



Webinar: Electric Machine Models for the RTDS Simulator
(Application: Generator Protection and Control Testing)

Wednesday, February 24, 2021

Questions and Answers

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

Q1: For modelling of very large power systems in real-time, network reduction can be mandatory. However, creating a dynamic equivalent for a huge number of different generators is not an easy task. As an alternative, a co-simulation environment for solving together the selected EMT and TSA subsystems seems to be more convenient. In fact, the RTDS platform has been providing this option for a long time under a FDNE based EMT-TSA type interface. Could you give some details about the embedded TSA program adopted by the RTDS on this implementation ? E.g.: the solver capability, the database compatibility, machines and controllers models, dynamic load models.

The RTDS Simulator has indeed long included a frequency dependent network equivalent (FDNE) facility. We will have made some improvements to it recently and the updated version will be available soon. In the RTDS Simulator's FDNE, the traditional admittance matrix is replaced by an FDNE rational model (representing the equivalenced subsystem's admittance over a wide frequency range), and the Norton current is replaced by a controlled current source associated with a TSA-type solution block. It better represents the dynamic behaviour of the equivalenced system than a traditional FDNE. For users, full documentation of the FDNE is available in the RSCAD software.

Additionally, the TSAT-RTDS Interface (TRI) allows the user to perform a real-time synchronized co-simulation with an EMT simulation running on the RTDS Simulator to a TSA simulation running in Powertech Labs' TSAT (Transient Stability Assessment Tool) software on a PC. The interface requires an FPGA card in the PC's PCIe slot.

RTDS Technologies is also currently developing a TSA solution that will run on the NovaCor hardware and will be released in the future.





Q2: For machine stator resistance value, should the single phase or three phase value be entered into the machine model?

Generally, it is assumed that all 3 phases have the same resistance, so enter the value for one phase only.

Q3: How would you use the machine model to test protection elements that use stator third harmonic voltages? / Can you simulate third harmonic components along the stator to detect faults in the last 5% of the winding?

In the machine's natural state, the windings have a space harmonic in addition to the fundamental distribution of the winding. When the machine rotates and there is back EMF, these harmonic voltages are produced along the windings. Some protection elements use these to detect the location of the fault – especially stator-ground faults when they are closer to the neutral. There are two ways to do this. One way is, if you know the design of the machine (the way the windings are distributed), you can calculate inductances as a function of rotor position and work out the space harmonics. The PDSM V2 model has a hidden option where you can enter those inductances and it generates those harmonics for you. That's the more difficult way. The other way is to artificially generate these harmonics. Based on our experiences and analysis, we know these harmonics are proportional to active power and terminal voltage, so we can generate artificial harmonics for each sub-winding based on that assumption.

This can be used to test devices that use stator third harmonic voltages to detect faults in the last 5% of the winding.

Q4: Is it possible to dynamically change the MVA rating of the synchronous generator?

Yes. This works for embedded phase domain models because dynamically, we work out the inductance and resistance matrix every timestep. So you can change the MVA naturally by scaling inductances and resistances.

If you look at the induction machine library, one of them has a parameter by which the rating can be dynamically changed. We haven't had an inquiry like this for the synchronous generator, but based on a customer request, we could implement this in RSCAD. If you are a user, you can contact support@rtds.com with this request.





Q5: Can you use the open winding induction machine model to change from star to delta dynamically to do star delta starter studies?

Yes. That is the main reason this option has been added. If you look at the newer phase domain machine models in the library (multi-phase and faulted machine models), the option to access both ends of the winding has been added. It allows the user to dynamically change the connection between star and delta using a system of breakers. So, if you know when you start the machine you'll switch from delta to star based on the speed of the machine, you can do it using this option.

Q6: Would there be any guidance on best practice of creating machine models when the only transient input data you have is PSS/E dyr files?

Our PSS/E Conversion program uses .dyr files to fill generator parameters. RSCAD generator data in the form of reactances and time-constants are compatible with PSS/E data.

Q7: This Question is completely off-topic. I am tuning the PID controllers of a multi-generator power system with meta-heuristic method with PSCAD and MATLAB. How can I link PSCAD and MATLAB? if it is possible for you to answer though. :)

PSCAD is not a product of RTDS Technologies. PSCAD should be contacted directly regarding any questions about their software.

If the question was meant to be regarding RSCAD, then please note that there is no way to create a real-time link between RSCAD and MATLAB. RSCAD does include a conversion utility which allows control schemes to be imported from MATLAB/Simulink into RSCAD. Please contact RTDS Technologies support if you are a user with specific questions about this utility.

