APPLICATIONS

DE-RISKING RENEWABLE ENERGY WITH THE RTDS® SIMULATOR

RTDS Technologies
AMETEK

The RTDS Simulator can be applied to many pieces and stages of Inverter-Based Resource (IBR) integration to de-risk the clean energy transition. Real-time electromagnetic transient (EMT) simulation provides a highly efficient, detailed representation of the dynamic and transient behavior of the power system, including renewables, their associated power electronics, and their fast-acting controls. Hardware-in-the-loop (HIL) testing with the RTDS Simulator is among the key tools supporting grid modernization and ensuring a reliable, sustainable electric supply for all.

HARDWARE-IN-THE-LOOP FUNDAMENTALS

- HIL testing can be performed on converter controls, power plant controllers, microgrid controllers, DERMS, protection, inverters, and more.
- Physical devices are interfaced with the simulated power system via analogue and digital signals, or communication protocols including IEC 61850, MODBUS, DNP3, IEC -104, and TCP/UDP.

INDUSTRY-LEADING MODELS AND TOOLS FOR UNDERSTANDING INVERTER-BASED RESOURCES

The RTDS Simulator's software, RSCAD® FX, includes a variety of options for modelling and testing distributed energy resources, converters, and their associated controls in the real-time simulation environment.

Documented example cases are available for a wide range of applications including solar PV, wind turbines, energy storage, hydrogen fuel cells, microgrids, and more. They can be easily modified and adapted via global parameter adjustment.

Power electronic converters can be modelled in detail with the innovative Universal Converter Model (UCM). It enables the testing of low-level controls such as PWM schemes, representing frequencies in the ~10 kHz range in the Mainstep environment and up to 150 kHz in the Substep environment.

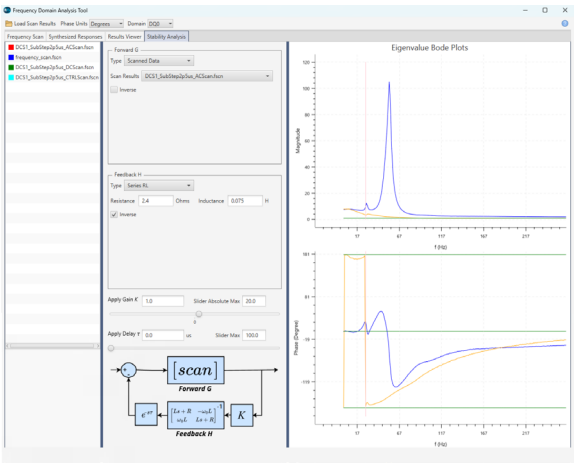
CLICK HERE OR VISIT THE QR CODE TO LEARN MORE ABOUT MODELLING POWER ELECTRONICS AND TESTING THEIR CONTROLS WITH THE RTDS SIMULATOR

Scaling transformers allow for one interconnection to represent many interconnections with the same topology. This component allows for efficient and convenient scaling of renewable energy plants while maintaining simulation fidelity.

Control schemes at every level can be modelled and tested, and our examples include grid-forming control, power plant control, optimal power tracking (including MPPT), and more.

Frequency scan and stability analysis is conveniently achieved using our built-in FSAT tool and can help users understand potential adverse interactions involving power electronic schemes.

ASSESS SYSTEM STABILITY USING OUR FREQUENCY SCAN AND ANALYSIS TOOL



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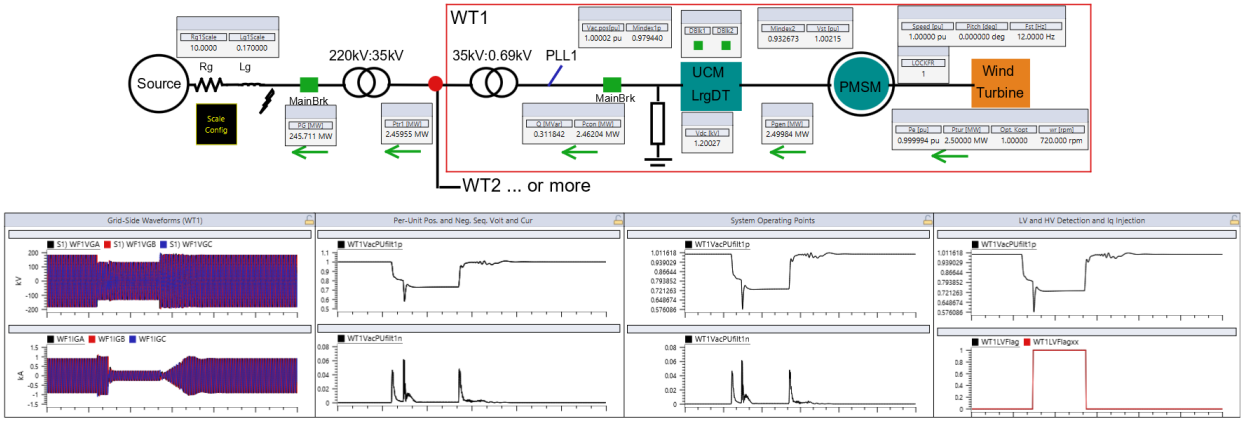
SOFTWARE-IN-THE-LOOP TESTING OF BLACK-BOXED VENDOR CONTROLS

Generic control models are often insufficient, but actual control hardware is not always readily available. To fill this gap, the RTDS Simulator allows for software-in-the-loop testing of black-boxed OEM controls. Detailed vendor control models can now be modeled in the real time simulation environment using compiled source code that protects the vendor's intellectual property. This is accomplished with the GTSOC V2 auxiliary hardware, which has four ARM processors that run compiled vendor source code in real-time.

***CLICK HERE* OR VISIT THE QR CODE TO WATCH A FREE WEBINAR ON BLACK BOX CONTROL TESTING WITH THE RTDS SIMULATOR**

FAULT RIDE-THROUGH TESTING

There is a growing need to ensure that renewables will remain connected to support the grid when they are needed the most. HIL tests with the Distributed Energy Resource's (DER's) real controller can ensure that important performance requirements, such as voltage or frequency ride-through, are met.



EXAMPLE CASES INCLUDE LVRT/HVRT TESTING (SHOWN HERE FOR A WIND FARM) AND IEEE 1547-COMPLIANT GRID INTERCONNECTION

POWER PLANT CONTROLLER (PPC) TESTING AND MODEL VALIDATION

Power plant controllers (PPCs) are used to coordinate the behaviour of many inverters and manage grid interconnection for the entire renewable plant. Detailed models of PPCs are often required by utilities because of the critical role they play in maintaining power system stability. The RTDS Simulator can be used to ensure device compliance with grid code and validate offline models against the behavior of the real controller.

HIL TESTING WITH THE ACTUAL CONTROLLER ENABLES VALIDATION OF OFFLINE MODELS, PROVIDING CONFIDENCE TO VENDORS AND NETWORK OPERATORS

POWER-HARDWARE-IN-THE-LOOP (PHIL) TESTING

PHIL testing involves the testing of power equipment, including inverters, connected to the simulated environment. The RTDS Simulator can be used together with a third-party four-quadrant amplifier to enable the exchange of power between the device under test and the simulated network. This provides an opportunity to characterize the behavior of the energy source and converter under stressed scenarios in the safety of a laboratory environment.

The RTDS Simulator supports a convenient direct digital interface to certain third-party amplifiers, including Spitzenberger & Spies, Egston, and Ponovo.