

universität freiburg

Faculty of Engineering

Prof. Dr. Moritz Diehl

Systems Control and Optimization Laboratory (SYSCOP)

Department of Microsystems Engineering

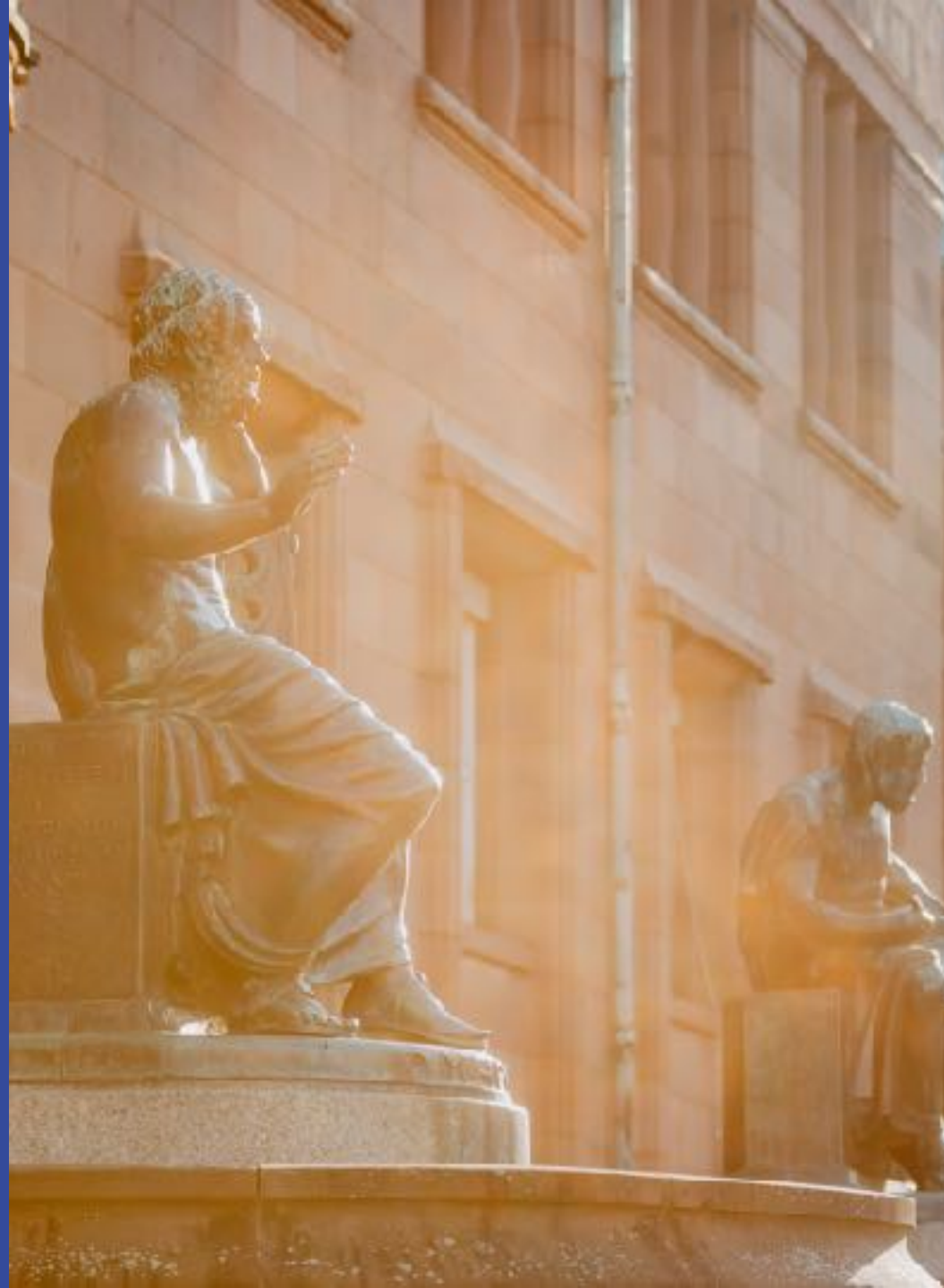
(Institut für Mikrosystemtechnik - IMTEK)

Faculty of Engineering (Technische Fakultät)

University of Freiburg

Georges-Köhler-Allee 102,

79110 Freiburg



Albert-Ludwigs-Universität Freiburg

universität freiburg

- founded in 1457
- 25 000 students (52% female, 14% international)
- all faculties (humanities, sciences, medicine, *engineering*)



University of Freiburg (since 1457)

Faculty of Engineering (since 1995, now 50 professors)

Computer
Science

Microsystems
Engineering

Sustainable
Systems Engineering

Systems Control and Optimization Laboratory (syscop.de)



Research and Teaching Activities of the Team / Laboratory

Research:

- **Model Predictive Control (MPC)** for
 - District heating networks (WOPS; with ISE, ...)
 - El. distribution grid (GRECCO; INATECH, ISE,..)
 - Solar adsorptive cooling (HS Karlsruhe)
 - Wind turbines (IAV Gifhorn)
 - PV-battery systems (ISE)
 - PV-Power Converters (ISE)
- **Airborne Wind Energy (AWE)** – Modelling and Optimization
- **General numerical methods and open source software** for estimation, control and optimization

Teaching:

- **Wind Energy Systems** (6 ECTS)
- **MPC for Renewable Energy Systems** (3 ECTS)
- **General method-oriented courses:**
 - Systemtheorie und Regelungstechnik (6 ECTS)
 - Modelling and System Identification (6 ECTS)
 - Numerical Optimization (6 ECTS)
 - Numerical Optimal Control (6 ECTS)
 - MPC and Reinforcement Learning (3 ECTS)

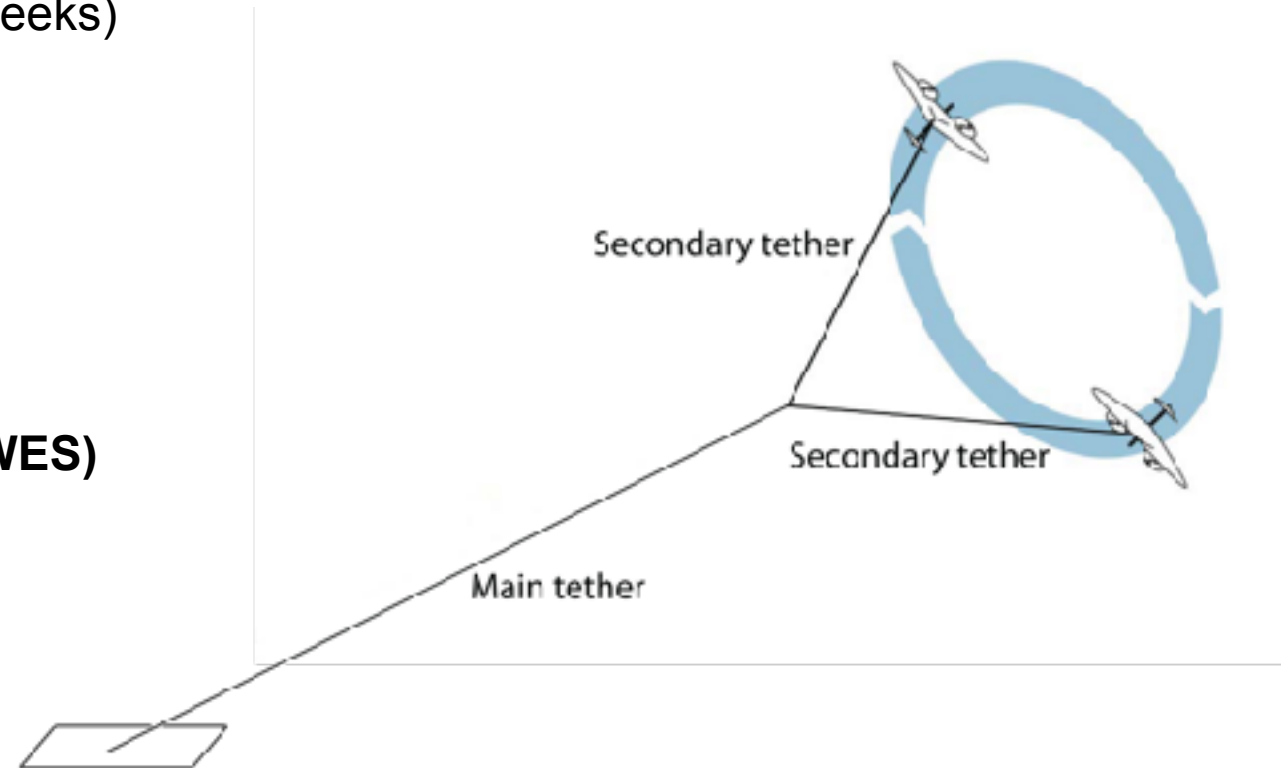
Topics of Interest

- **Optimal Design and Operation of Multi Energy Systems**

- Wind and Solar Power (stochastic, one day ahead)
- Heating, Ventilation and Air Conditioning (HVAC, hours)
- Hot Water, Cold Water, and Ice Storage (days, weeks)
- Geothermal and Seasonal Storages (months)
- Battery systems (days)
- Flexible loads


- **Multi Wing Airborne Wind Energy Systems (MAWES)**

- interaction with the atmospheric boundary layer
- interaction with electricity grid
- interaction with birds, airplanes, humans







Time	Program
8:30 - 9:00	Arrival & Coffee
9:00 - 9:15	Welcome of the delegation of the Chungcheongbuk-do Office of Education from the Republic of Korea @ KINOHÖRSAAL
9:15 - 9:45	Modeling and Optimization of Seasonal Thermal Energy Storage (Wonsun Song)
9:45 - 10:00	Walk to <i>livMatS</i> Biomimetic Shell building
10:00 - 10:30	Introduction to the <i>livMatS</i> Biomimetic Shell (Prof. Dr. Jürgen Rühle)
10:30 - 10:45	 Introducing the Center for Renewable Energy (ZEE) of the University of Freiburg (Prof. Dr. Moritz Diehl)
10:45 - 11:15	Economic Value of Dual-Wing Airborne Wind Energy Systems (Jochem De Schutter)
11:15 - 11:30	Coffee break
11:30 - 12:00	Highly Oscillatory Optimal Control Problems with a Variable Number of Subcycles (Jakob Harzer)
12:00 - 12:30	Solving Airborne Wind Energy Optimal Control Problems with Induction Modelling (Rachel Leuthold)
12:30 - 13:30	Lunch (Fraunhofer IPM / Mensa Flugplatz)

universität freiburg

Center for Renewable Energy (ZEE)

Prof. Dr. Moritz Diehl (Managing Director) and
Dr. Hawta Khayat (Scientific Administrator)

Zentrum für Erneuerbare Energien (ZEE)
University of Freiburg
Georges-Köhler-Allee 102,
79110 Freiburg



ZEE

Center for
Renewable Energy

Center for Renewable Energy - Zentrum für Erneuerbare Energien (ZEE)

ZEE History:

- founded in April 2007 at the **University of Freiburg**
- involvement of scientists from seven faculties and four external partner institutions:
 - **Fraunhofer Institute for Solar Energy Systems**
 - **Offenburg University of Applied Sciences**
 - **Forest Research Institute**
 - **Öko-Institut**



ZEE

Center for
Renewable Energy

Center for Renewable Energy - Zentrum für Erneuerbare Energien (ZEE)

ZEE Mission

ZEE promotes internationally-oriented and cross-disciplinary research on Renewable Energy Systems in Freiburg and Surroundings

Longer Mission (on ZEE webpage): The Centre for Renewable Energy is a cross-disciplinary scientific facility at the University of Freiburg. It collaborates with both internal and external institutions to conduct research, education, and advanced training in the field of renewable energy. ZEE values interdisciplinary teaching and the development of renewable energy policy. ZEE creates synergies between partners and enables high-ranking research clusters, focusing on renewable energy technologies and systems. ZEE serves as a bridge between research centers, communities, and policymakers.



ZEE

Center for
Renewable Energy

Center for Renewable Energy (ZEE)

Current ZEE Members:

Prof. Dr. Jürgen Bauhus
Prof. Dr. Stefan Glunz
Prof. Dr. Barbara Koch
Prof. Dr. Leonhard Reindl
Prof. Dr. Markus Weiler
Prof. Dr. Michael Pregernig
Prof. Dr. Moritz Diehl
Prof. Dr. Anke Weidlich
Prof. Dr. Dirk Schindler
Prof. Dr. Andreas Bett
Prof. Dr. Alexandra Klein
Prof. Dr. Cathrin Zengerling
Prof. Dr. Sonia Dsoke
Prof. Dr. Holger Neuhaus

Current ZEE Projects:

- GrECCo – Grid-Sensitive Energy Community Coordination
- MAWERO - Multi-wing Airborne Wind Energy Robustness Optimization
- Agri-photovoltaics (Agri-PV) Project



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Center for
Renewable Energy

Center for Renewable Energy (ZEE)

Board of Directors



Prof. Dr. Moritz Diehl
(Managing Director)



Prof. Dr. Andreas Christen
(Director)



Prof. Dr. Anke Weidlich
(Director)



Dr. Hawta Khayyat
(Scientific Administrator)



Prof. Dr. Barbara Koch
(Permanent Guests)



Prof. Dr. Stefan Glunz
(Permanent Guests)



Prof. Dr. Dirk Schindler
(Permanent Guests)



Christine Paasch
(Financial Administrator)

Yearly ZEE Flagship Event:

Renewable Energy Day (RED) Freiburg



RENEWABLE ENERGY DAY FREIBURG 2024



Aula der Universität
Freiburg (KG I)
Platz der Universität 3,
79098 Freiburg



Registration



RED 2023 on Dec 4, 2023



PATRICK GRAICHEN

How (not) to solve the climate crisis: Insights from political experience



HANS-MARTIN HENNING

Key features of the future energy system



CHRISTIAN PAUL

Freiburg's path to decarbonization

Join the Renewable Energy Day on July 15, 2024, and keep in touch with ZEE via Web and Email!

<https://www.zee-uni-freiburg.de/>



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