



POWER SYSTEMS STUDIES

Powertech

The Power of Trust. The Future of Energy.

POWER SYSTEM ANALYSIS



In today's competitive and rapidly changing operating environment, electric utilities constantly seek innovative ways to optimize power system performance, while at the same time ensuring an acceptable degree of security and reliability. Modern interconnected power systems are very complex and likely include a large number of non-conventional transmission and generation equipment such as HVDC links, FACTS, solar and/or wind generation, and energy storage systems.

Consulting studies to investigate system events and optimize power system performance

To meet these needs, Powertech provides a wide range of power system consulting studies, including comprehensive stability assessment, evaluation of transfer capability and security limits, integration of renewable resources, post-mortem analyses of system disturbances, and many other studies.

Powertech analysts utilize DSATools™, the widely acclaimed state-of-the-art software suite developed exclusively by Powertech and incorporating leading-edge technologies for off-line and on-line dynamic security assessment. Our up-to-date and real-world experience in performing power system consulting studies worldwide also aids our software team in constantly improving our software tools to address new technical challenges as they emerge.

Powertech specializes in generator testing and model validation for various types of generating units, ranging from small diesel generator sets to large combined-cycle, coal-fired and nuclear generating units, as well as wind and solar farms. In addition, Powertech is also renowned for its expertise in research on application of new technologies for electric utilities and research organizations, and development of advanced power system analysis tools, measurement techniques, and dynamic models.

Powertech serves a large regional, national, and international client base around the globe, which includes many large electric utilities, transmission and generation owners, and industrial load customers.



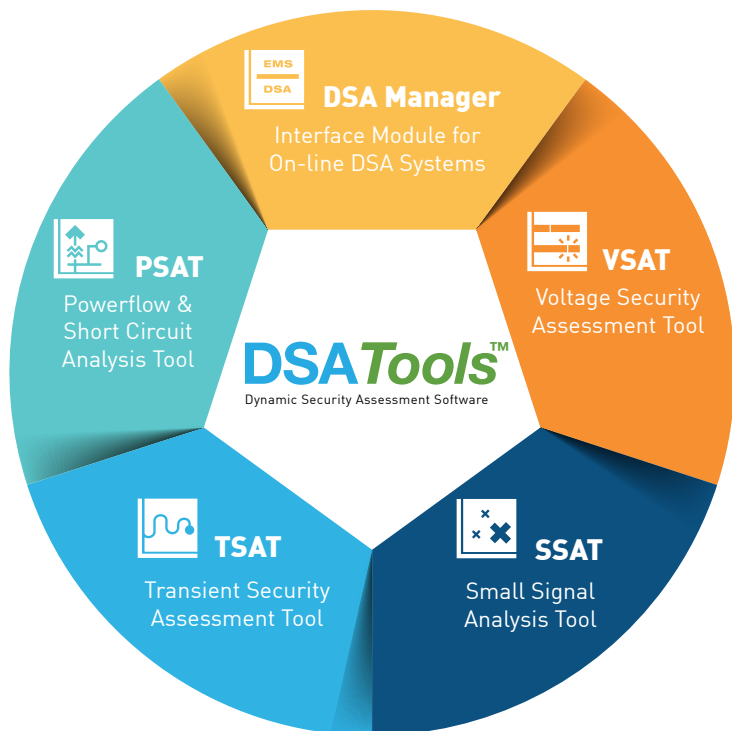
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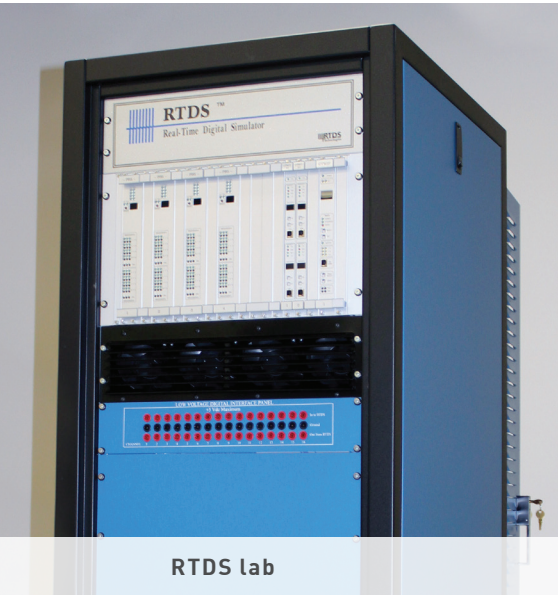
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CAPABILITIES



RTDS lab



Power System Studies technical training

Areas of expertise include:

- Comprehensive stability assessment
- Evaluation of transfer capability and security limits
- Post-mortem analysis of system disturbances
- Frequency control assessment
- Development and assessment of system design alternatives
- IPP integration and load interconnection studies
- Control system design and analysis
- Load characteristic measurement and model development
- Generator parameter measurement and modelling

The capabilities of Powertech's Power System Studies (PSS) Department reside in its experience and expertise.

DSATools™—a suite of state-of-the-art power system analysis tools developed by Powertech—provides the capabilities for a comprehensive system security assessment, including all forms of stability.

In addition, our Real-Time Digital Simulator (RTDS)-equipped protection and control lab provides unlimited potential for testing and evaluation of new control, protection, and communication devices and schemes.

Field Testing and Modeling

Powertech has extensive experience in performing generator tests and in developing and validating proper simulation models. The PSS Department has tested generating units of various sizes, manufacturers, and excitation and speed-governing systems.

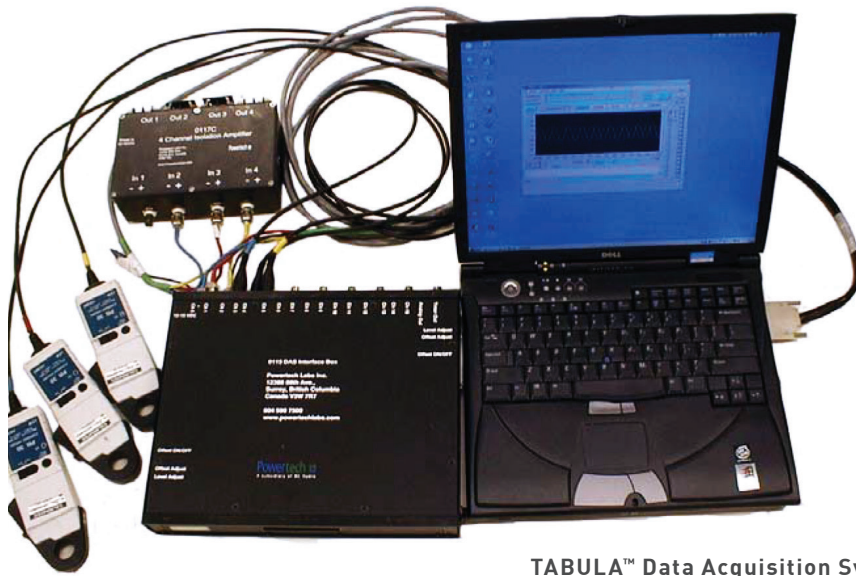
Powertech engineers have a long history of conducting studies to meet compliance requirements, including WECC-mandated generator testing policy and NERC reliability standards.

Powertech has also developed a specialized data acquisition system for generator testing and other field measurement tasks, known as the Tabula™ Data Acquisition System, with a suite of software programs to meet various field-testing requirements.

Technical Training

The PSS Department offers a wide range of technical trainings in power system analyses and field measurements for many utilities and clients in North America and around the globe.

SERVICES



TABULA™ Data Acquisition System



Solar and wind generation systems

Key services include:

Power System Studies

Powertech provides power system consulting studies, including comprehensive stability assessments for transient, small-signal voltage and security stability; evaluation of transfer capability and security limits; frequency control assessments; compliance studies; electromagnetic transients studies; generation and interconnection studies; development and assessment of system design alternatives; and post-mortem analysis of system disturbances.

Using advanced methods, Powertech helps clients maximize the transfer capabilities of their power systems through systematic planning and operation studies, and development of adequate remedial measures.

Field Testing and Modeling

Powertech has provided field testing services for more than 15 years. Engineers perform generator testing and validate simulation models to determine full capabilities of generators and plants, optimize control and protection settings, obtain accurate simulation models for units and plants, and achieve compliance with regulatory requirements.

Powertech works with clients to develop detailed test plans. Pre-test simulations can be conducted to predict the outcome of the field tests. Powertech then visits a plant to execute the test plan. From field test results, computer models are developed and performance validated against measurements using simulations.

Technical Training

Powertech offers technical training in power systems fundamentals, equipment modeling, power system stability theory, methods of analysis, application of software tools, and generator field testing and model development.

Training can be provided at a client's site or the Powertech offices. We specialize in custom courses on stability and control, and can provide instructions ranging from very basic study methods to the most advanced dynamic analysis of large power systems, including FACTS, HVDC and other complex control devices.

CASE STUDIES

The following projects are representative of Powertech's power system studies and generator testing.

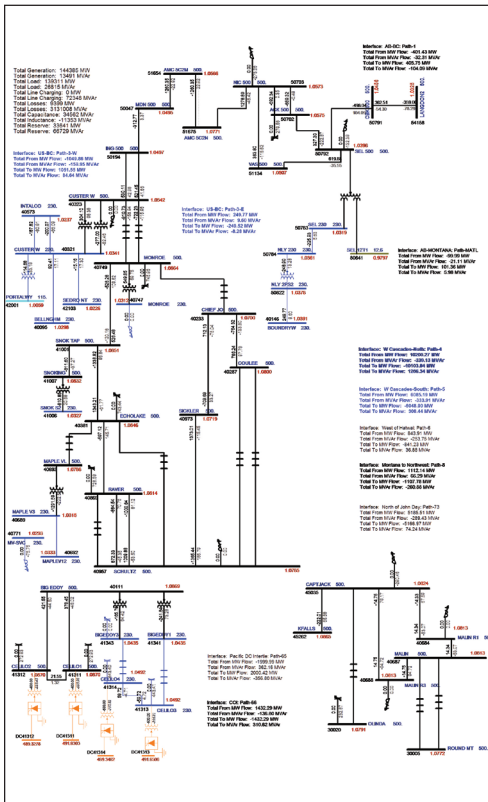
Small-Signal Stability Analysis

In this study, Powertech conducted a small-signal stability analysis of an interconnected power system. Small-signal stability refers to the ability of power systems to withstand small disturbances, which appear as poorly or negatively damped oscillations and cause security violations. This study focused on the sensitivities of the critical system modes with respect to different system conditions, transfer patterns, and contingencies. The results provided recommendations for tuning the existing Power System Stabilizers and adding new stabilizers in the system to accomplish optimal performance for identified critical modes without adverse effects.

Western Electricity Coordinating Council (NERC/WECC) planning criteria and applicable system operating orders. Appropriate mitigation measures were also considered. The study demonstrated that, under favorable system conditions, the path rating could be increased with implementation of mitigation measures.

Generator Testing and Model Validation

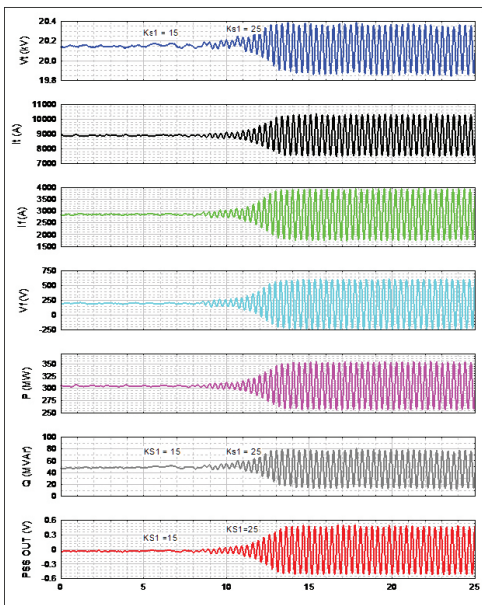
Generator model validation testing was conducted on eight hydroelectric generating units, according to WECC requirements. Since the previous model validation testing, some of the generators had been rewound and their excitation systems retrofitted with new digital controllers. To comply with the WECC generating unit baseline model validation policy, and to provide the utility with validated model parameters, Powertech performed testing including: open-circuit saturation, excitation removal, manual exciter step, direct-axis, quadrature-axis, AVR step response, reactive current rejection. The tests were designed and executed based on unit type and associated controls. Computer simulation models were developed, and the model parameters of the generators, excitation systems, and turbine-governor systems were validated using field test results.



Power system operating conditions

Path Rating (Total Transfer Capability) Study

Powertech performed a simultaneous transfer study of a rating increase on a transmission path to determine and address potential adverse impacts on four related paths. The study involved analysis of scenarios for different seasonal load conditions and generation patterns. For each simultaneous transfer scenario, the project team performed post-transient power flow analysis, voltage and transient stability studies in accordance with North American Electric Reliability Corporation/



PSS tuning

SELECTED CLIENTS



पावरग्रिड

Power Grid Corporation of India



BC Hydro
Power smart



THE POWERTECH ADVANTAGE

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in beautiful British Columbia, Canada. Our 11-acre facility offers 15 different testing labs for a one-stop-shop approach to managing utility generation, transmission and distribution power systems.



Powertech is home to a broad range of scientists, engineers, and technical specialists, with capabilities in electrical testing, cable condition assessment, mechanical and materials engineering, software technologies, power system studies, chemical analysis, gas systems engineering, and smart utility services. These skilled researchers have decades of collective and real-world experience and often work in cross-departmental teams to investigate, diagnose and solve complex problems.

As an independent, third-party testing facility, we adhere to the **highest** laboratory (**ISO 17025**), quality (**ISO 9001**) and environmental

(**ISO 14001**) management standards. Many of our scientists and engineers chair or participate in various standards committees within their fields of expertise. Additionally we have the capabilities to derive and develop **non-standard testing** methods and setups required to test product prototypes and perform forensic analysis.

Outside of the utilities industry, Powertech provides routine **testing** capabilities, product **development**, research and **consulting** services to support an array of industrial-type operations, electrical equipment manufacturers and automotive original equipment manufacturers.

