

Power System Studies Group

Power System Security

In today's rapidly changing operating environment, conventional planning and operating methods can leave systems exposed to failures. Numerous system blackouts have occurred due to phenomena such as voltage instability or low frequency inter-area oscillations; phenomena often undetected until failure occurs.

Optimizing System Performance

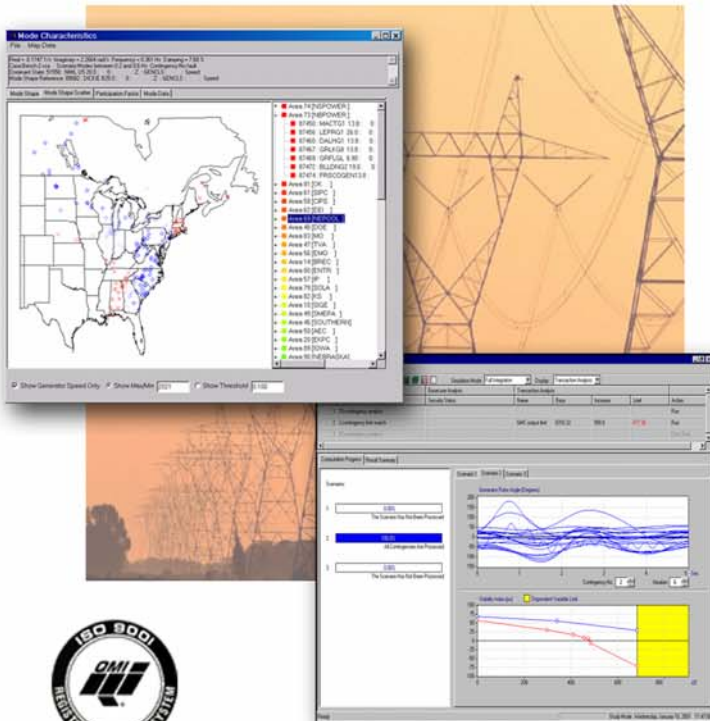
Utilities world-wide strive to get the most out of existing facilities. Advanced system analysis techniques, which include comprehensive stability assessment, can serve to optimize the use of existing facilities and minimize the need for system expansions. Today's interconnected systems are very complex and may include sophisticated devices such as high speed excitation systems, HVdc links, FACTS, and energy storage systems. Satisfactory performance depends heavily on the coordination of all controls and protections associated with these devices.



Comprehensive Solutions

Engineers in Powertech's Power System Studies Group have pioneered many of the advanced tools and techniques for power system analysis in use today. The group has extensive international consulting experience in all aspects of power system stability and control and is well recognized for their achievements in the field of software development, both for off-line and on-line applications. Powertech offers a wide range of services and products to provide comprehensive solutions to the most challenging power system analysis problems.

In addition to power system study services, Powertech has over 11 acres of indoor and outdoor testing facilities, including 18 world-class laboratories, located near Vancouver, British Columbia, Canada. Our experts help clients world-wide to assess and improve the performance, efficiency, safety, reliability, and environmental impact of structures, systems, equipment, and components.



System Studies and Technical Training

In today's competitive energy environment, it is essential to optimize system performance while at the same time ensuring an acceptable degree of security and reliability.

Powertech has extensive experience in assessing system performance, computing system limits, determining the cause of failures, and designing remedial measures. Using advanced methods, Powertech can help get the most out of a power system through the development of system operation strategies, facility expansions, and control tuning. In particular, we are world leaders in the field of stability and control analysis.

Comprehensive Study Capability

Powertech provides a wide range of study and consulting services including,

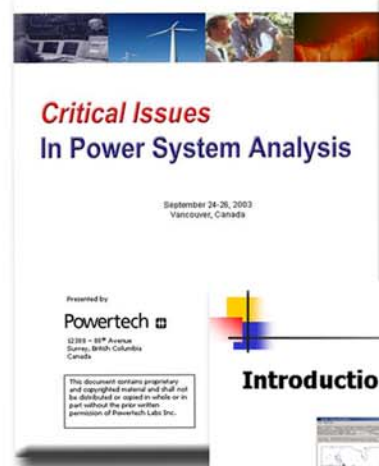
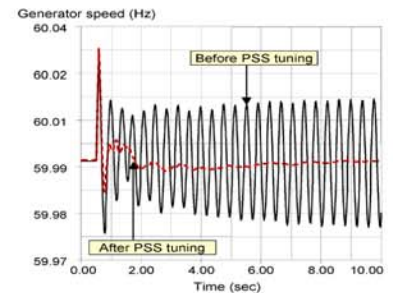
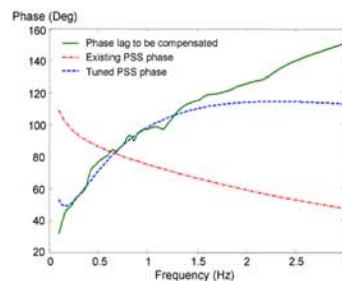
- Comprehensive stability assessment
 - Transient stability
 - Small-signal stability
 - Voltage stability
 - Frequency stability
- Evaluation of transfer capability and security limits
- Post-mortem analysis of system disturbances
- Frequency control assessment
 - Islanding studies
 - Under-frequency load shedding scheme design
 - AGC and governor performance
- Development and assessment of system design alternatives
- IPP integration impact studies
- System control analysis
 - Control design and tuning
 - Load-shedding, generation rejection, and special protection system (SPS) design
 - Reactive compensation planning
 - SSR Studies
 - HVdc and FACTS analysis
- Load characteristic measurement and model development
- Electromagnetic transients studies
- Generator parameter measurement and model development
- Power system simulation model development
 - Model verification
 - Custom modeling
 - Dynamic reduction

Technical Training

Powertech offers a full range of technical training in power system analysis. Training can be provided at a client's site, or at Powertech offices. Topics covered include,

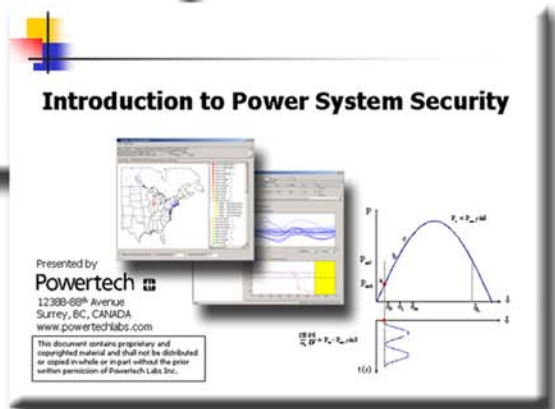
- Power system fundamentals
- Equipment modeling
- Power system stability theory
- Methods of analysis
- Study procedures
- Application of software tools
- Generator field testing and model development

We specialize in custom courses on stability and control and we can provide instruction ranging from very basic study methods to the most advanced dynamic analysis of large systems including FACTS and other complex control devices. We also provide complete hands-on training for our DSA PowerTools™ software suite.



$$\lambda = \sigma \pm j\omega$$

$$\zeta = \frac{-\sigma}{\sqrt{\sigma^2 + \omega^2}} \times 100$$



Software

Powertech is a leader in the development of techniques and tools for power system analysis and offers a number of leading-edge software tools for on-line use (connected directly to an EMS system) or off-line use (system planning and operations planning).

PSAT – Powerflow & Short circuit Analysis Tool

Provides full-featured powerflow analysis capabilities for performing steady state system analyses required in planning and operating studies. Such studies include steady-state voltage decline, line and transformer thermal loading, and active/reactive power supply problems. PSAT is also designed to be used as a case preparation tool for the other components of the DSATools™ suite. PSAT is a fully graphical tool with numerous features including,

- Drag-and-drop one-line diagram
- Table-driven data set-up and modification
- Extensive network manipulation functions
- Advanced device modeling
- Robust powerflow solution engine
- Comprehensive data importing/exporting

VSAT - Voltage Security Assessment Tool

Automatically determines voltage security limits, limiting contingencies, and problem areas. Features include,

- Comprehensive criteria definition (stability, voltage declines, reactive reserves, etc)
- Automatic Contingency Screening
- Steady-state and fast time-domain simulation
- Remedial Measures to increase transfer capability
- Distributed computation engine

TSAT -Transient Security Assessment Tool

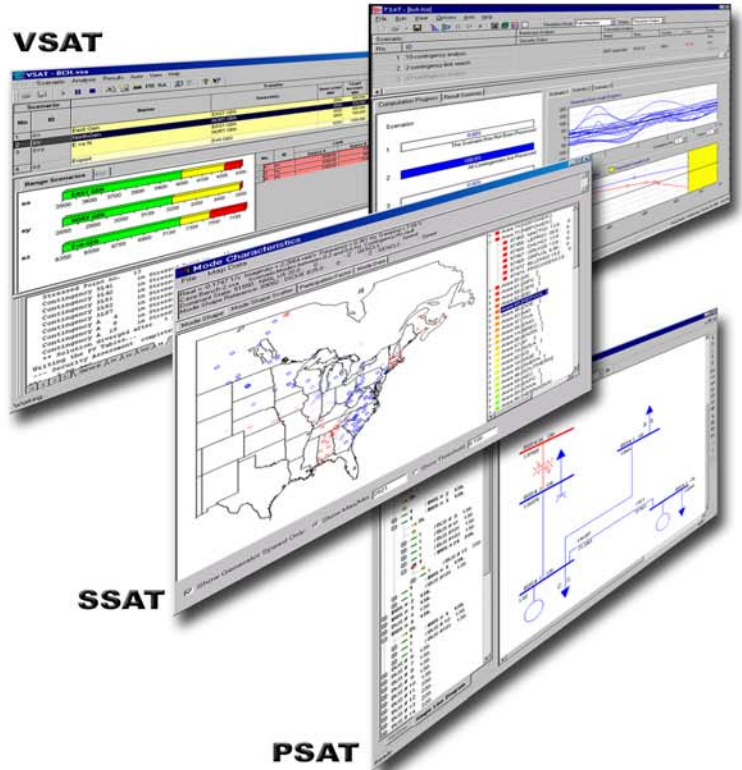
Automatically determines transient security limits, critical contingencies, unstable groups of machines, and transient voltage violations. Features include,

- Comprehensive criteria definition (transient stability, damping, transient voltage, and transient frequency)
- Full time-domain simulation engine
- Multiple contingency and multiple scenario processing capability
- Comprehensive model library and model customization capability
- Automatic power transfer limit determination
- Full graphical case setup and results analysis
- Distributed computation engine

DSATools™

Dynamic Security Assessment Software

TSAT



SSAT – Small Signal Analysis Tool

Performs comprehensive small signal stability analysis of large systems and includes a number of special features for automatic analysis of contingencies and power transfers. Features include,

- Comprehensive model library and model customization capability
- Variety of eigenvalue calculation options to address various problems
- Small signal stability index computation
- Frequency/step response computation
- Contingency and sensitivity analysis
- Automatic power transfer analysis determination
- Mode trace and root locus analysis
- Control design toolbox
- Full graphical case setup and results analysis

For more information on Powertech software visit

www.dsatools.com

Generator Testing and Modeling

To be able to conduct dynamic analysis of a power system, and to properly tune controls, it is first necessary to develop good models for all generators and their associated controls. Very often, models provided by manufacturers are inadequate or actual controls in the field have been modified and no longer are accurately represented by existing models.

To obtain accurate models, it is necessary to conduct some field tests from which the models can be derived. Simulations can then be used to validate the models against the actual field measurements.

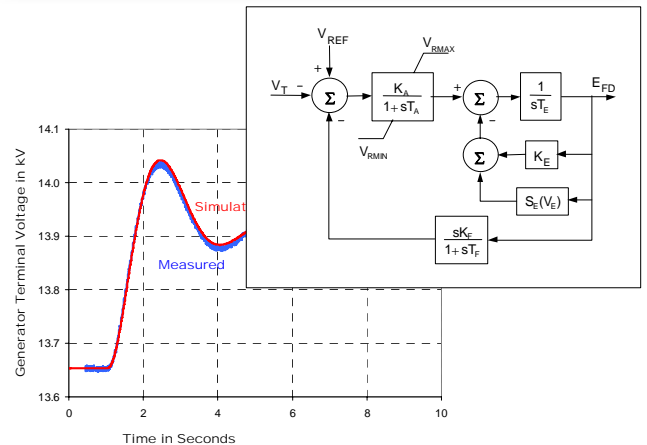
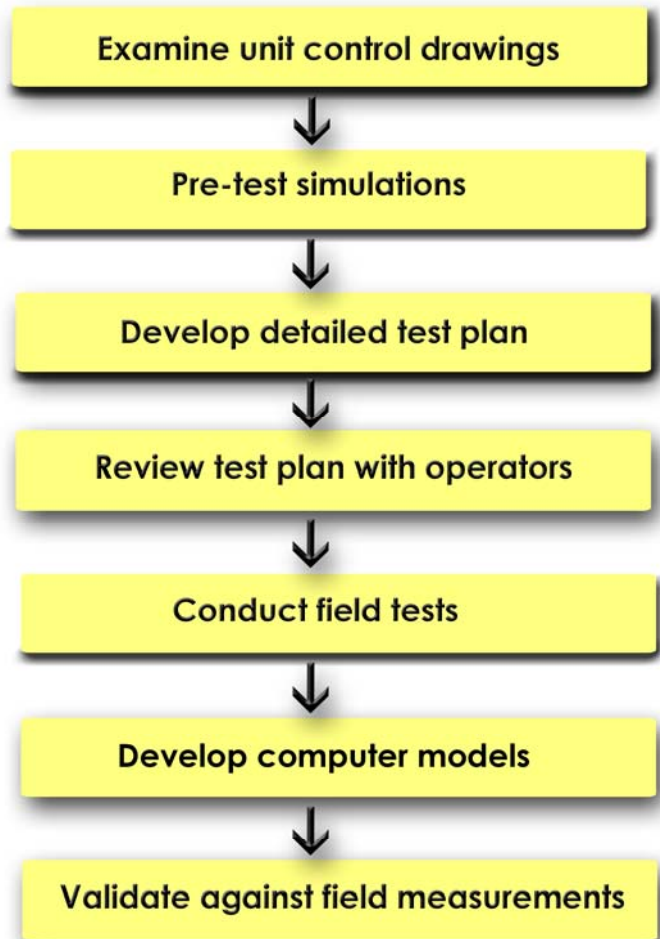
Powertech has extensive experience in conducting steady-state and dynamic tests to establish key system information including,

- Generator
- Speed governing system parameters
- Reactive power capability
- Protection performance



Powertech will work with the client to develop a detailed test plan. To minimize unexpected results during the field testing process, pre-test simulations will be conducted when possible, to predict the expected outcome of the field tests. Powertech will then visit the plant to execute the test plan, with the cooperation of plant operators.

From field test results, computer models are developed and their performance checked against the measurements using simulations. Using advanced analysis tools, simulations can be performed to study individual plant performance as well as the performance of the full interconnected system. Optimum control settings can then be determined.



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