RTDS Simulator commissioning and training at IIT Mandi, India

WHAT'S NEW: MARCH 2017

HIL testing and relay model validation at a collaborative real time simulation facility in South Africa

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IPST 2017
Seoul, South Korea
June 26-29, 2017

GUEST ARTICLE

Successes in South African grid modernization from a collaborative real-time simulation facility

Bruce Rigby, etalumiSe (Pty) Ltd & Durban University of Technology

In 2002, the Durban University of Technology (DUT) in South Africa received their first RTDS Simulator rack. Subsequently, the Real Time Power System Studies (RTPSS) Centre was established, with the goals of promoting power systems as a career option amongst students and fostering collaboration between academia and industry. Eksom, the state power utility, jointly funded the Centre with the goal of evaluating RTDS Simulator technology and its potential to aid in obtaining better performance from the transmission network as it grew in size and complexity. Fifteen years later, the RTPSS Centre is one of the world's largest university-owned real time simulation

The Real Time Power System Studies Centre

laboratories, featuring 10 fixed RTDS Simulator racks along with one portable rack. The Centre is a research hub where undergraduate teaching, postgraduate research projects, simulation training courses for academia and industry, and utility partner projects meet. Today, Eskom continues to actively collaborate with the Centre. This article introduces the Centre's real time simulation capabilities and how they have been used in conjunction with this utility partner to bring grid modernization and improved transmission network performance and operation to South Africa.

Over the past several years, a model of the entire Eskom transmission network has been developed for implementation on the RTDS Simulator. This model represents virtually all of the generation and transmission plants of South Africa's main grid (at 275 kV and above) with full topological detail. The model has been divided into three stand-alone sub-regional network models which are used to run specific protection system studies. Recently, the Eskom transmission network has seen continued growth in the use of series capacitor compensation to strengthen the network. Recognizing that the characteristics of series compensating capacitors can compromise the reliability of impedance protection on the transmission system, and that the introduction of non-linear MOVs to protect these capacitors adds further complexity and uncertainty under fault conditions, Eskom has used the RTPSS Centre's RTDS Simulator extensively for testing and settings verification studies to mitigate these issues.

Eskom has used hardware-in-the-loop testing of protective relays via the RTDS Simulator for a variety of applications. One area of use has been the verification of settings for impedance relays being placed on new 765 kV transmission lines which were in the final stages of commissioning by Eskom.

Testing was carried out for relays located at both ends of four new transmission lines by creating a closed-loop interface between the hardware relay and the network model in the RTDS Simulator. Then, a range of faults was applied internally to the protected line, on nearby lines, and behind nearby series capacitor banks for both strong and weak network topologies. The tests were successful in confirming the majority of settings philosophies and calculations used for the new distance elements, and also helped to identify some issues and find solutions. Other hardware-in-the-loop tests carried out at the Centre in partnership with Eskom include overcurrent relay stability tests and the settings verification of distance protection relays for current reversal conditions following the commissioning of a new series capacitor on the 400 kV network.
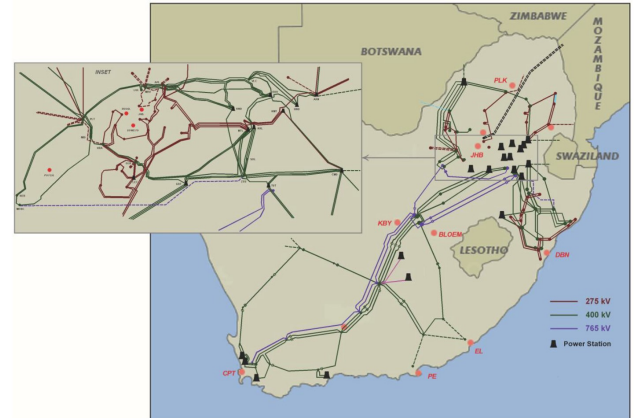
Geographical SLD of real time simulator model of Eskom's network

An additional area of application of the RTDS Simulator for Eskom is the validation of DIgSILENT PowerFactory-based relay models. These models, used day-to-day by protection engineers in the utility, are validated against actual relay performance under controlled, but representative conditions, and any shortcomings in the models rectified accordingly. Tests conducted include studies of the effects of load transfer, subsynchronous oscillations, switching transients, evolving faults, voltage and current reversals, offset frequency, and high impedance faults.

RTDS Technologies a proud Platinum Supporter of the 2017 IEEE PES General Meeting

As we endeavour to energize a more secure, resilient, and adaptable grid, collaboration and discussion become more important than ever. RTDS Technologies is proud to be a long-time supporter, participant, presenter, and vendor at many power system industry events. This year, we are a proud Platinum Supporter of the IEEE Power and Energy Society's General Meeting. Look for our signage, special giveaways, and our always-popular hospitality suite at the event!

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⫴5

- Single-phase (_rtds_spPQInject) and three-phase (_rtds_PQinject) constant PQ source models have been added. These models provide current injections for a given P & Q, P & Power Factor, or P & V_{ac}, as defined by the user, and are useful for representing the behavior of DERs with significantly reduced computation resources.

- A single-phase, single-branch filter component has been added which allows the user to select from a wide variety of filter types and monitor any available capacitor voltages or inductor currents.

- A new component has been added which acts as either a source or a load but only affects load flow calculations, having no impact on the dynamic simulation. This component is useful for cases in which a source may not naturally be present in the circuit but the user still wants to run a load flow initialization.

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