

# PLECS WORKSHOP

Three Day Advanced Workshop on Modeling and Simulation of Power Electronic Systems  
Stuttgart, May 4-6, 2015

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May 4	Day 1
10:00	<b>Introduction to PLECS</b> <ul style="list-style-type: none"><li>▶ General use of PLECS Blockset and PLECS Standalone</li><li>▶ Instantaneous switching</li><li>▶ Variable and fixed-step operation</li></ul> Exercise: Modeling a switched-mode power supply
12:00	Lunch
13:00	<b>Numerical Simulation, Solver Settings</b> <ul style="list-style-type: none"><li>▶ Definition of stiff and non-stiff systems</li><li>▶ Explicit and non-explicit solvers</li><li>▶ Stability domains</li><li>▶ Accuracy considerations, step size control</li><li>▶ Proper handling of discontinuities, zero-crossing detection</li></ul> Exercise: Solver accuracy and settings
14:30	Break
15:00	<b>Thermal Modeling</b> <ul style="list-style-type: none"><li>▶ Combined electrical-thermal simulation</li><li>▶ Switching &amp; conduction loss descriptions</li></ul> Exercise: Thermal modeling of a buck converter, advanced exercise on the thermal design of an inverter with PLECS
16:30	<b>Magnetic Modeling</b> <ul style="list-style-type: none"><li>▶ Reluctance-resistance analogy approach</li><li>▶ Permeance capacitance analogy model</li><li>▶ Magnetic component library</li></ul> Exercise: Modeling a forward converter transformer using the magnetic domain
17:30	End of Day 1
18:30	Dinner

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May 5	Day 2
08:30	<b>Mechanical Domain and Electrical Machine Modeling</b> <ul style="list-style-type: none"><li>▶ Simulation of electromechanical systems</li><li>▶ Inelastic collisions</li><li>▶ Electrical machine models and implementations in PLECS</li></ul> Exercise: Modeling an electric vehicle using the PLECS mechanical domain
10:00	<b>Break</b>
10:30	<b>Analysis Tools</b> <ul style="list-style-type: none"><li>▶ Steady state analysis</li><li>▶ AC sweep and impulse response analysis</li></ul> Exercise: Control design of a flyback converter using PLECS
12:00	<b>Lunch</b>
13:00	<b>Simulation Scripting</b> <ul style="list-style-type: none"><li>▶ Pre- and post-process simulation results</li><li>▶ Automated simulations, parameter sweeps</li></ul>
13:30	<b>C-Code Integration</b> <ul style="list-style-type: none"><li>▶ Solver operation</li><li>▶ Sample time settings</li><li>▶ DLL Block</li></ul> Exercise: Efficient PWM generation using the PLECS C-Script block
15:15	<b>Break</b>
15:45	<b>Code Generation</b> <ul style="list-style-type: none"><li>▶ Basic ideas</li><li>▶ Code generation for the electrical circuit and control loop</li><li>▶ Limitations</li></ul> <b>PLECS Web-based Simulation</b> <ul style="list-style-type: none"><li>▶ Introduction and demonstration</li><li>▶ Existing examples</li></ul>
16:30	<b>Outlook for Processor-in-the-Loop Simulation and Q&amp;A</b>
17:00	<b>End of Day 2</b>
18:30	<b>Dinner</b>

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May 6	Day 3
08:30	<b>Introduction to Processor-in-the-Loop Simulation (PIL)</b> <ul style="list-style-type: none"><li>▶ Principle of Operation</li><li>▶ Advantages of a PIL Simulation</li><li>▶ Overview of an embedded control project for a BLDC motor</li></ul> Exercise: Getting familiar with the embedded control project An evaluation board of Texas Instruments and the required software will be provided.
10:00	<b>Break</b>
10:15	<b>PIL Embedded Framework</b> <ul style="list-style-type: none"><li>▶ Integration into the control execution</li><li>▶ Definition of Read and Override Probes</li><li>▶ Establishing the communication link</li></ul> Exercise: Making the example project PIL capable
12:00	<b>Lunch</b>
13:00	<b>PIL Embedded Framework (Continuation)</b> Exercise: Making the example project PIL capable
13:30	<b>PIL Integration in PLECS</b> <ul style="list-style-type: none"><li>▶ Defining a hardware target</li><li>▶ Usage and configuration of the PIL Block</li><li>▶ Peripheral modelling and configuration</li></ul> Exercise: Implementing a PIL controlled BLDC drive system in PLECS
16:00	<b>Q&amp;A</b>
16:30	<b>End of the Workshop</b>
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