

Staff, Expertise & Research Areas

The team of scientific co-workers, senior engineers and technicians of about 20 persons is headed by Prof. Joachim Böcker. Before his appointment in 2003, Prof. Böcker gained 13 years of experience in industrial research and development with AEG and Daimler. The department is focusing on three main areas: power electronics, electrical drives and energy management. The nature of the projects varies from basic research to applied research in cooperation with various industrial partners.

Power Electronics

Challenges to be solved are application-specific energy conversion, control and distribution - always aiming to improve the system performance with respect to efficiency, volume, weight and dynamics. Currently considered applications are power supplies for data centres, electric spot welding, chargers for EVs/HEVs, DC/DC converters in power distribution systems, piezo electric drives and piezo electric assisted cutting and bonding applications.



Converter for electric spot welding



Thermal modelling of electrical drives

Main Topics

- Soft and hard switching techniques for isolating and non-isolating topologies
- Power semiconductors (Si, SiC, GaN) switching loss characterisation
- Control concepts for PFC rectifiers and resonant converters

Electrical Drives

Application areas cover traction drives for EVs/HEVs, servo drives for industrial applications, wind power generators and high speed drives for turbo compressors and machine tools.

Principal objectives are improvement of the drive system performance and optimized utilisation of energy and resources. Recently also the improvement of system reliability and safety level are targeted.

Main Topics

- Various controller (e.g. FOC, DTC, MPC) and observer concepts
- Modelling and simulation, HiL, dynamic co-simulation (FEA & time-domain)
- Thermal modelling and system identification
- Model-based fault detection and management (e.g. fault-tolerant control)

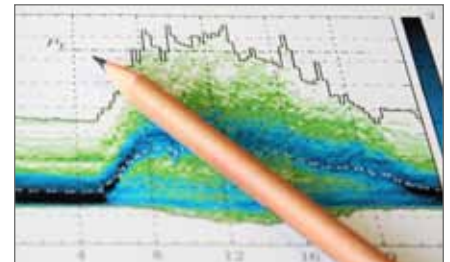
Energy Management

Aspects for reduction of supply costs, the increase of total system efficiency and in general the most economic use of energy are investigated.

Typical applications within the focus are: industrial microgrids, loads in the domestic area, EVs/HEVs and hybrid energy storage systems.

Main Topics

- Model predictive control
- Analysis and prediction of power profiles
- Optimal component/system dimensioning



Energy management

Laboratory

Well equipped with high-performance measuring equipment to solve different measurement challenges.

Electric Motor Test Beds

- Air-conditioned motor test cabin with load machines up to 250 kW
- RCP hardware (DSP/FPGA-based)
- Rotor telemetry system

Power Electronic Test Beds

- Programmable power supplies/sinks
- Power semiconductor characterisation test beds
- Calorimetric power loss measurement