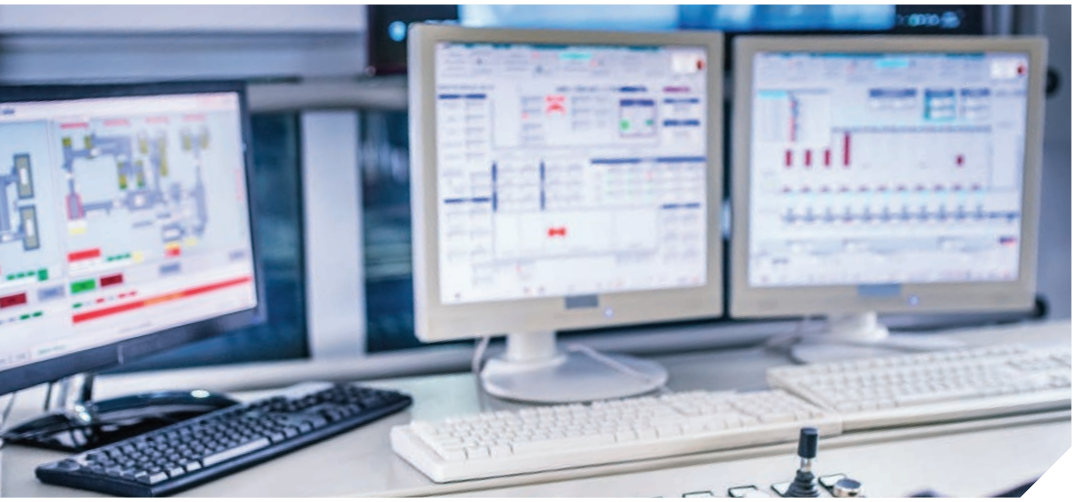
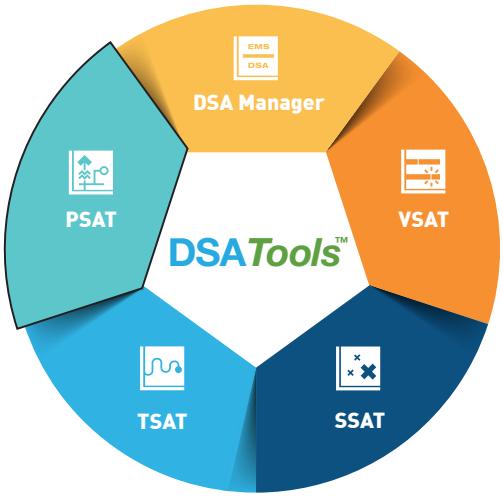
PSAT Powerflow & Short-circuit Analysis Tool

PSAT is a software tool for powerflow analysis of power systems. PSAT has a rich set of features and functions for building powerflow cases, managing powerflow data, solving powerflow, and visualizing system conditions.





PSAT is a state-of-the-art powerflow program developed to provide the following functions:

- Full-featured powerflow analysis capabilities for performing steady-state system analyses required in system planning and operating studies. Such studies include steady-state voltage decline, line/transformer thermal loading, active/reactive power supply problems, contingency analysis, short-circuit analysis, static network reduction, etc. For these applications, PSAT allows the user to easily manipulate the system parameters, quickly and reliably solve the powerflow, and examine the results in comprehensive output tables or on graphics. It also provides the capability to import and export data in a variety of formats.
- Powerflow data preparation for input to other DSA*Tools*™ programs. This function entails input of powerflow data in a variety of commonly available formats, adding new network components and models, manipulating the data as required to obtain the desired initial system conditions, checking data quality, solving the powerflow, reporting powerflow solution quality, and providing this data to other applications.
- Support to a wide range of models, including conventional network, various types of generation, true three-winding transformer, FACTS, switched shunt, SVC/STATCOM, two- and multi-terminal HVDC with LCC and VSC, DC grid, negative and zero sequence network, station node/breaker configuration.
- Complete single-line diagram (SLD) and station diagram (SD) functionality. These can be readily drawn by using the dragging-and-dropping approach. All system data can be entered and modified via SLD and SD. System data, as well as powerflow solution results can be displayed on SLD and SD. Advanced features such as animation and contouring are available for enhanced result visualization.
- Advanced features, such as support to macro and Python scripts, are available.

PSAT is designed for powerflow analysis, as well as for use with the other components in the DSA*Tools*™ Suite including VSAT, TSAT, and SSAT. Together they form a powerful analysis package for the comprehensive planning and operation studies needed for today's complex power systems.

PRODUCT FEATURES

- *Comprehensive modeling capabilities*
- *State-of-the-art solution algorithms*
- *Sophisticated single-line diagram (SLD) and station diagram (SD)*
- *Data manipulation via tables or graphs*
- *Full support for node/breaker models*
- *Handles a variety of input formats*
- *Short-circuit calculation*
- *Static network reduction*
- *Support to macros and Python scripts*

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DATA ENTRY, MANIPULATION, AND VERIFICATION

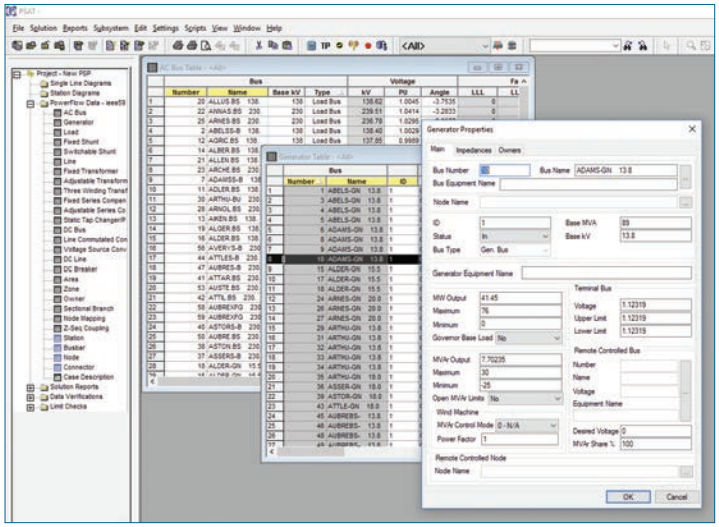
All input data in PSAT can be entered and viewed using data tables. Data tables can be used to display data of all components in the system. The user can customize these tables to show data for a defined subsystem and/or in a specific order. In addition, PSAT has single-line diagram (SLD) and station diagram (SD) capabilities, which allow the user to create such diagrams by using a few straightforward techniques. Two display modes are available for the graphics: system/station view and bus/component view, to suit for different applications.

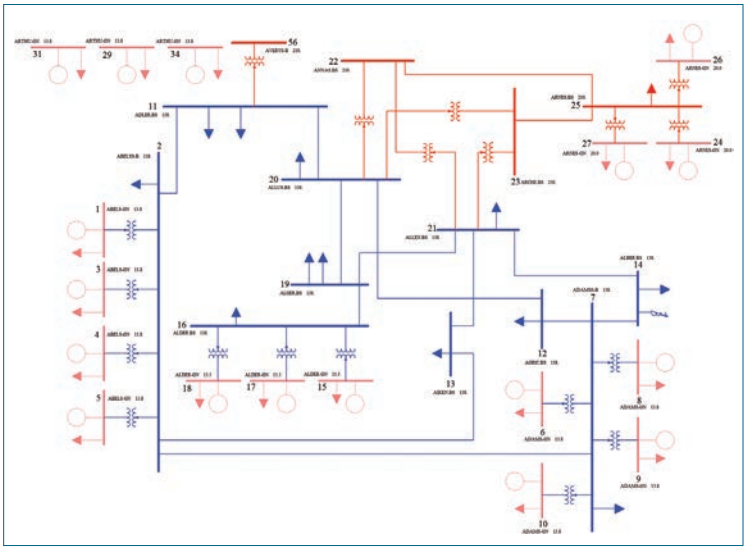
Data changes can also be applied by rules, for example, scaling load, generation, and shunt.

All powerflow data as well as SLD/SD can be exported to other applications in a variety of formats (such as Excel).

PSAT offers a comprehensive set of data sanity check functions including:

- Network topology checks such as identification of isolated buses, islands, and parallel branches with the same ID.
- Isolated components in a station, branches in a station, transformers and compensators between stations.
- System parameter checks such as branches with unusual parameters, transformers with unusual tap ratios, and negative load/generation.
- Other possible data problems such as branches connecting buses at different kV, duplicate bus names, buses controlled by more than one device, and non-identical parallel transformers.

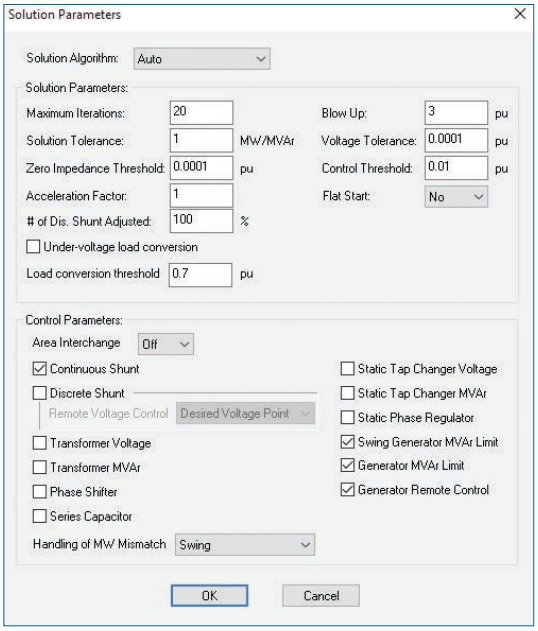




MODELING

PSAT provides a full range of conventional powerflow models as well as advanced models such as:

- **Generators:** The model allows local or remote voltage control within reactive power limits.
- **Loads:** Voltage dependency of load may be modelled by a combination of constant current, constant impedance, constant MVA, and functions of voltage with non-integer exponents.
- **Switchable Shunts:** The model allows local or remote voltage control by adjusting shunt admittance discretely, continuously or according to a droop characteristic (for SVC).
- **HVDC Links:** Two-terminal and multi-terminal HVDC systems with LCC or VSC are represented in PSAT with comprehensive converter models and flexible dc network configurations.
- **FACTS Devices:** Popular FACTS devices, such as SVC, STATCOM, TCSC, TCTCT, TCPST, and UPFC, can be modeled in PSAT.
- **Node/breaker Models:** Detailed node/breaker models can be represented and arranged by the power plants or substations in which they are physically located.
- **Other Models:** Phase shifter, three-winding transformers, sectional branches, area interchange controls, etc.

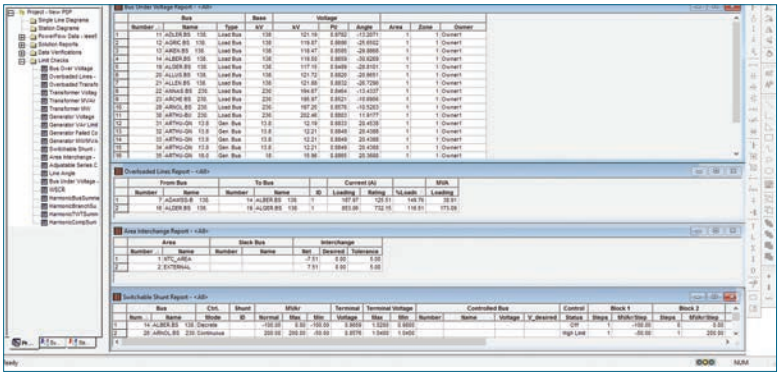


POWERFLOW SOLUTION TECHNIQUES

In PSAT, the following powerflow solution algorithms are available:

- Fast Decoupled
- Newton-Raphson
- Automatic: The Fast Decoupled method is used first and the solution method is switched to Newton Raphson, if necessary, to achieve faster convergence.

During powerflow solutions, various powerflow controls can be enabled, such as switchable shunt and ULTC adjustments, area interchange control, FACTS controls, etc. PSAT uses an advanced Global Linear Programming technique for adjustment of devices controlling active and reactive power flows so as to improve the convergence of the powerflow solution.



POWERFLOW SOLUTION REPORTING

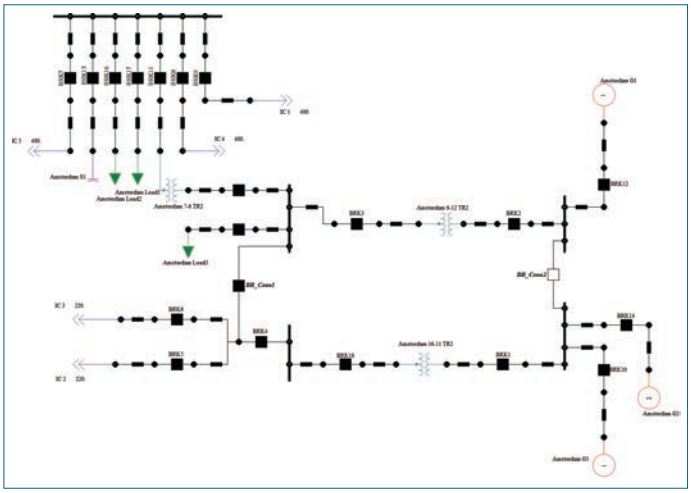
After a powerflow solution, the user can select from a wide array of output reports including:

- Mismatches of the solved powerflow.
- Individual component summaries (voltages, flows, etc.)
- Subsystem summaries, such as load, generation, losses.

In addition, a number of solution checks can be performed:

- High/low bus voltages.
- Branch/transformer overloads.
- Failed or violated generator controls.

Powerflow solutions can be shown on SLD and SD. Any criterion violations can be indicated with custom colours.



MACRO AND SCRIPTS

The macro feature in PSAT allows all activities performed in a PSAT session to be recorded in a text file. The recorded macros can be edited and played back.

PSAT provides a set of function API compatible with Python scripting language. The user can create Python scripts that call these functions to execute various powerflow tasks.

DATA IMPORT AND EXPORT

PSAT has its own powerflow data structure and format, which can be stored either in ASCII or binary files. This powerflow data can be used by any of the DSA*Tools*™ programs.

PSAT has the capability of importing and exporting the powerflow data in a variety of commonly used formats, including CIM/XML (with the add-on module CIM Import), PSS/E, PSLF, IEEE, BPA, etc.

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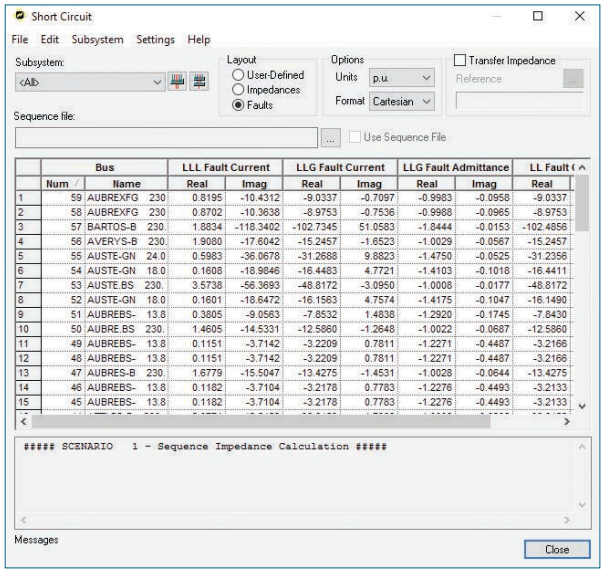
OTHER FEATURES

The following features are also available in PSAT:

- Power system components can be identified using bus numbers, bus names, or equipment names
- MW and MVAR flow animation on SLD
- Contour plot on SLD
- Short-circuit calculations
- Static network reduction
- Harmonic analysis (with the add-on module Harmonics)
- Comparison of powerflow cases
- Analysis of power systems of up to 100,000 buses
- Runs on MS Windows 7/10/server 2012 R2/server 2016



OTHER POWERTECH SERVICES

- Licensing of the power system analysis software package DSA*Tools*™
- Licensing of other software products for utility applications
- Implementation of on-line dynamic security assessment (DSA) systems
- Development of custom software systems
- Development of models for use in power system analysis
- Generator field testing, model development and validation
- Training
- Technical consultancy studies including
  - Development of power system base cases
  - System planning and operation studies
  - Facility (including renewables) interconnection studies
  - Compliancy studies (such as NERC TPL, CIP, UFLS, etc.)
  - Post-mortem analysis of system disturbances

ABOUT POWERTECH LABS

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.

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.

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