CYME
Power Engineering Software and Solutions

CYME 7.2 New Features

Power the Smart Grid and meet the energy needs with the CYME Power Engineering Software

Eaton's CYME is pleased to announce the release of its latest CYME 7.2 Power Engineering Software.

As part of the CYME 7 Series, CYME 7.2 centers on delivering simplicity to your fingertips while combining industry-led features with engineering. Whether it is to power your smart grid or to optimize your power system for higher efficiency and reliability, the CYME Power Engineering Software has the analytical tools required to help you meet your energy needs.

To heighten our commitment to support smart grid visions and distributed resources management, the CYME 7.2 version brings new analysis and equipment with smart controls.

Key features include:

- Distribution state estimator
- Battery energy storage system
- Smart inverters

CYME 7.2 also brings the required technologies together to address the challenge of complex modeling and analysis of secondary grid networks.

Key features include:

- Network protectors with complete relay settings
- Analyses to support heavily meshed networks

The reliability of power systems is an important aspect of system analysis. CYME 7.2 features extended analytical capabilities to assist engineers in achieving a more in-depth understanding of impacts of faults and proper coordination.

Key features include:

- Short circuit IEC© 61363
- Distance protection
- Low voltage cable sizing
- Enhanced protective device analysis

Evolving with the new challenges of the electric industry, the equipment modeling capabilities of the CYME software are continuously refined to emulate the behavior of devices in the most complete way possible.

Enhanced equipment include:

- Corner grounded delta transformer
- Overhead lines and double circuits
- Conductors
- Cables
- Shunt capacitors
- Synchronous Generators

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Enhancements have been brought to the framework and user interface to continue to increase the friendliness and ease-of-use of the software.

Enhancements include:

- Embedded chart manager
- New functionalities with multi-explorer
- Improved equipment data management
- Improved study file management
- Improved one-line diagram editing
- Extended result box customization
- Extended keyword customization
- Unicode supported

Distribution State Estimator

The Distribution State Estimator analysis uses a sophisticated algorithm which allows more detailed and accurate distribution network modeling. It estimates the unbalanced power consumption and the voltages at every level of the system.

The analysis is able to:

- Process voltage measurements from voltage meters and other measurement types (kW, kvar, PF, Amps)
- Estimate load and power flow
- Identify errors in topology and measurements
- Handle measurement redundancy
- Include distributed generation
- Initialize loads

CYME's Distribution State Estimator is based on a robust modified-augmented-nodal analysis approach which is capable to:

- Solve for heavily meshed networks such as secondary grid networks
- Minimize the difference between measurements and calculated values
- Take into account options such as line transposition, source impedance and line charging

Battery Energy Storage Systems and Smart Controls

Distributed energy resources operators has become increasingly more interested in regulation controls following a modification to the IEEE-1547© standard. CYME 7.2 offers the modeling of Battery Energy Storage Systems and Smart Inverters to address related study needs. Such device and controls allow to exercise regulation in order to achieve better voltage profile and peak-shaving.

The smart inverter controls are added to inverter-based DER systems such as WECS and PV systems.

Features:

- Six management types as per IEC-61850© standard, including: Volt-VAR control, dynamic reactive current support, watt-power factor control, volt-watt control, maximum generation level and adjust power factor.
- Customizable control properties
- Inverter control curve library for customized control curves

Battery energy storage systems allow bidirectional active power flow using active power regulation.

Features:

- Modeling includes specific parameters to define the battery management system (BMS), the battery module and the overall battery energy storage system.
- Detailed specifications of the AC/DC converter
- Management type of the storage controller include: no monitoring, power monitoring and DER monitoring
- Charge and discharge delays

Both the battery energy storage systems and the smart inverters are taken into account by the following analyses:

- Load Flow
- Long-Term Dynamics
- Short-Circuit

Secondary Grid Network Analysis

The modeling and analytical capability of the Secondary Grid Network Analysis module have been extended in order to be an unmatched solution for the study of secondary grid networks.

The network protector model now includes complete relay settings which specify:

- Trip functions: insensitive, remove open/block open, sensitive, sensitive plus non-sensitive, time delay
- Close functions: straight closing curve, circular closing curve

Other features:

- Polar plots are available to provide graphical representation of the trip and close regions of the network protectors.
- Robust load flow algorithm tailored for heavily meshed unbalanced systems
- Display of the current is available on the polar plot after a load flow analysis.

Distance Protection

CYME 7.2 offers the Distance Protection module to assist engineers in the design and validation of protection schemes which involves distance relays.

Generic distance relay types available are:

- Mho
- KD-10
- HZ
- Quadrilateral
- RAZOA
- GCX51A
- GCXY51
- Reactance
- Polygon
- Polygon-Mho

Features of the module include:

- Estimate function to set the reach of each protection zone and the compensation factor
- Load encroachment
- Protection characteristics displayed on R-X diagram
- Analysis to verify relay operations under both normal and fault conditions

Low Voltage Cable Sizing

The Low Voltage Cable Sizing module calculates the cable size at a given location to respect the ampacity level, the voltage drop limit during normal operating conditions and the short-circuit withstand capability.

Features:

- Adheres to the standards IEC© 60364-5-52 and NEC-NFPA©-70-2011
- Calculation for low voltage cables (below 1000V)
- Cable size from CYME library or NEC standard
- Calculation takes into account of conductor material, insulation material and manufacturer

Short-Circuit IEC©-61363

A new short-circuit method is offered as per the IEC©-61363 standard for the calculation of AC and DC components of the short-circuit current.

The calculation of this standard caters for the calculation of short-circuit levels on three-phase radial AC electrical installation of ships and mobile and fixed offshore units.

Features:

- AC and DC components of the current are calculated from fault inception to steady-state for three-phase symmetrical short-circuit condition
- The initial current (I"k), the peak current (Ip), the breaking current (Ib) and the DC breaking current (Idc) are calculated
- Time-domain plot available to show the short-circuit current from fault inception point to steady-state

Enhanced Fault Analysis

Besides the addition of the new IEC©-61363 calculation method, the analytical capability of the Fault Analysis module has been further extended in CYME 7.2 with the following:

- An inter-circuit fault calculation for the computation of fault currents for faults occurring between two circuits (independent or double-circuits)
- Result boxes customized with appropriate keywords for both the ANSI short-circuit and the IEC©-60909 short-circuit methods
- New ANSI reports: high voltage buses current summary, low voltage buses current summary, low voltage circuit breakers current summary, contact parting currents, and closing and latching currents reports
- IEC©-60909 short-circuit report to display abnormal conditions and short-circuit levels for all protective devices.

Enhanced Protective Device Analysis

New functionalities are added to the Protective Device Analysis module to provide a solution with the right tools to address different protection and coordination issues.

Enhancements include:

- Abnormal conditions tab in multi-explorer pane to display protection problems (coordination, clearing, protective device loading, rated voltage exceeded issues). Color-coding is extended to one-line diagram and reports
- Current adders are now part of the coordination criteria
- The short-circuit method and its parameters can be specified for Branch Device Coordination
- TCC settings can be imported into protective devices from the data repository or from TCC files
- Create an equipment with specific settings onto the one-line diagram via a drag-and-drop operation from the data repository
- Ground fault protection curve has been added to solid state LVCBs.
- Sectionalizer model enhanced to be taken into account by the protective device coordination. New fields include: type (hydraulic or electronic), maximum momentary current, actuating current and trip settings. Coordination criteria available for sectionalizers.
- The Protection – Loading report now lists the optimal rating of each fuse which would satisfy the loading criteria
- Load current multiplier and load current adder are added to the loading criteria. The worst case scenario is compared to the maximum loading allowed.
- Criteria for cable and conductor damage added
- For reclosers, the clearing can be applied on the cumulative of the slow curves, the cumulative of the fast curves, or the cumulative of both the slow and fast curves
- A new option has been added to the Protective Device Analysis to Verify Short-Circuit rating. It tests if the interrupting rating or the momentary rating is larger than the short-circuit current
- A new option is available with the Protective Device Analysis to verify cold load pickup
- It is possible to define the protection range using the maximum and/or the minimum short-circuit current
- The coordination analysis now verifies if the number of count to lockout of a sectionalizer is smaller than the one of the relay or recloser upstream
- The coordination analysis now verifies if the actuating current of a sectionalizer is bigger than the one of the relay or recloser upstream

Load Flow Analysis

A new Power Factor Correction tool is available after a Load Flow simulation. The tool allows to size capacitors and reactors at a given node to achieve a desired power factor after running a Load Flow analysis.

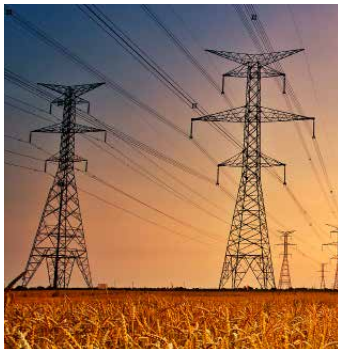
Other enhancements in the Load Flow Analysis include:

- Option to include multi-stage switchable shunt capacitors in the analysis
- Option to lock capacitors at their current state for a given simulation
- System voltage limits can be defined per voltage level and per customer type
- Load and generation scaling factor can be applied by network
- Option to ignore results downstream of three-phase fuses in the Feeder Loading report
- Restore calculation parameters

Python Scripting

CYME 7.2 brings various enhancements to the Python Scripting Tool:

- A debugger has been integrated to offer features such as breakpoints, step-in/step-over, stop/continue and variables explorer
- Description added to functions and parameters in code completion
- Tooltip display expanded to console
- Variable value inspection
- Command manager added to keep history of commands
- New analyses supported: Distribution State Estimator, Simultaneous Fault, Load Growth, Short-Circuit IEC©-61363, Network Configuration Optimization, Network Reduction, Network Diagnostic, Network Equivalent
- New functions and models are added to the Python API
- Python engine upgraded from 2.7 to 3.4 to support Unicode encoding



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Cable Modeling

CYME 7.2 provides an even more accurate representation of cable installations, thanks to its improved cable modeling.

- Estimate function available to calculate the 1s withstand rating of the cable
- Ampacity derating factor available
- Possibility to use different neutrals for a cable installation
- Specify number of cables per phase
- Additional typical installations available which includes flat touching, flat spacing, trefoil and custom
- Typical installations with neutrals are also available

Conductor

The CYME 7.2 version offers a redesigned conductor library with additional estimation features for GMR and withstand rating.

Other enhancements include:

- New conductor material library
- User-defined temperature value per conductor available
- Frequency can be defined locally by device for the calculation of AC resistance

Overhead Lines

Overhead line and double-circuit models have been enhanced to include the possibility of using two different neutral conductors.

The frequency and temperature can be defined locally as part of each overhead line equipment.

Equipment modeling refinement

Evolving with the industry, we continue to refine the equipment models of the CYME Power Engineering software to provide models that emulates each device's behavior as best as possible.

CYME 7.2 includes the following equipment enhancements:

- Transformer configuration to include the corner-grounded delta
- Improved transformer impedance estimation function
- Estimation function for the reactive power limits of synchronous generators
- Database of manufacturers for bus ways
- Impedance estimation function for bus ways
- Bus ratings as per ANSI or IEC standards
- Current status of shunt capacitors available

Chart Manager

An embedded chart manager, which is both user-friendly and powerful, is available with CYME 7.2.

Functions include:

- Chart management via multi-explorer bar
- Result sets saved to allow quick chart plotting without re-running simulations
- Saved charts are classified with associated study files
- Charts generated with older CYME versions can be imported
- Chart merging function allow easy result comparison
- Customization of charts (background and frame color, grid lines, legend, font, etc).
- Creation of theme templates applicable to charts
- Export chart to JPEG format or to clipboard

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

CYME International T&D
1485 Roberval, Suite 104
St.Bruno, QC, Canada J3V 3P8
P: 450.461.3655 F: 450.461.0966
P: 800.361.3627 (Canada/USA)
CymeInfo@eaton.com
www.eaton.com/cyme

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