precision agriculture, Large-scale networked and infrastructure systems (water locks, bridges, tunnels, energy networks), Hybrid motion control, Control over communication networks.



CST: Supervisory control and model-based systems engineering (b)

Hybrid systems and control, Networked systems, Security, safety & privacy, Event-triggered control, Supervisory control, Model-based systems engineering

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
  Modeling dynamics (Q1 – Weiland)
- ☑ Multi-body & nonlinear dynamics (Q2 – v/d Wouw)
- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

4CM70 Integrated System Design

4DM40 Modeling and control of manufacturing networks

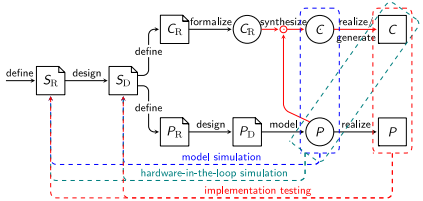
4DM20 Engineering Optimization

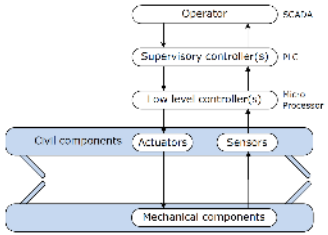
4CM40 Physical and data-driven modeling

4DM80 Fault detection and isolation for control systems

Keywords: system design, supervisory control, high-level system control, systems engineering, synthesis-based engineering,

Key application domain & examples: large-scale infrastructure systems such as locks, bridges, tunnels; manufacturing systems and machines; high-tech systems





CST: Robotics for Care, Cure, Agro-food & Trucks

Decision-making, perception, path planning, optimal state estimation, localization, world modelling, energy efficient control

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- ☑ Modeling dynamics (Q1 – Weiland)

OR Multi-body & nonlinear dynamics (Q2 – v/d Wouw)

- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)

System identification (Q3 – Schoukens)

Specialization & elective courses

Advanced motion control

Optimal control and RL

Mobile Robot Control

Machine Learning for Systems and Control

Engineering optimization

Model Predictive Control

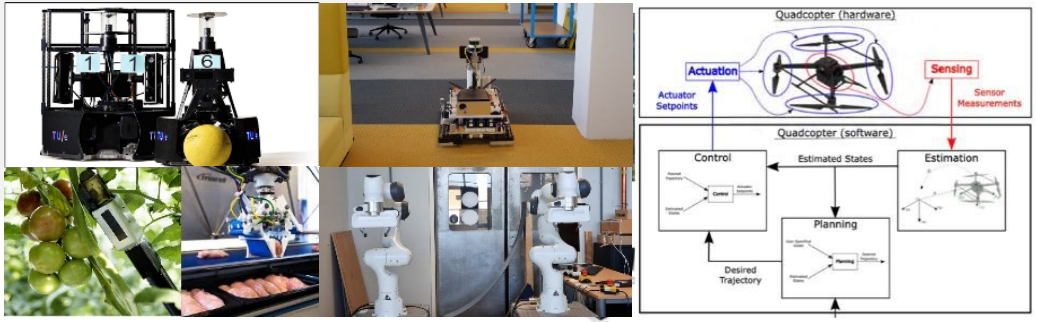
Scientific computing for Mech. Engineering

Data fusion & Semantic interpretation

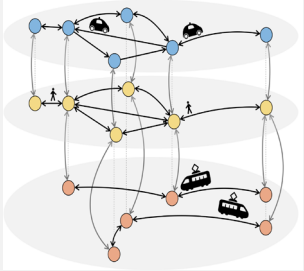
Advanced Sensing using Deep Learning

Keywords: decision-making, perception, path planning, optimal state estimation, localization, world modelling, energy efficient control.

Key application domain: Logistics, Agriculture and Care; Medical Manipulators; aerial Vehicles, AGVs and Robot Dogs, Electron Microscopy, Precision Farming, Automotive



CST: Automotive Powertrains & Smart Mobility



Optimal design and control of sustainable powertrains Autonomous Mobility-on-Demand

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- ☑ Modeling dynamics (Q1 – Weiland)

OR Multi-body & nonlinear dynamics (Q2 – v/d Wouw)

Stochastic filtering and estimation (Q2 – Breschi)

Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)

System identification (Q3 – Schoukens)

Specialization & elective courses

Optimal Control and Reinforcement Learning

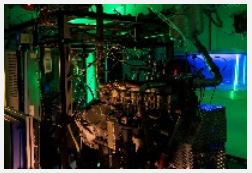
Engineering Optimization

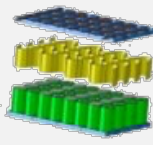
Advanced Full-Electric and Hybrid Powertrain Design

Advanced Control for Future HD Powertrains

Model Predictive Control, Machine Learning for Systems

Control, Energy management, Hybrid Systems and Control





Keywords: Optimal design and control of sustainable powertrains based on all-electric/hybrid drivelines, fuel cells or advanced combustion concepts using sustainable fuels. Autonomous Mobility-on-Demand, Future Mobility, Automated and Connected Driving.

Key research areas: powertrain modelling, (multi-domain) system optimization, self-learning control, (hybrid) electric racing

TU/e

CST: Process Control and Energy systems: fusion* and beyond

System identification & control for distributed parameter systems, model predictive control, supervisory control, (distributed) hybrid control

*Also ideal combination with master program: Science & Technology of Nuclear Fusion

Core courses

- ☑ Control engineering (Q1/Q3 – Witvoet)
- ☑ Systems theory (Q1 – Heemels)
- ☑ Modeling dynamics (Q1 – Weiland)

OR Multi-body & nonlinear dynamics (Q2 – v/d Wouw)

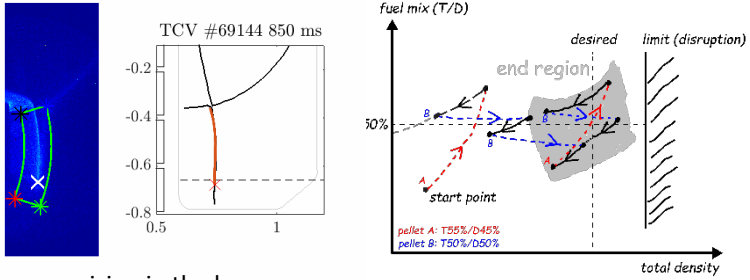
- ☑ Stochastic filtering and estimation (Q2 – Breschi)
- ☑ Supervisory Control of Cyber-Physical Systems (Q3 - Reniers)
- ☑ System identification (Q3 – Schoukens)

Specialization & elective courses

Fusion on the back of an envelope
Control and Operations of Tokamaks
Control of Magnetic Instabilities in Fusion Plasmas
Model Predictive Control/Hybrid Systems and Control
Engineering optimization
Optimal control and reinforcement learning
MPC
Extremum seeking control for data-based perf.
Advanced motion control /robust control
Non-linear control / Learning control

Keywords: System identification & control for distributed parameter systems, model predictive control, supervisory control, (distributed) hybrid control

Key application domain & examples: nuclear fusion, (hydrogen) energy transition, CO_2-dissociation, electro-chemical solar cells, processing and manufacturing industries, energy systems, hyperthermia cancer treatment, thermal systems, cooperation and optimization for precision agriculture



vision in the loop (Tokamak, EPFL Switzerland)

distributed burn control with ice pellets (bullets)