PSS®E

High-Performance Transmission Planning Application for the Power Industry

Answers for energy.

SIEMENS

# PSS®E architecture – power flow, short circuit and dynamic simulation

Siemens Power Technologies International (Siemens PTI) is a provider of network consulting, software solutions and T&D training. The Siemens PTI PSS®E software product is an integrated program providing power flow, short circuit and dynamic simulation in an integrated environment, as well as a rich user automation environment based on Python scripting, thus allowing user control and results customization. Smart interfaces facilitate a seamless data exchange among all PSS® products for the most efficient way to manage your assets, today and tomorrow.

PSS®E analytical capabilities include:

- Power flow
- Contingency analysis
- Probabilistic contingency
- Dynamic simulation (including extended term)
- Short circuit (including IEC 60909).

Optional modules provide:

- Optimal power flow (OPF)
- Small signal stability analysis (NEVA)
- Graphical model builder (GMB).
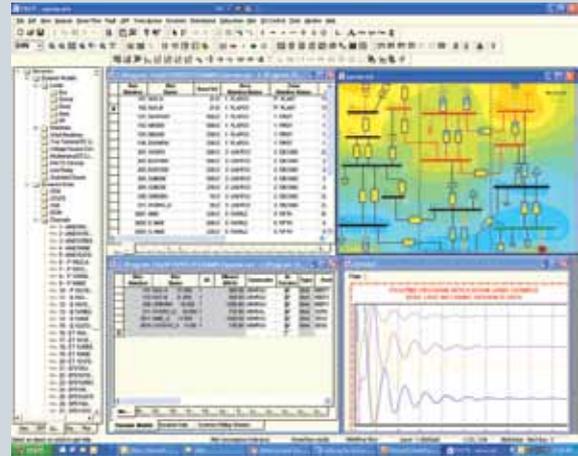
Steady State	Time Domain	Frequency Domain	Advanced Modules	Data Management and Program Interfaces
Power flow	Dynamics	NEVA**	Optimal power flow (OPF)	PSS®E integration with Google Earth
Short circuit ANSI, IEC	Vast library of machines models, load, FACTS device, DC lines, generic wind turbines	Eigenvalue/modal analysis	Graphical Model Builder (GMB)**	PSS®ODMS enterprise wide Network model management
Probabilistic and deterministic contingency analysis			Protection*	MOD® Web-based planning project case manager
Multi-level contingency analysis D N-1 / N-2 / N-3	User developed models		Distance protection	PSS®MUST Managing and Utilizing System Transmission
PV/QV analysis	Manufacturer specific wind-turbine models		Overcurrent time protection	PSS®DB integration platform for PSS® software
Non-divergent power flow	Integrated plotting package		Protection simulation	
Spread sheet interface, slider diagram			Harmonics*	
Python scripting				
Vast array of APIs, automation capability via IDEV, Python, IPLAN, PSAS, PSEB				
Contour plotting				
Scenario manager				

* PSS®SINCAL Module
** Module shared by other PSS® products.

PSS®E – benefits at a glance

- Fast powerful, and real-world tested system models up to 150,000 buses

- Modern graphical user interface (GUI)

- Balanced and unbalanced fault analysis, contingency analysis (deterministic and probabilistic)

- Extensive automation and customization capability — BAT commands, Python, PSAS

- User-defined subsystems — subsystems based on areas, owners, zones, bus kV or combinations

- Comprehensive model library including emerging technologies such as advanced FACTS devices and wind turbines

- Code-based, user-written model building

- Powerful, easy-to-use integrated plot facility

- Graphical construction of user-defined controller models

- Small signal and Eigenvalue analysis

PSS®E – benefits at a glance

A timely tool for addressing key reliability concerns in power systems, including:

- Multiple contingency analysis (N-1-1; N-2; N-1,N-1)
- Cascading failure vulnerability analysis
- Automatic application of mitigation strategies
- Development of probabilistic reliability indices.

Simulates all simple and complex fault types, including:

- Three-phase (3PH) faults
- Single-line-to-ground (LG) faults
- Double-line-to-ground (LLG) faults
- Line-to-line (LL) faults
- IEC 60909 calculations
- ANSI standard calculations.

Rapid-fire expansion of analytical content:

- Incorporation of major analytical enhancements
- Staying abreast of regulatory reliability requirements
- Has the right tools to study new technologies.

Ideally suited to solving the challenges of all power system regulatory environments, including:

- Transfer capability investigation
- Voltage collapse analysis
- Reactive power scheduling
- Ancillary service opportunity cost assessment
- Impact assessment
- Congestion analysis
- Location-based marginal cost assessment.

A leader in standardized data exchange, including:

- PSS®E data sets are comprehensive and include robust planning models
- Proprietary file structure serves as a standard for exchange around the world
- A leader in embracing Common Information Model XML file exchange for increased model exchange accuracy across vendor platforms. Rich automation lets you take control!
- Provides tools for development of user-customized models
- Permits user-specified execution and reporting.

PSS®E – analytical capabilities

The Siemens PTI PSS®E software package is widely recognized as one of the most fully featured, time-tested and best performing commercial programs available for power systems analysis. Over 30 years of commercial use and user-suggested enhancements have made the PSS®E power flow base package comprehensively superior in analytical depth, modeling, and user convenience and user flexibility. Rich graphical tools allow the user to easily edit models and present results.

Power flow

Since its first release, the accuracy of the PSS®E power flow has been proven against real systems' responses and it is the benchmark against which other software is tested. The algorithms and models contained in PSS®E, and in particular its user flexibility, have allowed every major new and evolving technology to be proven before large-scale introduction into the industry.

PSS®E's world-wide acceptance is based on Siemens PTI embedding in PSS®E many of the study techniques used by Siemens PTI consultants and by the user community. Therefore, PSS®E users reap the benefits of the experience of the very best power system planning engineers worldwide. On top of the standard models and analyses provided directly by PSS®E, the user is provided tremendous capabilities to customize execution and results preparation and presentation using the powerful Python scripting language.

Short circuit

The short circuit module has a number of short circuit calculation algorithms to meet the diverse needs of fault analyses. All algorithms are self-contained within PSS®E, and the module requires only a valid power flow working case and the power system zero and negative sequence data. The short circuit module can simulate one or all fault types at one bus or all system or sub-system buses in one run, thereby reducing analysis time. In addition, PSS®E performs IEC 60909-based fault analysis. The single requirement prior to entering the IEC fault calculation method is a valid power flow working case.

The system zero and negative sequence data is required only if unsymmetrical faults are to be simulated. The PSS®E short circuit analysis is well suited to follow protection coordination work.

PSS®E – analytical capabilities

Contingency analysis

When performing a contingency analysis in PSS®E, contingencies can be specified either automatically (e.g., all N-1 contingencies) or by a user-defined list. The result is a comprehensive list of contingencies tested and those that indentify violations. The PSS®E Corrective Action feature can then be applied to automatically mitigate contingency violations that then provides a refined list of the most serious violations to be resolved.

Probabilistic contingency

Siemens PTI brings you comprehensive transmission probabilistic contingency analysis by enhancing the core state-of-the-art analytical formulations from our PSS®TPLAN software and integrating them into PSS®E. The probabilistic contingency capabilities feature easy configuration, detailed modeling of remedial action schemes, effective identification of voltage collapse conditions, and automatic handling of generation dispatch and load shedding requirements. These combined features provide program users with an all-inclusive tool to evaluate transmission reliability performance in large or small power systems on a deterministic and probabilistic basis.
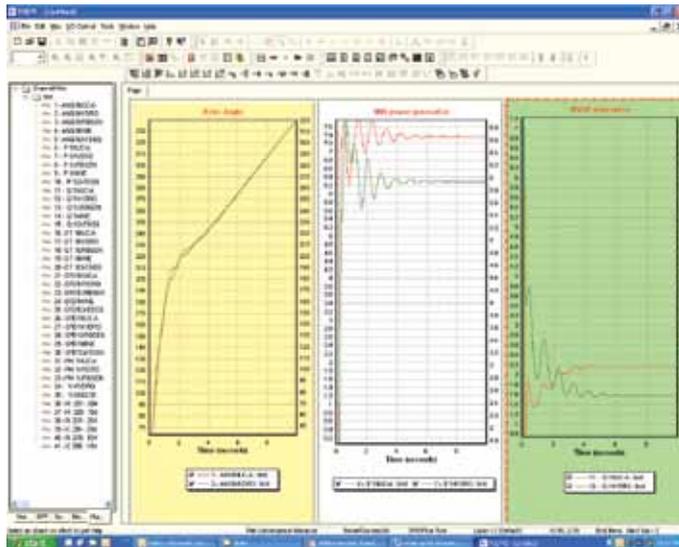
Dynamic simulation

The dynamic simulation module of PSS®E is a versatile tool to investigate system response to disturbances that cause large and sudden changes in the power system. The dynamic simulation module not only offers a vast library of built-in tested models for modeling different types of equipment, it also offers the capability to create user-defined models of any complexity.

User models can be developed using Fortran code, or the Graphical Model Builder (GMB) can be used to graphically build and test control block diagrams for use in PSS®E and other PSS® products. An integrated plotting package allows the user to specify comprehensive and customizable plots with the ability to export to several popular graphic formats.

PSS®E – expanding capabilities

Optimal Power Flow (OPF)

OPF improves the efficiency and throughput of your power system performance studies by adding intelligence to the power flow solution process. Whereas a standard power flow relies on the engineer to systematically investigate a variety of solutions before arriving at an acceptable solution, PSS®E OPF automatically adjusts controls to determine the optimum solution. From virtually any reasonable starting point, you are assured that a unique global optimal solution is attained, a solution that simultaneously satisfies system constraints given a pre-determined objective.

Small Signal Stability Analysis (NEVA)

Stability problems, such as inter-area oscillations, have become increasingly common in large interconnected power systems. The NEVA module provides Eigenvalue and modal analysis and extends the PSS®E dynamics analyses capabilities to allow detailed investigation of small signal oscillations as well as indicating the optimum location and testing of corrective devices. NEVA is integrated with the PSS®E shell, thereby using the PSS®E standard models and the Graphical Model Builder (GMB) models.
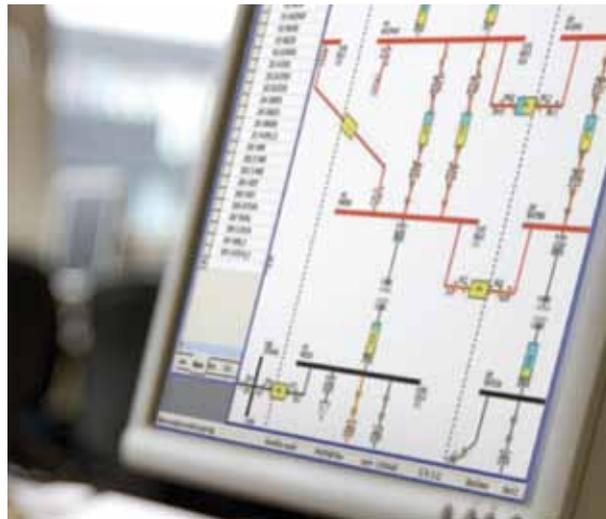
Graphical Model Builder (GMB)

GMB is a powerful and easy-to-use model development tool based on combining elemental graphic components into a representation of complex control block diagrams. Accurate power system planning requires that precise models be used in the simulation software. PSS®E software is designed for modeling complex dynamic network systems using either standard dynamics models or specialized models developed and tested using GMB.

PSS®E – comprehensive analysis software for use in transmission system studies

Transmission planning and analysis tools are essential for utility companies to meet the design challenges of today's aging grid and tomorrow's Smart Grid. Keeping pace with the demand for reliable power and ever expanding complex networks, utilities rely on powerful tools to design systems to meet forecast needs.

PSS®E, offered by Siemens PTI, is a powerful and easy-to-use power system network analysis tool that goes beyond traditional power flow analysis to provide you with the ability to fully optimize and refine your transmission system. PSS®E offers proven technology and a "world" of user experience, yet it is flexible and user-adaptable to changing policies and procedures.

The PSS®E program package incorporates years of Siemens PTI experience and algorithm growth and has been developed in close cooperation with its world-wide users. With this background it has become one of the world's leading electrical transmission planning software programs. PSS®E provides users with powerful reliability analyses and employs the latest computer technology and numerical algorithms to efficiently solve network challenges, large and small.

PSS®E is one of the most responsive tools with respect to new features and analytical capabilities, addressing immediate user needs as well as future needs. And, in conjunction with other PSS® software, it offers a truly open and versatile CIM-compliant platform for data and application integration.
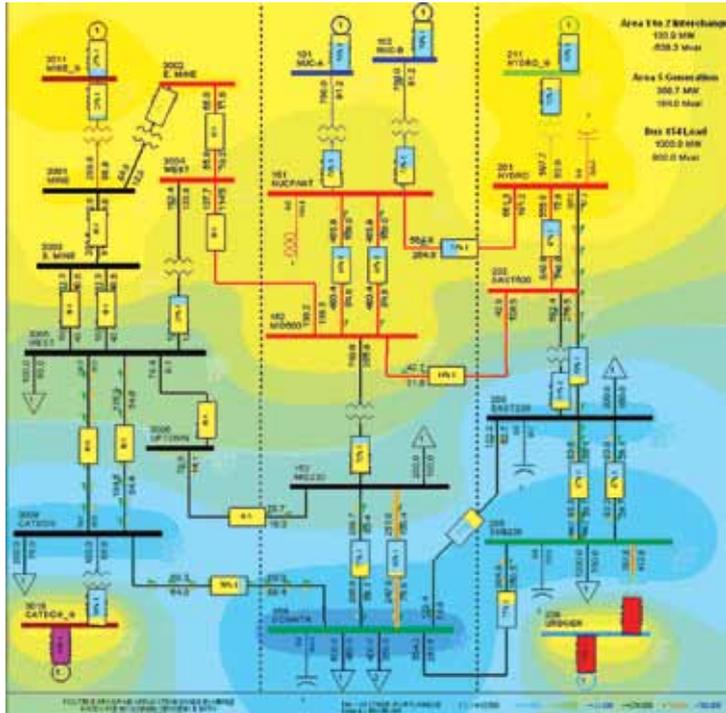
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available, which may not apply in all cases.
The required technical options should therefore
be specified in the contract.

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