



Electrical Engineering

Center for
Industrial
Electronics



SDU Electrical Engineering Centre for Industrial Electronics

A lighthouse for education,
R&D and testing



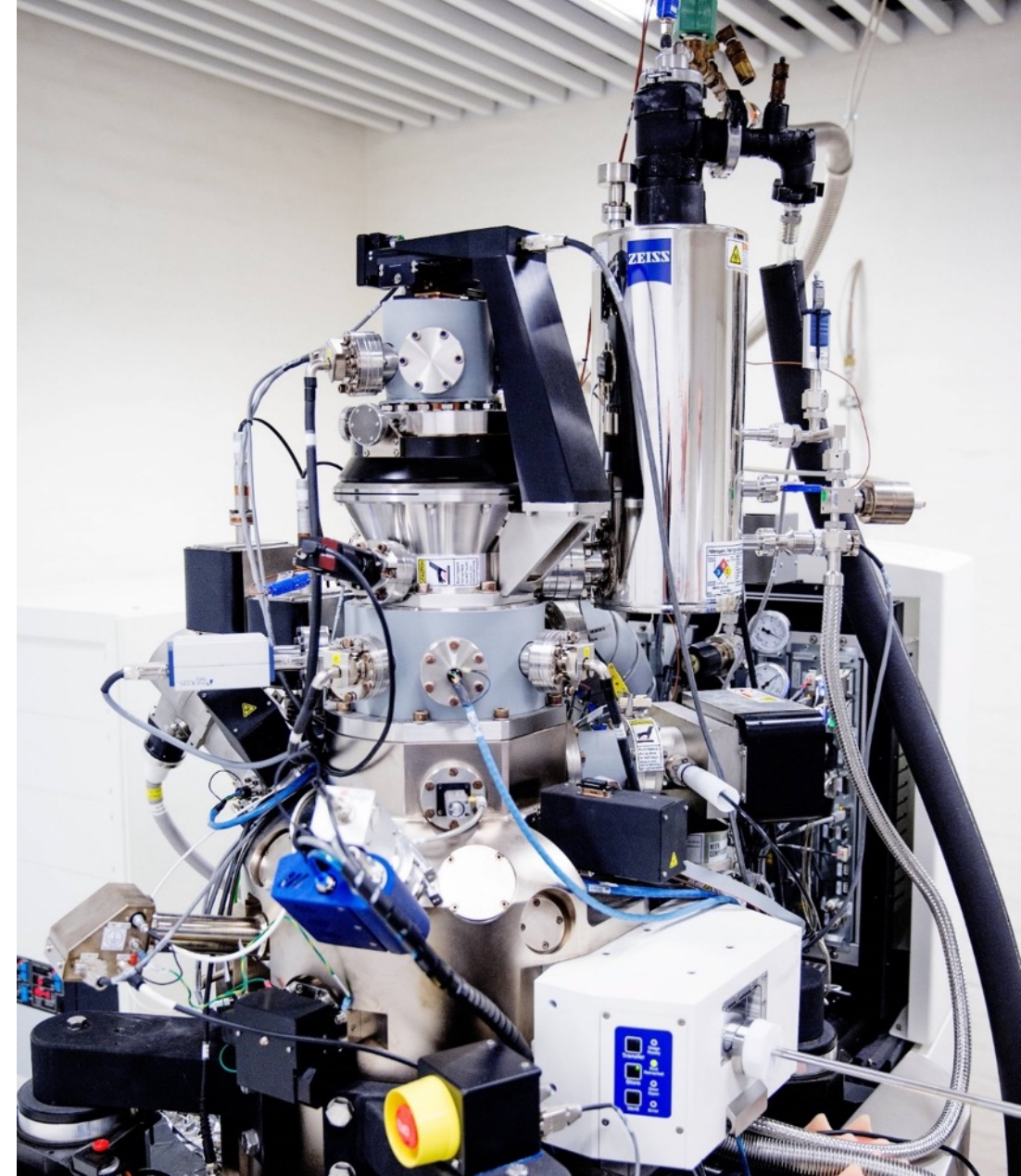
Ass. Prof. Dr. Thomas Ebel
Head of CIE and EE SDU

EE Technology Areas

Power Electronics

- Passive Components
- Energy Storage and Micro grids
- Power converters and systems
- Reliability of components and systems
- Motors and Control
- EMI/EMC
- Intelligent Systems

Acoustics



Energy Storage Devices “Netzpatron” (Grid-Protection)

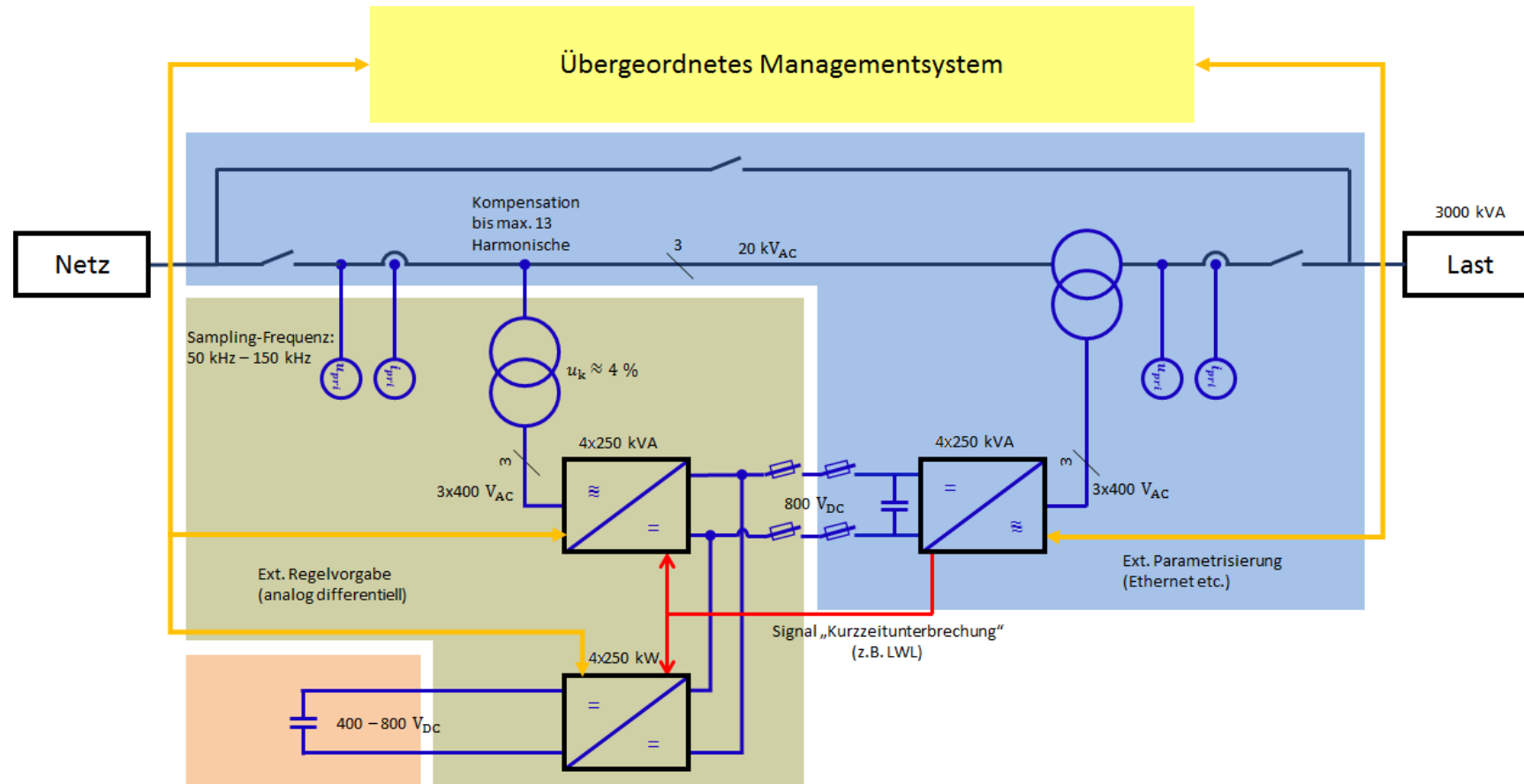


Abbildung 1: Strukturbild des Netz-Patrons

Elcap 2 F / 900 V Energy Storage Devices for Grid-Protection

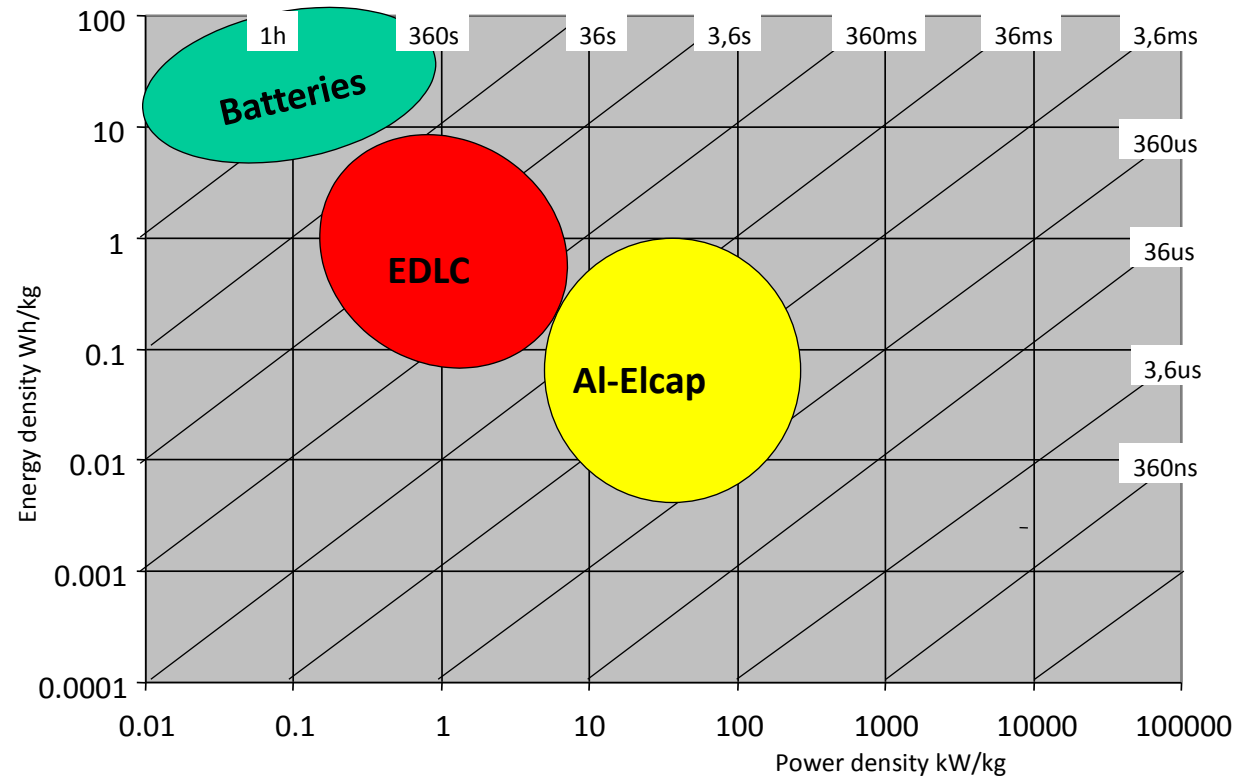


Abbildung 8: Ragone- Diagramm, in dem Energiedichte und Leistungsdichte sowie Lade- / Entladezeiten von Energiespeichern wie Batterien, Superkondensatoren und Aluminium-Elektrolytkondensatoren dargestellt sind.

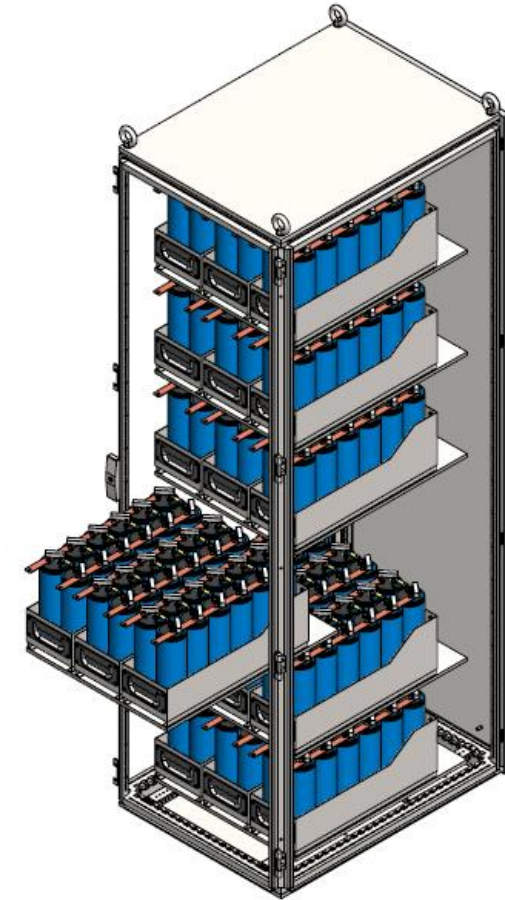


Abbildung 9: Der von FTCAP entwickelte Energiespeicher mit Schubladensystem

Source: FTCAP

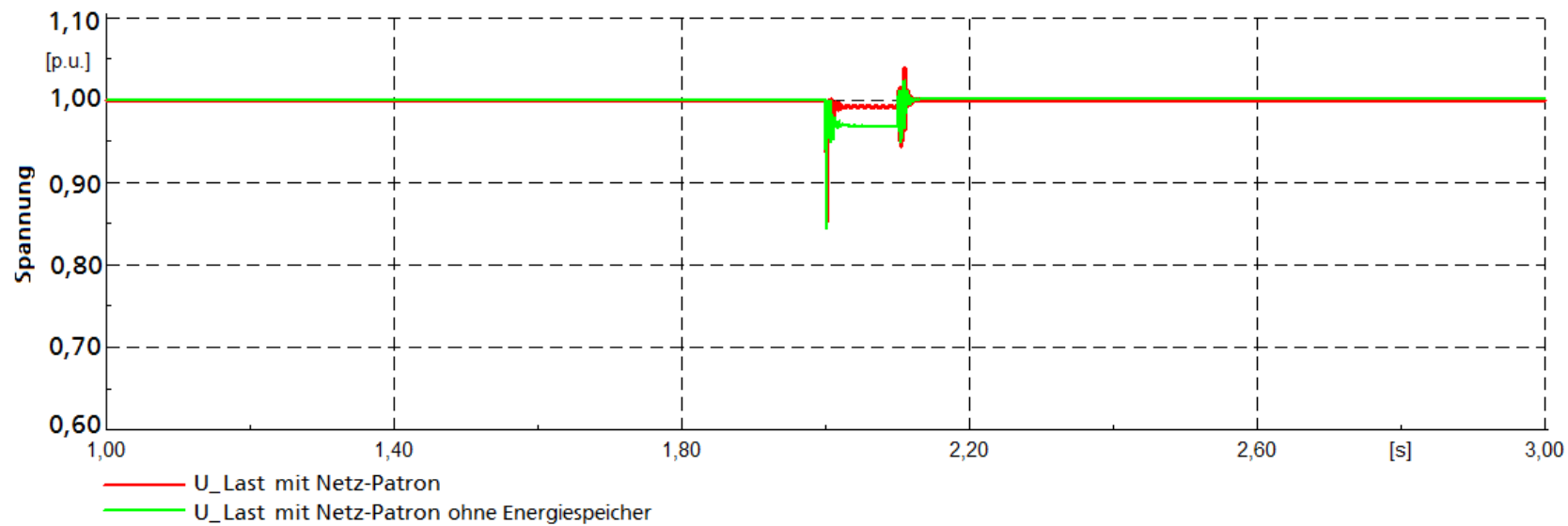
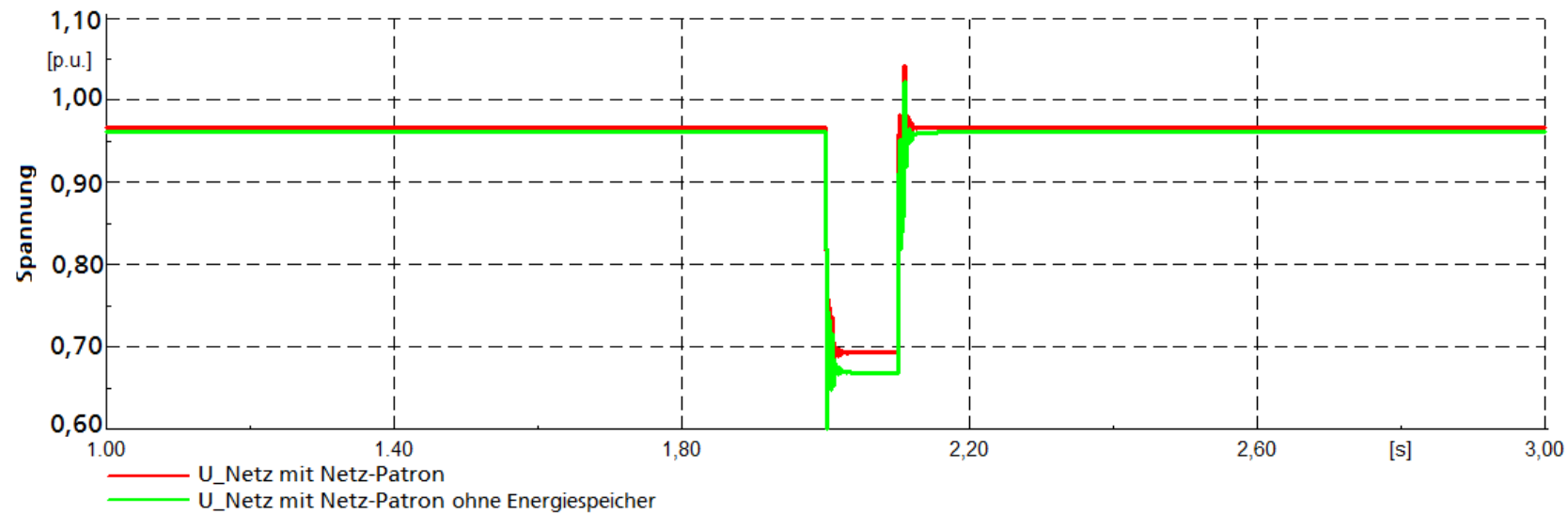


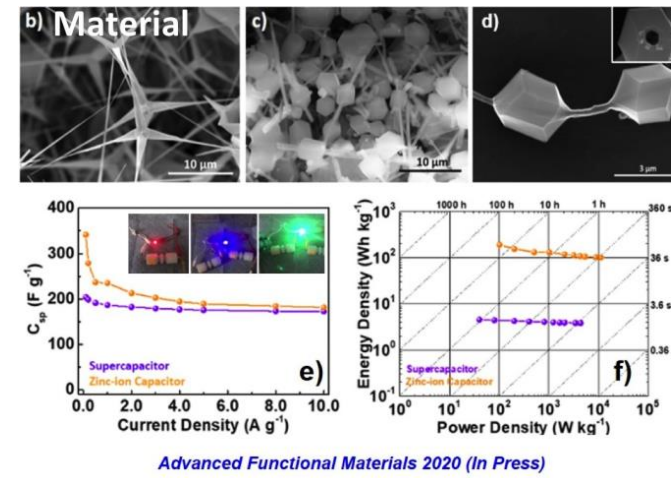
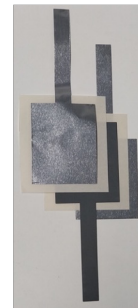
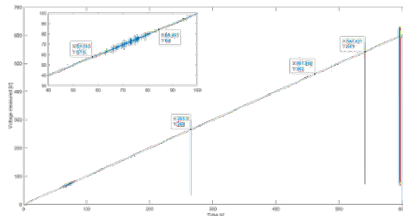
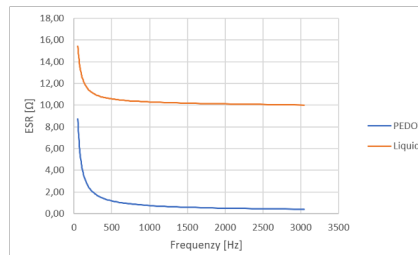
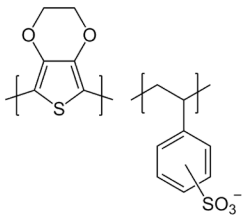
Abbildung 7: Verlauf der Spannung am Anschlusspunkt des Netz-Patrons und der versorgen Last bei einem netzseitigen Spannungseinbruch auf 70 % der Nennspannung

Hybrid Energy Storage Devices for Grid-Protection

- Electrolytic capacitor for short time interruptions below 15 m - **SDU**
- New Super-capacitors for longer interruptions 1 min - **SDU**
- Batteries for long time interruptions

HV (500 V) Polymer Alu EI Caps

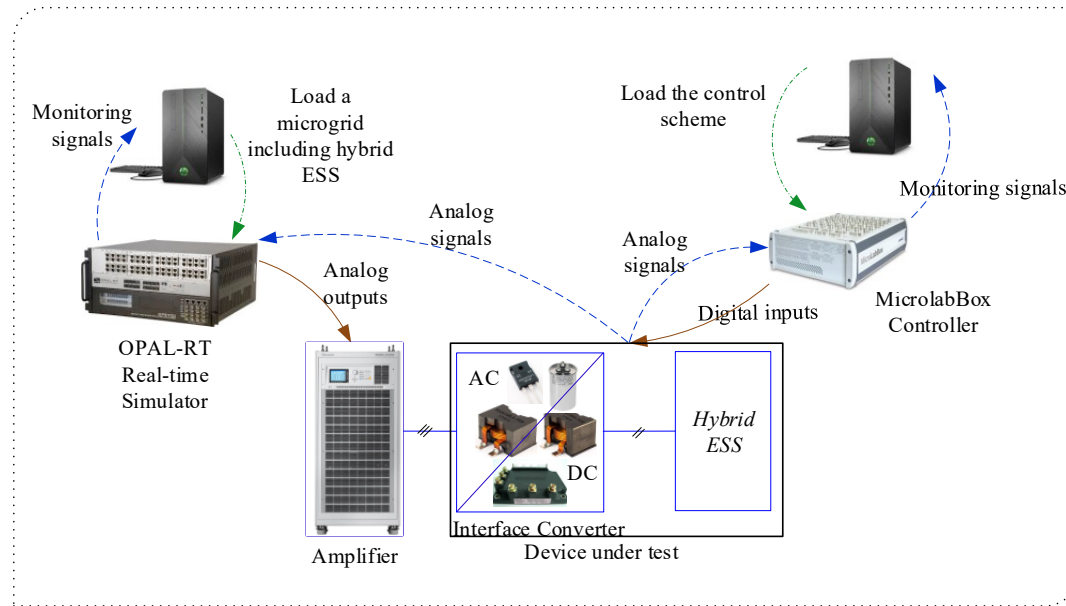
- Stack construction
- Breakdown voltage over 500 V
- $T > 150^{\circ}\text{C}$
- $> 3 \times$ Ripple current load
- ultra long life-time $> 10.000 \text{ h}$



Advanced Functional Materials 2020 (In Press)



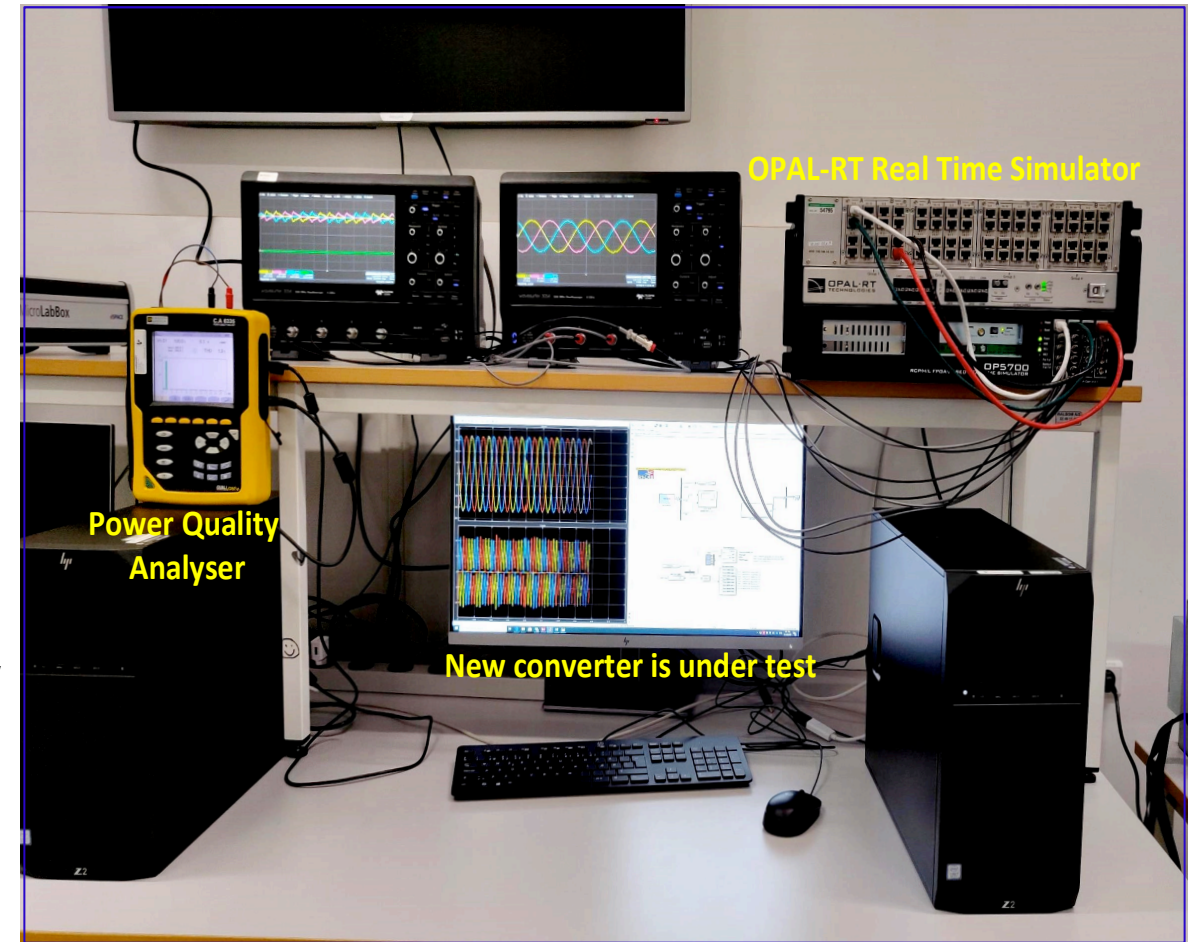
Micro Grid Lab @ SDU EE _ Ass. Prof. Mehdi Savaghebi



Design and implementation of control and protection schemes for low inertia grids and microgrids

Analysis, simulation and lab-scale validation of power systems with high penetration of renewables

Control design and implementation for energy storage systems



Thank you for your attention