EPE'25 – Call for Tutorials

Typhoon HIL Integrated Simulation Environment: Streamlining the Development Cycle from Offline to Real-Time HIL Simulation.

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Tutorial Objectives:

Model-based system engineering is a crucial methodology that supports the entire development cycle of power electronics products and research projects, from design to test and integration. This process typically involves various simulation approaches (e.g., MIL, SIL, and C-HIL) tailored to the specific requirements of each development stage. However, it often leads to the use of multiple software toolchains, necessitating the creation and maintenance of multiple models. As a result, manual changes must be propagated across these models, requiring additional time and leading to poor version control, a higher risk of introducing modeling errors, and increased costs.

In response to these challenges, this tutorial explores how to seamlessly transition from offline simulation to real controller implementation, maintaining true model continuity from the early design phase through practical implementation and testing. Typhoon HIL's integrated model-based engineering solutions will be showcased, demonstrating how to streamline the development process for power electronics applications. An example workflow will guide attendees from initial design using the TyphoonSim™ offline simulator, through automatic code generation for target microcontrollers, and concluding with real-time testing using Hardware-in-the-Loop (HIL) technology.

Target Audience:

This tutorial offers a valuable opportunity for those looking to deepen their understanding of streamlining the design and testing of controllers for power electronics applications. Attendees should have basic knowledge of power electronics and control systems.

The tutorial includes hands-on sessions where participants will interact directly with the software toolchain. We kindly ask attendees to bring their laptops and ensure the software is installed and running prior to the training. Detailed instructions and event-specific trial software licenses will be provided in advance.

Topical Outline:

Part 1 - Introduction: (Estimated time: 30 minutes)

- Why Hardware-in-the-Loop testing?
- Challenges of real-time simulation for power electronics.
- Product development cycle and different simulation methodologies.
- The challenges of fragmented development cycles.
- Typhoon HIL's integrated simulation environment.

Part 2 – Application Example and Hands-On Offline Simulation using TyphoonSim™ (Estimated time: 60 minutes)

- Introduction to the application:
  - Option 1: Grid-Connected Inverter with Reactive and Active Power Control.
  - Option 2: Battery Charger with Dual Active Bridge (DAB) Converter.
  - Option 3: EV motor drive.
- Model and control implementation.
- Hands-on: Offline simulation using TyphoonSim™.

Part 3 – Controller Hardware-in-the-Loop (Estimated time: 60 minutes)

- From offline MIL to real-time HIL.
- Introduction to the Typhoon HIL automatic code generation tool.
- Control implementation in a Texas Instruments LaunchXL-F28379D using the HIL TI LaunchPad Interface.
- Real-time C-HIL testing using the HIL101.

Part 4 – Conclusions (Estimated time: 15 minutes)

- Conclusions and Q&A session.

Provisional Schedule of the Tutorial:

Schedule:

13:00 - 14:30: Part 1 / Part 2
14:30 - 15:00 : Coffee break
15:00 - 16:00 : Part 3 / Part 4

About the Lecturers:

	**Caio OSORIO** earned his M.Sc. and PhD in electrical engineering from the Federal University of Santa Maria (UFSM), Brazil, having also joined the University of Oviedo, Spain, as visiting PhD researcher, and the Fraunhofer IZM, Berlin, in a practical internship. In 2021, Caio joined Typhoon HIL as an Applications Engineer, working in the development of high-fidelity model-based testing solutions for industrial and academic partners worldwide. Currently, as the Global Manager of Academia Programs, he is committed to advancing environmentally sustainable power technologies through research, teaching, and training initiatives, leveraging Hardware-in-the-Loop technology and real-time simulations. Caio has collaborated on numerous research projects and co-authored over 50 papers and three book chapters in areas including real-time simulation technology, robust control applied to power converters, integration of renewable energy sources, and control of electrical machines.
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	**Jane DOE** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.