Organisational Information

Sign up at: www.ecpe.org/events

Registration Deadline:

5 May 2026

Participation Fee:

€ 345,– *	for industry
€ 305,– *	for universities/institutes
€ 135,– *	for students/PhD student (limited spaces; copy of students ID required)

* plus VAT

- The online participation fee includes remote access via the meeting software Webex and digital proceedings.
- Digital proceedings will be provided by download link latest one day before start of the event.
- Upon receipt of registration confirmation via email you are signed-up for the event. The invoice will be sent via email.
- 15% discount for participants from ECPE member companies.
- 10% discount for participants from ECPE competence centres.
- Cancellation policy: Full amount will be refunded in case of cancellation upon to 2 weeks prior to the event. After this date 50 % of the fee is non-refundable (replacement is possible).
- We reserve the right to cancel the event if the minimum number of participants is not reached.

Organisational Information

Organiser	ECPE e.V. Ostendstrasse 181 90482 Nuremberg, Germany www.ecpe.org
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Course Instructors:

Dr. Tobias Geyer
ABB Motion High Power (CH)

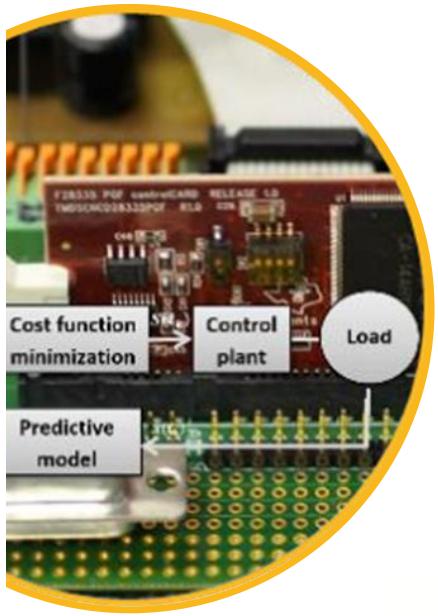
Prof. Dr. Ralph Kennel,
Technical University of Munich (DE)

Prof. Dr. Steven Liu,
Technical University Kaiserslautern (DE)

European Center for Power Electronics e.V.

Online Event

ECPE/Cluster Tutorial
Model Predictive Control for Power Electronics, Drives and Power Grid Applications



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7 - 8 May 2026

Cluster Leistungselektronik

ECPE/Cluster Online Tutorial

Model Predictive Control for Power Electronics, Drives and Power Grid Applications

7 - 8 May 2026

Model Predictive Control (MPC) is a conceptually simple yet powerful methodology to control power converters, electric drives and large systems, such as electrical power grids. MPC provides many advantages over traditional controllers including the capability to intuitively handle a large variety of control problems by considering different modes of operation and directly incorporating system constraints and additional requirements. The underlying concepts are intuitive, the resulting controllers are inherently stable and, once calculated, easy to implement. The advances in processing power of digital signal processors have recently promoted MPC into the first commercial applications, which opened a door toward improved performance and efficiency of power converters, drives and power grids.
The goal of this tutorial is to provide working knowledge on the development and implementation of MPC in different application fields. The introduction teaches the basic MPC principles, including mathematical techniques and optimization methods necessary to formulate and solve the control problem. The subsequent application-specific presentations address practical challenges in MPC of drives, grid connected converters, photovoltaic inverters and electrical power grids. Case studies demonstrate practical MPC controller designs and evaluate and discuss their results. The embedded implementation section provides practical implementation guidelines by addressing hardware, software, programming methods and suitable design tools. Finally, in the last session, advanced MPC concepts are explained and demonstrated on examples

All presentations and discussions will be in English.

Course Instructors

Dr. Tobias Geyer, ABB Motion High Power (CH)
Prof. Dr. Ralph Kennel, TU Munich (DE)
Prof. Dr. Steven Liu, TU Kaiserslautern (DE)

Program

Thursday, 7 May 2026

08:15 Start WEBEX

08:45 Welcome and Tutorial Opening | C. Gould, ECPE

Introduction and Basic Concepts

09:00 Introduction and Basic Concepts | R. Kennel
- Basic Principle of Predictive Control
- Trajectory based and Hysteresis based Predictive Control
- Benefits of Predictive Control

09:45 Control Theory | T. Geyer
- Introduction to Control Theory
- State-Space Modeling
- MPC Concept

10:45 Break

11:00 Numerical Optimization | T. Geyer
- Introduction to Mathematical Optimization
- Convex and Non-convex Problems

11:30 Linear MPC | S. Liu
- A Simple Numerical Example in Matlab

12:15 Lunch break

Direct MPC

13:00 Introduction to FCS-MPC and Applications | R. Kennel
- Comparison of Conventional Control and MPC
- MPC of AC/DC Converters
- Current Control of Three Phase Inverters
- Model Predictive Power Control in Active Front End and Further Examples

14:00 Generalization to Long Horizon FCS-MPC | T. Geyer
- Derivation of the Integer Optimization Problem and Sphere Decoding
- Drive System with LC Filter
- Tuning Guidelines

15:15 Break

15:30 Direct MPC of Photovoltaic Inverters | R. Kennel
- Case Study: Design of MPC for Quasi Z-Source Inverters with LC Filters
- Validation and Evaluation of the Performance

MPC of Power Grids

16:15 MPC for Electrical Power Grid | S. Liu
- Control Problem Formulation
- Mathematical Model of Power Grid
- Objective Function and Constraints for Optimisation
- Validation and Evaluation of the Performance

17:30 Open Questions from the 1st day

17:45 End of 1st Day

Program

Friday, 8 May 2026

08:30 Start WEBEX

PMW based MPC Concepts

09:00 MPC based on Optimized Pulse Patterns | T. Geyer
- Optimized Pulse Patterns
- Fast Control of Optimized Pulse Patterns

10:15 Indirect MPC (Part 1) | T. Geyer
- Indirect MPC of Three-phase Grid-connected Converters (a Numerical Example)

10:45 Break

11:00 Indirect MPC (Part 2) | T. Geyer
- Indirect MPC for Modular Multilevel Converters
- MPC of LCI Drives

11:45 Lunch break

Implemenation

12:30 Algorithms and Embedded Implementation of MPC | S. Liu
- Embedded MPC Implementation: Hardware and Software
- Embedded MPC with SoCs
- A Workflow Example – MPC for a Grid-connected Converter with DSP and FPGA

Advanced Topics

13:45 Advanced MPC Topics | T. Geyer
- Stability
- Explicit Solution of MPC
- Hybrid Systems

14:15 Break

14:30 Further MPC Concepts | S. Liu
- Hierarchical MPC
- Distributed MPC
- Data-driven MPC

Summary and Discussion

15:45 Summary | T. Geyer

16:00 Q & A and Discussion

16:15 End of 2nd Day