

# EPE TUTORIAL

Advanced Modelling and Simulation of Power Electronic Systems  
EPE 2016 ECCE Europe – Karlsruhe, September 5, 2016

This tutorial is designed for engineers to improve and deepen their understanding of modelling and simulation of power electronic systems. Using presentations, demonstrations, discussions and hands-on exercises the subject is learned and applied on specific problems.

## Content

The workshop (WS) specifically addresses development engineers who not necessarily have experience with the simulation software PLECS. In the workshop, you will learn modeling techniques to make your simulations of power electronic circuits and controls even faster. We will consequently apply the top-down approach of PLECS where individual components are modeled as simple as possible and as detailed as necessary. In addition, the workshop offers many opportunities to get in touch with the developers/application engineers of PLECS. After a short introduction to PLECS and into numerical simulation algorithms, which will enable you to always pick the right solver for achieving maximum speed and accuracy, the WS covers all-important concepts of the PLECS Blockset and PLECS Standalone, including thermal, magnetic and mechanic modeling, script programming and analysis tools.

The required PLECS software licenses will be provided ahead of the WS.

In addition we will demonstrate Processor-in-the-Loop and Hardware-in-the-Loop simulation with PLECS. You will see how to run a PIL and HIL simulation.

**The Tutorial contains hands-on exercises; a computer with PLECS Standalone installed will be needed, the PLECS license can be obtained from the Plexim web site.**

Application engineers and developers from Plexim who have a vast experience in designing models and teaching modelling and simulation techniques will conduct this workshop. Many universities and industrial research organisations offer this WS to their staff annually to keep their researchers up to date.

### Benefits

"The team at the University of Nottingham find the annual PLECS Workshop very worthwhile and our researchers enjoy the valuable opportunity to learn from the application and software engineers as well as providing feedback for further development of PLECS."

— Dr. Pat Wheeler, Professor of Power Electronic Systems at the University of Nottingham

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08:00 Registration

09:30 Introduction to PLECS

- ▶ Instantaneous switching
- ▶ General use of PLECS Blockset and PLECS Standalone
- ▶ Instantaneous switching
- ▶ Variable and fixed-step operation

Exercise: Modelling a switched-mode power supply

11:00 Break

11:30 Solver Settings

- ▶ Definition of stiff and non-stiff Systems
- ▶ Explicit and non-explicit solvers
- ▶ Stability domains
- ▶ Accuracy considerations, step size control
- ▶ Proper handling of discontinuities, zero-crossing detection

Exercise: Solver accuracy and settings

13:00 Lunch

14:00 Introduction to Thermal & Magnetic Modelling & Simulation

- ▶ Stability domains
- ▶ Switching & conduction loss descriptions
- ▶ Combined electrical-thermal simulation
- ▶ Permeance Capacitance Analogy Model

Exercise: Thermal modelling of a buck converter

15:30 Break

16:00 Overview of PLECS Tools

- ▶ Stability domains
- ▶ AC Sweep and Impulse Response Analysis Tools
- ▶ Steady State Analysis Tool
- ▶ Implementing custom components

Exercise: Creating a custom PV string component

17:30 End of day

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## Scope

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