Tutorial Title:

High-Fidelity Power Electronics Simulation on an FPGA with electrical Hardware Solver (eHS)

Instructors Team:

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Abstract:

In this tutorial, we will introduce the attendees to high-fidelity and high-speed Hardware-in-the-Loop (HIL) simulations leveraging an FPGA. We will focus on explaining the structure of OPAL-RT's electrical Hardware Solver (eHS) to solve modelling challenges that require low timesteps beyond the capabilities of running models on the CPU of the real-time simulator. We will then explain the model development workflow to develop the CPU and FPGA models to address various use cases such as the modelling of three-phase inverters and other power electronic converter topologies. Additionally, we will also provide a brief overview of some advanced features and applications of eHS to address accurate modelling and simulation of high switching frequencies for converters such as Dual-Active Bridges and Resonant Converters. Finally,we will provide a detailed walkthrough to show the attendees how an example inverter topology can be modelled and simulated using eHS.

Tutorial Outline:

1. *Introduction to high-speed HIL simulations and eHS [30 minutes]*
2. *Solver Overview [30 minutes]*
3. *Model development workflow [60 minutes]*
4. *Break [15 minutes]*
5. *Advanced Features & Applications [45 minutes]*
6. *Hands-on walkthrough [45 minutes]*
7. *Q&A [15 minutes]*

Instructor Biography:

Dr. Aditya Ashok is the Director of Energy Systems at OPAL-RT and responsible for managing R&D projects in the US. He has extensive experience in developing and utilizing cyber-physical system testbeds to tackle use cases including high-fidelity simulation studies for model validation, development of resilient controls, cyber-physical security, and resilience for future grids.

Dr. Zerui Dong is a Power Electronics Simulation Engineer with OPAL-RT and has extensive experience in developing advanced real-time models of power electronic converters and power systems to support customer R&D projects. His areas of expertise include applications of real-time simulation, hardware-in-the-loop, modeling, and integration of renewable energies.