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Condition Monitoring of HV Breakers

High voltage circuit breakers are an integral and expensive component of the power transmission system. Greater emphasis on increasing reliability while reducing maintenance costs is a fact of life. Intelligent Breakers are now being developed with condition monitoring features incorporated into their control systems. An ideal condition monitoring system would ensure proper in service operation, would identify and allow the repairs of any failure before that failure occurs and have zero associated costs. Can the benefits and potential maintenance savings of condition monitoring systems be applied to the vast inventory of existing in-service breakers in a cost effective manner ?

A Feasibility Study for Manitoba Hydro was undertaken by the HVDC Research Centre, to review the development of the high voltage breaker condition monitoring technology and investigate retrofitting condition monitoring systems to breakers presently in service in the Manitoba Hydro system.

What is Condition Monitoring ?
On-line condition monitoring systems offer the potential identification of problem areas and allows "as required" instead of "time based" maintenance scheduling. The condition monitoring system collects information from the breaker during each operation, calculates a variety of operating characteristics, compares these characteristics against known normal characteristics, and alert the plant maintenance staff of any operational abnormalities. The breaker **Main Interrupting Mechanism** subsystems can be monitored for properties such as contact erosion and SF6 gas density. **Breaker Auxiliaries** are monitored for properties such as displacement, operating energy, trip and close coil, continuity, and auxiliary contacts.

ABB SF6 ELF Breaker

Manitoba Hydro has recently installed a number of ABB 230 kV SP4 ELF SF6 breakers with 3 independent poles and SF6 gas systems. The ELF was chosen for detailed investigation because the breaker control design is a traditional electrical mechanical relay based design, representative of other in service breakers and no commercial on-line monitoring system has been retrofitted to it. Recently developed commercial monitoring systems were evaluated as potential retrofit systems for the ELF and no single system was found to satisfy all of the monitoring needs for the distinct ELF breaker structure and configuration.

The feasibility report concludes that there are potential benefits for on-line monitoring of the ELF breakers. At the present time Manitoba Hydro, the Centre, in cooperation with ABB Varennes, the Canadian manufacturer of ABB ELF breakers, are proposing to install a retrofit condition monitoring system on selected ELF breakers in the Manitoba Hydro system for a 2 year field trial. The goal of installing this retrofit system is to further evaluate this technology; from the available sensors to the intelligent interpretation of the data; in order to ensure that a cost effective system can be developed and the data collected is presented in a format useful to the maintenance staff responsible for the breakers.

If you are interested in this research and would consider participation and cooperation in this research project please contact :

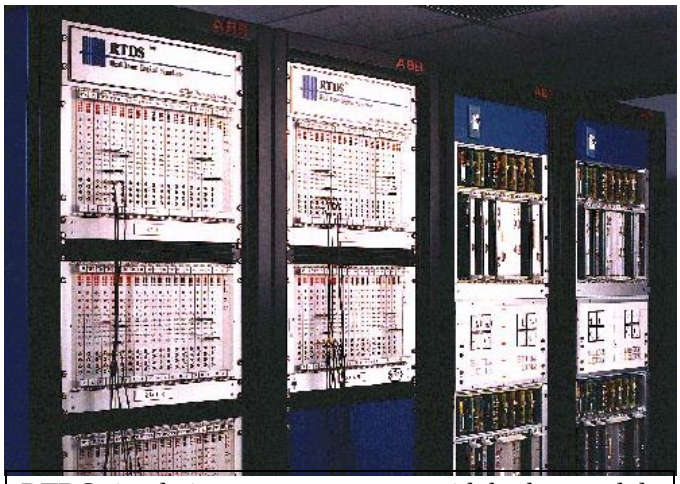
Randy Wachal at the Centre
Tel +1 204 989 1249
Fax +1 204 453 5074
email: rww@hvdc.ca

RTDS ™ - Riding High !!

Since opening their doors in early 1994, RTDS Technologies Inc. (the company granted an exclusive licence for the RTDS simulator developed at the Manitoba HVDC Research Centre) has been making incredible inroads in the real time simulator market. To date, the company has sold over 60 racks of RTDS equipment to more than 15 different companies world wide. This is a significant achievement, particularly when one considers that the simulation capabilities of these 60 racks is quickly approaching the combined capacity of all analogue simulators and TNA's presently in service.

There are several reasons why the RTDS has virtually taken over from analogue simulators, not the least of which is economics. The initial cost of an RTDS simulator is about 10 times lower than its analogue counterpart, not to mention the potential savings in maintenance and operating costs.

PSCAD, the graphical user interface used by both EMTDC and RTDS, saves the user weeks to months of labor intensive setup time. It is no longer necessary for users to make the tedious and error prone patch cord connections required throughout an analogue simulator. Instead, RTDS users can simply draw their systems graphically using predefined power system components. This, along with the reduced climatic and space requirements, provide for a dramatic reduction in operating costs.



RTDS simulating a power system with both ac and dc transmission interfaced with real HVDC Controls

Depending on the power system to be simulated, the RTDS is 10-20 times smaller than an equivalent TNA. To simulate the circuit shown in Figure 1, only one rack of RTDS equipment is required, whereas an equivalent analogue simulator requires 5-10 full sized cubicles.

In addition to the areas HVDC and TNA studies,

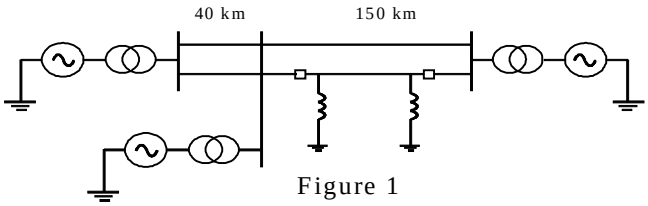


Figure 1

other power system sectors are now taking advantage of the efficient and economic offering provided by an RTDS simulator. For instance, the protective relay test market has recognized the benefit and superiority of real time digital simulation as opposed to conventional playback systems. As well, the reduced cost and increased flexibility have opened up new market segments (e.g. learning institutions) that previously could not justify this type of simulation/testing tool.

If the technological and economic advantages are considered, it is no surprise that all of the major HVDC system manufactures, several protective relay test facilities, research organizations and universities have begun using RTDS simulators. The RTDS is a solid new technology which is constantly being improved to meet the ever changing and demanding needs of its users.

For more information on RTDS please contact:
Paul Forsyth @+1 204 989 9700 / email paf@hvdc.ca

PSCAD/EMTDC V3 Coming Soon "March 1996"

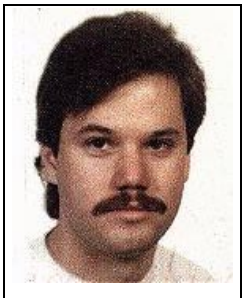
The release of an all new version of PSCAD for BETA testing is expected in the near future. Due to a large number of requests for a version which will run on a personal computer, PSCAD V3, will be portable to both the UNIX and Windows platforms. This opens up the huge PC world for PSCAD users.

The approach taken for this version was not to develop for UNIX and Windows, but to develop a completely new implementation which is targeted at a 'virtual' windowing environment.

The next version of PSCAD is not referred to as the 'PC-version' since it is really an 'all-platform' implementation. The more platforms supported by the tool kit, the more platforms supported by PSCAD V3. The new version has been completely rewritten to accommodate the new design, and as a result has provided an excellent opportunity to implement many new exciting features to the application. Some of these new feature are listed below.

- Single Line Diagrams for Multi-Phase Circuits
- Hierarchical Design and Separate Compilation
- Object Linking and Embedding
- Multiple Document Interface
- Component Workshop
- Draft Zoom In - Zoom Out Feature
- Run Time Data shown on Draft Screen


Arthur Neufeld


Craig Muller

For more information please contact PSCAD Development Team pscad@hvdc.ca
or +1 204 9891240 Fax +1 204 453 5074

PSCAD / EMTDC in Baltimore @ IEEE Winter Meeting

You are cordially invited to visit our information suite during the Winter IEEE Power Meeting in Baltimore. We will be located in the Stouffer Harborplace Hotel from the 5:00 to 8:00 pm on January 22 to January 24.

PSCAD/EMTDC will be set up on workstations and the Centre will be introducing new Version 3 in a beta test format. Version 3 operates on UNIX or PC windows based systems and has many enhanced features the users have requested from us.

PSCAD/EMTDC USERS GROUP will be meeting in conjunction with the Winter IEEE meeting and will be also be held in the Stouffer Harborplace Hotel, starting at 1:00 pm on January 21.

You are most welcome to attend and your comments and contributions are greatly appreciated.
See you There !!!!!!

External Electrical Effects
Nelson River HVDC Transmission Line
Final Report

After over 10 years of field collection the LUNDAR project is completed and the Phase 3 Final report is available. The primary goal of the LUNDAR project concerns the measurement and analysis of the electrical effects for a unique HVdc system operating in the Manitoba environment. The Nelson HVdc transmission system contains 895 km parallel bipolar lines operating at ± 450 kV and ± 500 kV. Measurements beneath the lines record electric field, ion current density, radio interference and audible noise. Remote sites located 1 km on either side of the Central Site measure electric field , polar ion density and net space charge density. Two weather stations and a condensation particle counter complete the long term data collection system. Field measurements were merged with the pole voltages and currents to provide the database necessary for statistical analysis. Manitoba Hydro and the Manitoba HVDC Research Centre ran the project cooperatively as a joint venture.

Copies of the final report are available for $100 CAN
To order your copy of the report or for further information please contact:

Randy Wachal ; Project Coordinating Engineer ,
Manitoba HVDC Research Centre
400-1619 Pembina Highway, Wpg., R3T 2G5
+1 204 989 1249
Fax +1 204 453 5074
e-mail : rww@hvdc.ca

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Manitoba HVDC Research Centre

400-1619 Pembina Highway
Winnipeg , Manitoba
R3T 2G5 CANADA

+1 204 989 1240
Fax +1 204 453 5074
email : journal @ hvdc.ca