



Student Theses (M.Sc., B.Sc.) "Efficient Power Electronics for Electrocaloric Heat Pumps or Soft Robotics"



The newly founded research group "Smart Converters for Emission-Free Mobility of the Future" deals with highly efficient electrical energy converters for emission-free mobility of the future. Smart converters with intelligent operating concepts enable flexible and adaptable system integration of electrical sources, storage systems and consumers as well as the coupling of the electricity, heat and mobility sectors.

In order to accelerate sustainable mobility and the energy transition, the group is researching:

- Highly efficient power electronics with new topologies and operating concepts,
- compact voltage converters for intelligent charging, storage and driving,
- **electrocaloric heat pumps for cooling and heating in mobile applications.**

Student theses (MA/BA/FA/SA) are available. An associated future laboratory is being set up at the Institute for Electrical Energy Conversion (IEW), University of Stuttgart, as part of the Innovation Campus Mobility of the Future (ICM).

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Topics and applications (selection)

- Power
 - Highly efficient voltage converters > 99% e.g. partial power conversion, soft-switching and multilevel converter topologies
 - Reconfigurable control technology
 - Optimization of efficiency and power density
 - Isolated and non-insulated voltage transformers
 - Wide-bandgap devices and ICs (GaN, SiC)
- Applications and Topics:
 - 400V ... 1.2kV control for capacitive loads (electrocaloric capacitor) by means of power converter
 - Fast and precise thermal measurement technology, measurement technology for electrocaloric effect
 - Design of thermal and mechatronic components for electrocaloric heat pumps
- Related topics:
 - > 1.2kV ... 10kV Driver for Electrocaloric Polymers, or for Soft Robotics (Dielectric Elastomer Actuators)

Work content (selection)

- Circuit simulation (PLECS, Spice, ADS)
- Design and characterization of power electronics (transistors, gate drivers, sensors)
- Programming and commissioning (control technology, rapid prototyping)
- Measurement technology for electrical voltage transformers (efficiency with power meter, switching behavior with oscilloscope)
- The topic and duration of the thesis are determined individually
- Student (f/m/d), 3-6 months (BA, MA, SA, FA)

Please send your application (incl. current transcript of records) or questions to:
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