

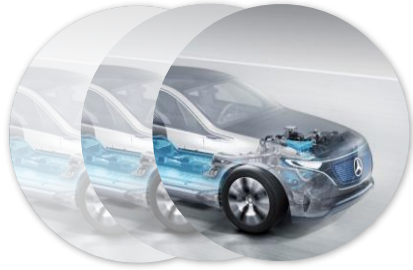
University of Stuttgart
Institute for System Dynamics

Specialization area **System Dynamics and** **Automation**

Prof. Dr.-Ing. Dr. h.c. Oliver Sawodny

isys

Current Trends



MOBILITY

Electromobility
Autonomous Driving
Car-to-X Communication



DIGITALIZATION

Cyber-Physical Systems
Artificial Intelligence



SMART CITIES

Adaptive Structures
Traffic Flow Modeling
Zero-Energy Buildings

Core expertise of ISYS

SYSTEMS ENGINEERING

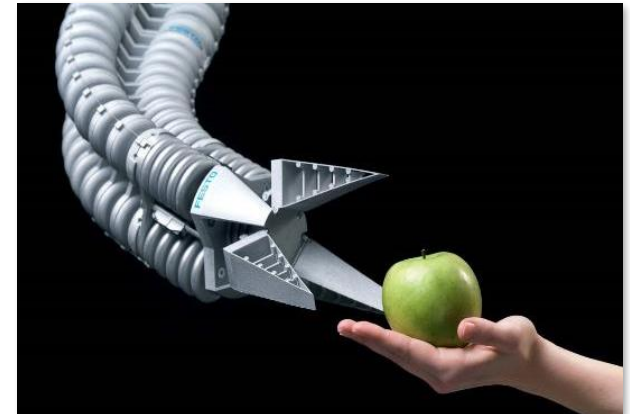
- Engineering Cybernetics
- Cross-Domain Modeling

HARDWARE / SOFTWARE ENGINEERING

- Sensor Technology
- Signal Processing
- Numerics
- Programming / Toolchain
- Functional Safety

APPLICATION-ORIENTED CONTROL ENGINEERING

- Flatness-Based Methods
- Trajectory Generation
- Model-Based Feedforward Control



Research focus of ISYS

METHODS

Modeling

Distributed-Parameter Systems

Identification

Numerical Optimization Methods

Simulation

Analysis and Synthesis

Differential-Geometric Approaches

Trajectory Generation



Physically Motivated
Model-Based Approaches

APPLICATION

Automation of Mechatronic Systems

Large-Scale Robotics

Automotive

Drive Systems / Fluid Power

Opto-Mechatronics

Building Systems Engineering

Process Industry

Medical Engineering



Implementation in Automation Technology

Projects at ISYS

Applications

LARGE-SCALE ROBOTICS

- Active Vibration Damping for Fire-Fighting Turntable Ladders
- Load Sway Damping for Mobile Harbor Cranes
- Hydraulic Multi-Joint Manipulator as an Explosive Ordnance Reconnaissance System
- Simulation of Flexible Tower Cranes
- Automation of Concrete Pumps
- Active Load Stabilization for Reach Trucks
- Control of Flexible Small Mobile Cranes
- Automation of Hydraulic Excavators



LIEBHERR

STILL

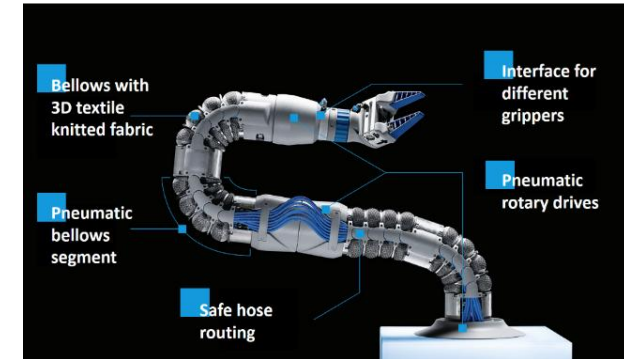
KION
GROUP

MAGIRUS

Applications

DRIVE & ENERGY SYSTEMS AND FLUID POWER

- Open- and Closed-Loop Control of Hydraulic and Pneumatic Actuators
- Energy Efficiency in Pneumatics, Compressed Air Generation and Distribution
- Visual Servoing in Robotics
- Open- and Closed-Loop Control of Soft Grippers
- Kinematics and Kinetics of a Bionic Soft Arm



FESTO

Rexroth
Bosch Group



BOSCH

KAESER

KHS
Filling and Packaging – Worldwide

DFG

Applications

AUTOMOTIVE

- Centralized Control of Active Suspension Systems
- Methods for the Functional Safety of Vehicle Dynamics Control Systems
- Traffic-Dependent Range Estimation for Electric Vehicles
- Route Planning Tools for Electric Vehicles
- Cloud-Based Driving Strategies for eTrucks (Car-to-X Communication)
- Online Brake Performance Estimation in Commercial Vehicles
- Thermal Management for Electric Vehicles



Audi S6 Avant e-tron
Performance and adaptation in response to
Superior with adaptive air suspension



DAIMLER



Audi
Vorsprung durch Technik



BOSCH



KNORR-BREMSE

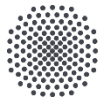


Master Lectures at ISYS

Specialization “System Dynamics and Automation” 18/12 ECTS

Course	Language	ECTS	Lecturer	Semester
Modeling and Identification of Dynamical Systems	German	6	Sawodny	SuSe
Numerical Optimization and Optimal Control	German	6	Gienger	SuSe
Flat Systems	Englisch	6	Sawodny	WiSe
Dynamics of Discrete-Event Systems	German	6	Tarin	SuSe
Dynamic Filtering	Englisch	6	Tarin	SuSe
Internship System Dynamics	German	3	–	WiSe/SuSe
Control of Safety-Critical Systems	Englisch	3	Schmidt	SuSe
Trajectory Generation	German	3	Gienger	WiSe
Machine Learning in System Dynamics	Englisch	3	Böhm	WiSe

Englisch taught courses



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Thank you!

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Specialization area
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