Webinar and Demo: Real-Time Simulation for De-Risking Energy Storage Integration

Wednesday, May 26, 2021

Questions and Answers

If you have any further questions, please contact marketing@rtds.com.

Q1: Will the webinar recording be made available?

Yes. The webinar recording is available to all registrants. A link has been included with this document in the post-webinar email.

Q2: The resolution of the webinar video was poor. Is there a way to obtain a higher-resolution video?

We apologize for this! Yes, we will be sending out a higher-resolution version of the RSCAD demonstration portion of the webinar to all registrants.

Q3: Is there a sample case which includes a fuel cell connected to an AC network (via converter)?

Yes. RSCAD includes a fuel cell sample case, which can be found in the Energy Storage Systems sample cases folder. The case includes a PEM fuel cell connected to a two-level converter (implemented in the small timestep environment) and includes a transformer and AC source.

Q4: In the fuel cell sample case, is it possible to control the power absorbed by the fuel cell?

It is not currently possible to control the power absorbed by the fuel cell (i.e. charging the fuel cell). However, we are currently looking into this and will likely release it as a future development.

RTDS Technologies Inc.
150 Innovation Drive
Winnipeg, MB R3T 2E1
CANADA
+1 204 989 9700

Q5: From a simulation point of view, what is the difference between flywheel and pumped hydro systems? Do both have the possibility to increase or decrease ramping capacities?

In the simulation example, the pumped hydro system is 300MW and uses a doubly fed induction generator (DFIG) configuration with speed/gate governor control for generation and motor operation. The flywheel simulation is a 2MW system with a permanent magnet synchronous machine (PMSM) configuration using grid side and machine controls for fast speed and power control. Yes, both can be ramped up and down using power controls.

Q6: Since load balancing needs full day studies, is it possible to conduct studies for a 24 hours?

Yes, the RTDS Simulator can theoretically be run 24/7 as long as it has a suitable operating environment (15-30 °C, 40% and 90% relative humidity non-condensing).

Q7: Are there any plans to add other battery models than Li-Ion-batteries (e.g. redox-flow-batteries) to the RSCAD library in the future?

We are currently investigating other battery models to implement in the RSCAD library. If you have a particular suggestion, please email support@rtds.com. We sometimes develop models based on customer needs.

Q8: Is memory included within your battery storage model? Across multiple fault events this may become relevant.

Memory is currently not considered in our battery model.

Q9: For power electronic converters - do you include an inertia grid forming control option in addition to a standard grid following approach? A truly grid forming inertial control will be constantly exchanging energy with the grid as frequency & voltages and phase steps on the real grid occur, as it seeks to maintain its voltage angle reference to the grid and releases energy to achieve that relative to the defined inertia. So, the detail of the grid forming converter control design becomes highly relevant to the detail needed in the storage model and to some extent vice versa. Has anyone done this yet using the library models?

The control approach of the converters is not inherent to the converter model itself, and is implemented by the user via controls components from the RSCAD library. In this way, it's

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CANADA
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possible to create a grid-forming control approach. Also, we are currently working on an RSCAD sample case that will demonstrate grid-forming control, so that could be used for a base.

You have indeed identified a challenge of representing true grid-forming control. We have had several customers study grid-forming converter operation with the RTDS Simulator, but we're not sure if this particular challenge has been modelled.

Q10: Could we also use a non-linear controller instead of PI controllers in the switched battery system model?

Yes, non-linear control could be implemented using RSCAD control components.

Q11: In one sample case, renewables were connected by short transmission lines (5km) and PI section line models. Could we also frequency dependent line models in conjunction with these components in RTDS?

Yes, RSCAD includes multiple options for travelling-wave transmission line models, including Bergeron and frequency dependent lines. Modelling frequency dependence increases the calculation burden for the RTDS Simulator, so these models require a greater quantity of simulation hardware.

Note that when using travelling wave transmission line models, the travel time of the line (time required for a disturbance to travel form one end of a line to the other) must be at least one timestep long. This creates a minimum line length that is dependent on timestep (e.g. at a timestep of 25 us, the minimum length of a travelling wave transmission line is 7.5 km).

Q12: What compiler is used in the RTDS Simulator?

The RSCAD software uses its own compiler which was written in-house at RTDS Technologies.

Q13: Can we use executable files of models created in MATLAB?

RSCAD includes a MATLAB/Simulink conversion tool which can be used to import control models from MATLAB directly into RSCAD. It cannot be used for power systems components.

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+1 204 989 9700

Q14: Does RSCAD provide blackbox type functionality, similar to PSCAD, so that vendors can provide their controller blackbox RSCAD model, for example, for their grid forming inverters?

Yes. RSCAD FX achieves this through a feature called Compiled Hierarchy Boxes. Components (such as a vendor control system) can be placed inside a hierarchy box which is then pre-compiled. A compiled file representing the contents of the box is generated, and can be used in the simulation case once the hierarchy box is replaced by a Compiled Hierarchy Box component. When the case is sent to a third-party, the contents of the box will be obscured (black-boxed to protect IP), but the user can run the case.

Q15: Sometimes I faces problems like timestep overflow and floating point error in control of power electronics converter. Can You give idea how to avoid such things?

These are relatively common errors that are solvable. Please contact support@rtds.com for questions about your specific simulation case, and our support team will get back to you promptly.

Q16: Are models available for changing from Pump to Generator mode and vice versa, including starting of the machines?

The sample case has separate control models for pump and generation mode. There is a switch to select the operation to either pump or turbine mode. However, the transient dynamics of this transition is not currently modeled in the sample case.

Q17: Can we simulate battery internal fault conditions?

Currently, the battery model has the capability for a temporary state-of-charge reduction which emulates a fault. If there are additional fault types that you are interested in modelling and you are an RSCAD user, please email support@rtds.com and we may be able to incorporate this into our model development plans.

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