Organisational Information

Sign up at: www.ecpe.org/events

Registration Deadline:

12 September 2023

Participation Fee:

€ 670,– * for industry

€ 520,– * for universities/institutes

€ 180,– * for students/PhD students
(limited spaces; copy of students ID required; dinner € 50,-* extra)

* plus VAT

- ➢ The regular participation fee includes dinner, lunches, coffee/soft drinks. The reduced (PhD) students fee includes all the above except for dinner (can be booked for an extra fee of € 50*)

- ➢ The presentations will be provided by email via a download link short before the event. A printed version of the tutorial handout is available on request (€ 50,-*).

- ➢ Upon receipt of registration confirmation via email you are signed-up for the event. The invoice will be sent via email.

- ➢ 25 % discount for participants from ECPE member companies.

- ➢ 10 % discount for participants from ECPE competence centres.

- ➢ Further information (hotel list and maps) will be provided after registration and can be found on the ECPE web page.

- ➢ Cancellation policy: Full amount will be refunded in case of cancellation up to 2 weeks prior to the event. After this date 50 % of the fee is non-refundable (substitutes are accepted anytime).

- ➢ The number of participants is limited to 20 attendees.

Organisational Information

Organiser	ECPE e.V. 90443 Nuremberg, Germany www.ecpe.org
Technical Chair	Benjamin Stickan, Fraunhofer ISE
Technical Contact	Chris Gould, ECPE e.V. +49 911 81 02 88 - 21 chris.gould@ecpe.org
Organisation	Marietta Di Dio, ECPE e.V. +49 911 81 02 88 - 13 marietta.didio@ecpe.org
Venue	AIT Austrian Institute of Technology Giefinggasse 2, 4, 6 1210 Vienna Austria

Source photo: © AIT/Johannes Zinn
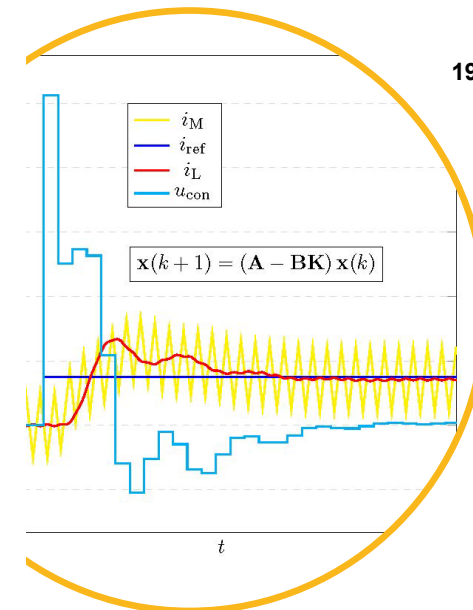Source graph front page: Fraunhofer ISE

European Center for Power Electronics e.V.

ECPE Tutorial

Digital Control | Modelling and Feedback Design in State-Space

19 – 20 September 2023

Vienna, Austria

$$\mathbf{x}(k+1) = (\mathbf{A} - \mathbf{BK})\,\mathbf{x}(k)$$

Legend: i_M, i_{ref}, i_L, u_{con}

ECPE Tutorial

Digital Control | Modelling and Feedback Design in State-Space

19 – 20 September 2023
Vienna, Austria

Within the last two decades, state-space control methods have become the state-of-the-art for power electronics applications. Their superior dynamic behavior over Proportional Integrator (PI) based schemes makes them the method of choice when it comes to fast and accurate converter control, while still retaining a relatively low computational complexity. Owing to a constant increase in harmonics and disturbance behavior requirements, state-space controller design nowadays already belongs to the tool set of many development teams.

This tutorial is specifically designed for engineers and scientists who want to build up or improve their skills in power electronics control. It provides structured guidelines for state-feedback implementation of current or voltage tracking issues, exposing pitfalls and outlining strategies to avoid them.

The first aim is to convey an intuitive understanding of linear ordinary differential equations, eigenvalues, eigenvectors and their connection to stability, accompanied by representative examples from power electronics. Furthermore, accurate modelling and simulation strategies of continuous and discrete systems are discussed.

The second aim is to enable the participants to design robust state feedback controllers for typical applications. This includes tailored solutions such as prefilter, feedforward and integral action implementation.

To give an extensive hands-on experience, a significant part of the tutorial will consist of assisted exercises with Plexim PLECS® and GNU Octave.

Course Instructors:

Benjamin Stickan, Fraunhofer ISE (DE)
Dr. Christoph Siedle, Fraunhofer ISE (DE)

All presentations and discussions will be in English.

Programme

Tuesday, 19 September 2023

09:15 Start of Registration & Welcome Coffee

09:45 Welcome, Opening
Chris Gould, ECPE e.V.

10:00 ODEs, State-Space and Initial Value Problems
Benjamin Stickan

10:30 The Matrix Exponential
Benjamin Stickan

11:00 Introduction to PLECS and Octave
Benjamin Stickan

11:30 Exercise

12:00 Lunch

13:00 Modelling in State-Space
Benjamin Stickan

13:30 Exercise

14:00 Switched Systems with Blanking Time
Benjamin Stickan

14:30 Exercise

15:00 Coffee Break

15:30 Brief Introduction to Numerical Integrators
Benjamin Stickan

16:00 Exercise

16:30 Concatenation of Linear Systems
Benjamin Stickan

17:00 Open Discussion

17:30 End of 1st Day

19:30 Dinner at Mnozil's Restaurant Zum Kellergwölb
Seilerstätte 13   1010 Vienna, Austria

Programme

Wednesday, 20 September 2023

09:00 Start of 2nd Day

09:00 State-Space Modelling of LCL Filter, Discretization
Christoph Siedle

09:30 State-Space Controllers and Pole Placement
Christoph Siedle

10:00 Exercise

10:30 Coffee Break

11:00 Controller, Prefilter and Feedforward Control
Christoph Siedle

11:30 Exercise

12:00 Controller Integrator
Christoph Siedle

12:30 Exercise

13:00 Lunch

14:00 Robustness and Damping Time Constants
Christoph Siedle

14:30 Exercise

15:00 Actuator Limitation and Anti-Windup
Christoph Siedle

15:30 Coffee Break

16:00 Exercise

16:30 Resonant Controller Integrator (SOGI)
Christoph Siedle

17:00 Wrap up, Final Discussion

17:30 End of Tutorial