DSA*Tools*™
Dynamic Security Assessment Software

SSAT Small Signal Analysis Tool

Product Features

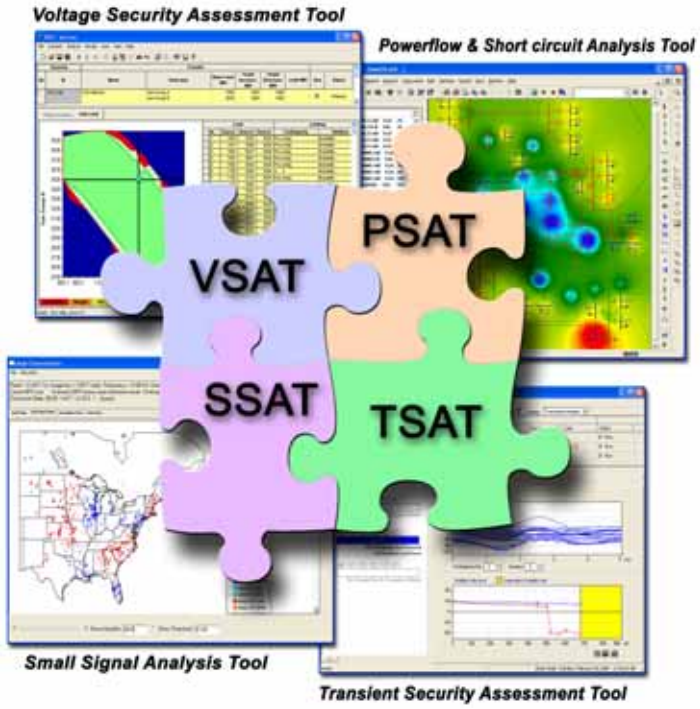
- Extensive and flexible modeling capability
- 6 eigenvalue calculation options to address different modal analysis problems
- Small signal stability index computation
- Frequency/step response computation
- Comprehensive system analysis tools
- Control design toolbox
- Case setup and analysis tools
- Support of major power system data formats

SSAT is a software tool developed by Powertech Labs Inc., for small signal stability analysis of power systems. This tool is designed to help investigate, and to provide solutions to, the system oscillation problems that have been increasingly recognized as important security concerns for the operation of systems. Its extensive computational capabilities offer a "one-stop" solution to the small signal stability problem. Complemented by other tools in Powertech's **DSA*Tools***™ suite, namely PSAT (Powerflow & Short circuit Analysis Tool), VSAT (Voltage Security Assessment Tool), and TSAT (Transient Security Assessment Tool), SSAT helps give accurate and reliable stability assessment of a power system under rapidly changing operating conditions.

SSAT is built on the linearized dynamic model of a power system and it uses modal (eigenvalue) analysis techniques to assess the small signal behavior of the system. A number of eigenvalue computation algorithms are implemented in SSAT to cater to different types of applications, including

- QR algorithm
- Implicitly restarting Arnoldi algorithm
- An enhanced version of the AESOPS algorithm

Each of these algorithms is used to solve specific modal analysis problems.



The eigenvalue computation algorithms are applied to the power system model that has been formulated in such a way to ensure accuracy of the results and efficiency of the computations:

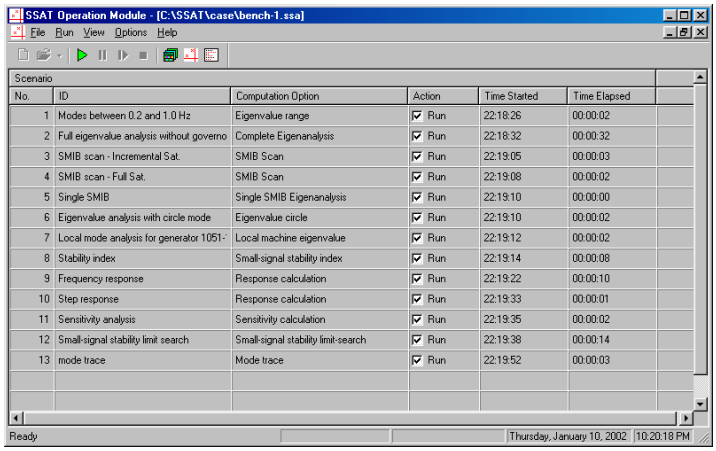
- Analytical linearization is used to derive the linear dynamic model of the system.
- Matrix transformations are performed so as to focus the computations on the required types of modes.

The advanced computation features and analysis options in SSAT are embedded in an easy–to-use interface which allows the user to create study cases and to specify computation tasks effortlessly. Assisting tools such as UDMEditor, CDT, and Case Scheduler further simplifies the use of the software.

The modeling and data requirements for SSAT are compatible with those for nonlinear time-domain simulations (such as TSAT).

SSAT can be used in a broad range of applications, including validation and calibration of dynamic models, verification of system oscillations, identification of characteristics for critical modes, system planning and operation studies, determination of stability limits, and control system design and tuning.

SSAT incorporates many innovative features and advanced functionalities for small signal stability analysis.



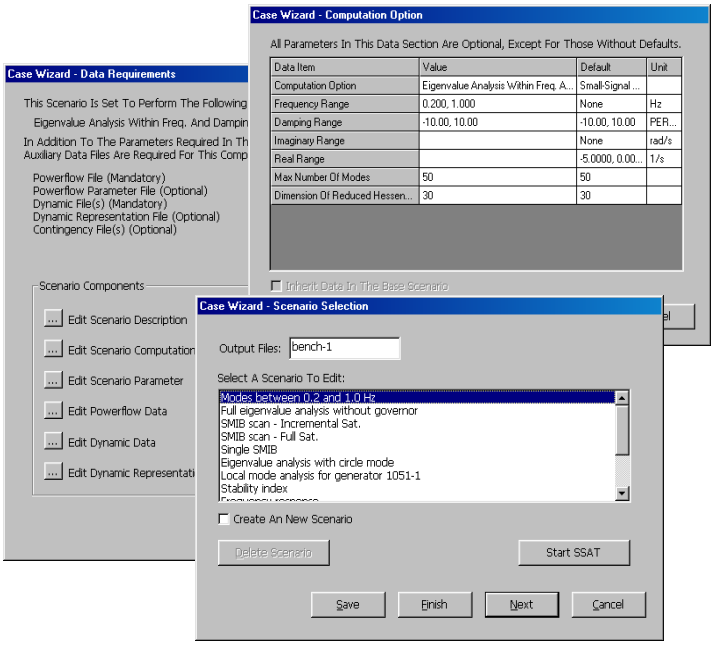
Model Library

SSAT supports a comprehensive model library, including the following conventional models:

- **Generator**: from classical to two-axis 6th order models.
- **Excitation system**: all IEEE standard exciter/AVR and PSS models and common extended models.
- **Speed governing system**: all IEEE standard models and common extended models.
- **Load**: ZIP model, voltage/frequency dependent model, induction motor model.

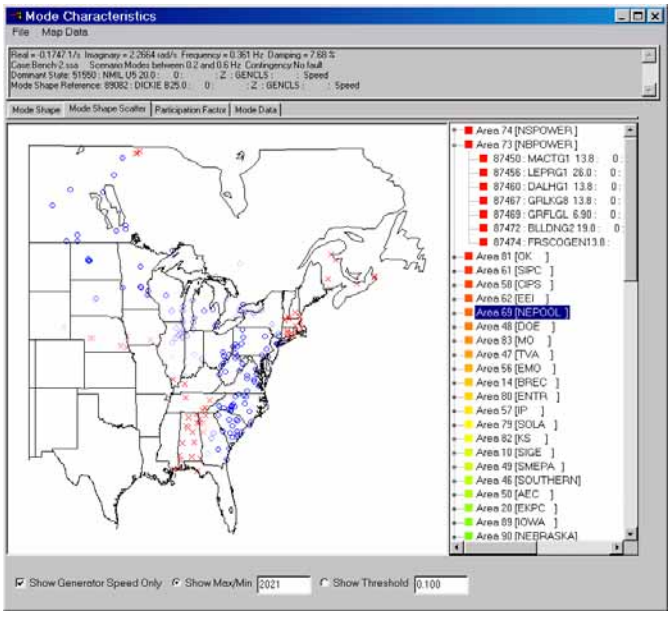
Among the advanced modeling capabilities, SSAT offers:

- **Renewal energy source models**: wind turbines, photovoltaic plants, battery and other storage devices, ocean tidal and wave generators, etc.
- **User-defined modeling**: function block and connectivity based UDM approach with capability to interface with user-written control blocks.
- **FACTS model library**: SVC, TCBR, STATCOM, TCSC, SSSC, TCMCT, TCPST.
- **HVDC model library**: two- and multi-terminal HVDC models, converter-based FACTS models.



Analysis Options

- **Contingency analysis**: in addition to the base case, post-contingency conditions can be studied. A fully-featured powerflow solver is used to obtain the post-contingency conditions.
- **Sensitivity analysis**: the sensitivities of specific modes with respect to dynamic model parameters and various system conditions can be assessed.
- **Transaction analysis**: this determines the power transfer limits subject to small signal stability criterion, for power transactions defined using the same concept as VSAT and TSAT.
- **Mode trace (root locus) analysis**: specific modes can be traced for specified power transfers (or powerflow conditions), contingencies, and/or dynamic model parameters.

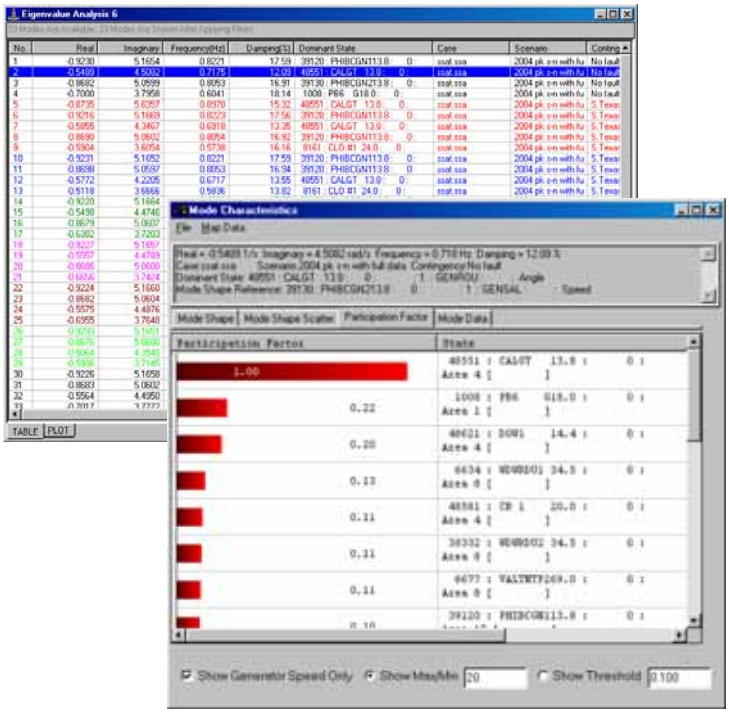


Computation Features

- Computation of all modes in a system or in single-machine-infinite-bus equivalents of all generators.
- Computation of the modes within a specified range of frequencies and/or damping (ideal for computation of interarea modes).
- Computation of the modes associated with specified generators (ideal for computation local modes).
- Computation of small signal stability indices. The computation can include the entire spectrum, or specific group of modes defined by frequency ranges or by participating generators.
- Full modal characteristics (mode shapes and participation factors) for the modes computed.
- Time and frequency response computation (ideal for control design/tuning and model validation.

Case Setup Tool

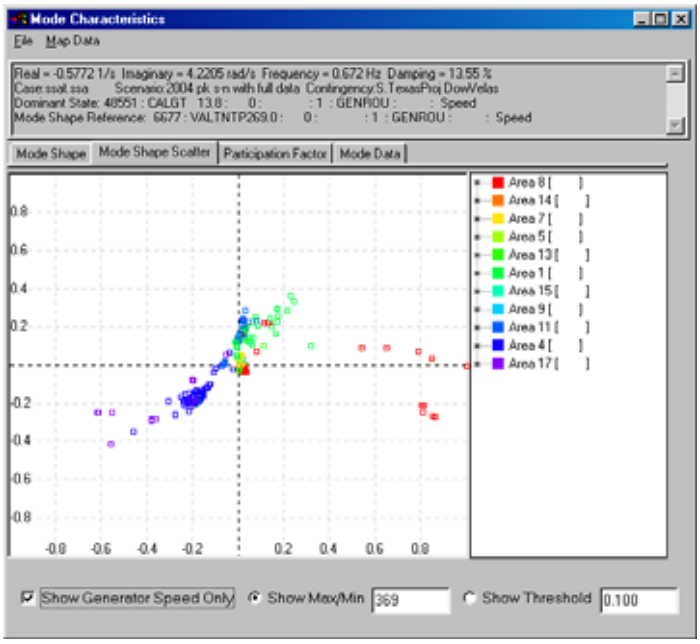
- The Case Wizard helps create custom cases and computation tasks.
- Full graphic interface for working with all data required.
- Creation of contingencies with custom events or by rules.
- Connection to UDMEditor for creating, examining, and modifying user-defined models.
- Connection to PSAT for examining, modifying, and solving powerflow.



Output Analysis Tool

The Output Analysis Module of SSAT helps examine all computation results from SSAT runs:

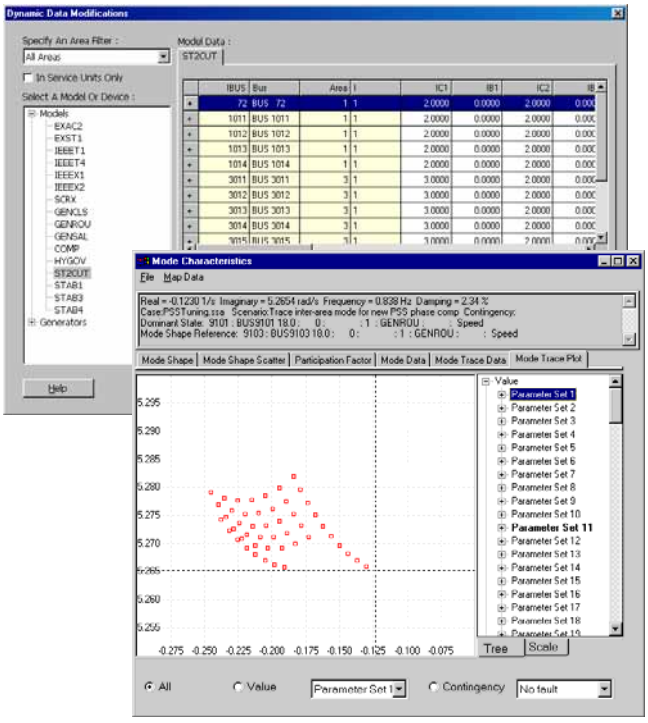
- Different views (tabular or graphical) for the visualization of results.
- Various analysis tools to show trends and patterns from the raw computation results.
- Tools for identification of local/interarea modes, and for filtering specific modes from multiple computation scenarios and contingencies.
- Geographical display of modal characteristics, with full “on-the-fly” editing functionality.
- Case comparisons.
- Fully customizable plots.
- Data and graphics importing/exporting facilities (ASCII text, MS Office, and HTML).



Control Design Toolbox (CDT)

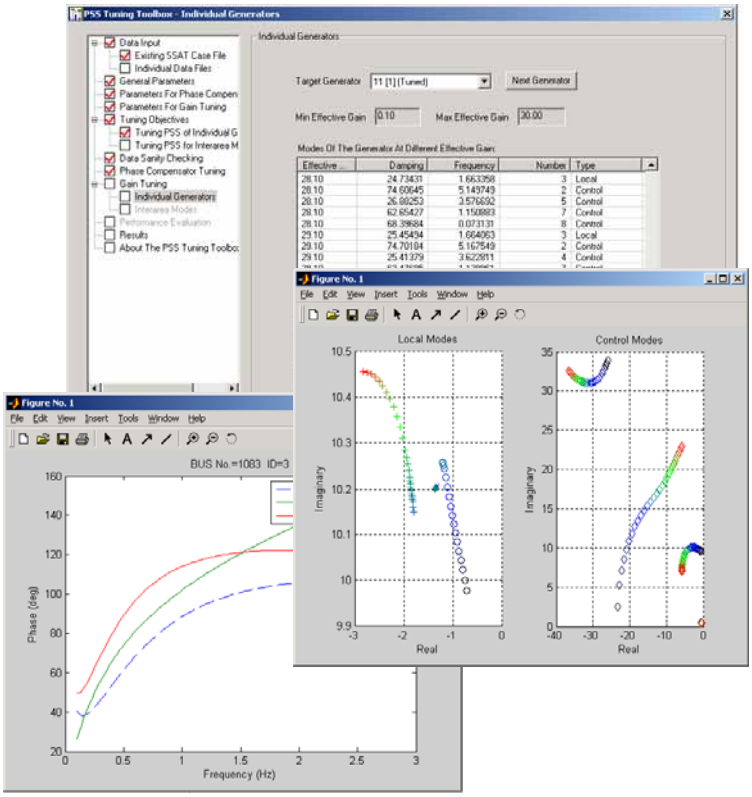
This is an add-on module to SSAT which provides features for PSS design and tuning:

- Step-by-step wizard walks the user through the entire PSS design and tuning process.
- Automatic connection to MatLab® and SSAT engine.
- Designing and/or tuning PSS for local or inter-area modes.
- Capabilities of tuning individual or groups of stabilizers.
- Customizable parameters and tuning constraints.
- Graphical interface for data setup, tuning, and result analysis.



Other Features

- Multiple scenario and multiple contingency processing capability.
- Option to use single or double precision arithmetic, selectable at run-time.
- Option to export basic matrices of the linear dynamic model of the system.
- Case Archive feature to allow easy archiving and exchange of study cases.
- Batch processing.
- Analysis of power systems of up to 100,000 buses and 15,000 generators.
- Runs on the MS Windows 2000/XP/Vista/7 platform.
- The Control Design Toolbox (CDT) requires Matlab® and its Optimization Toolbox.



Other Powertech Services

- Evaluation of transfer capability and security limits
  - Powerflow analysis
  - Transient Stability analysis
  - Small-Signal Stability analysis
  - Voltage Stability analysis
- Post-mortem analysis of system disturbances
- Frequency control assessment
  - Islanding studies
  - AGC & governor performance
  - Design and evaluation of under-frequency load-shedding schemes
- Increasing transfer capability
  - Control-tuning and design
  - Load shedding schemes
  - Reactive compensation planning
  - Special protection system design and verification
- Assessment of planning alternatives
- Custom modelling & dynamic model reduction
- Reliability Assessment of power systems
- Generator field testing, model development & validation
- Load characteristic measurement and model development
- Custom software and model development
- Training

In addition to extensive power system study capabilities, Powertech has a $50 million lab and test facility which includes high voltage, high current, and high power labs, as well as capabilities in hydrogen technologies, chemistry, metallurgy, and materials engineering.

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