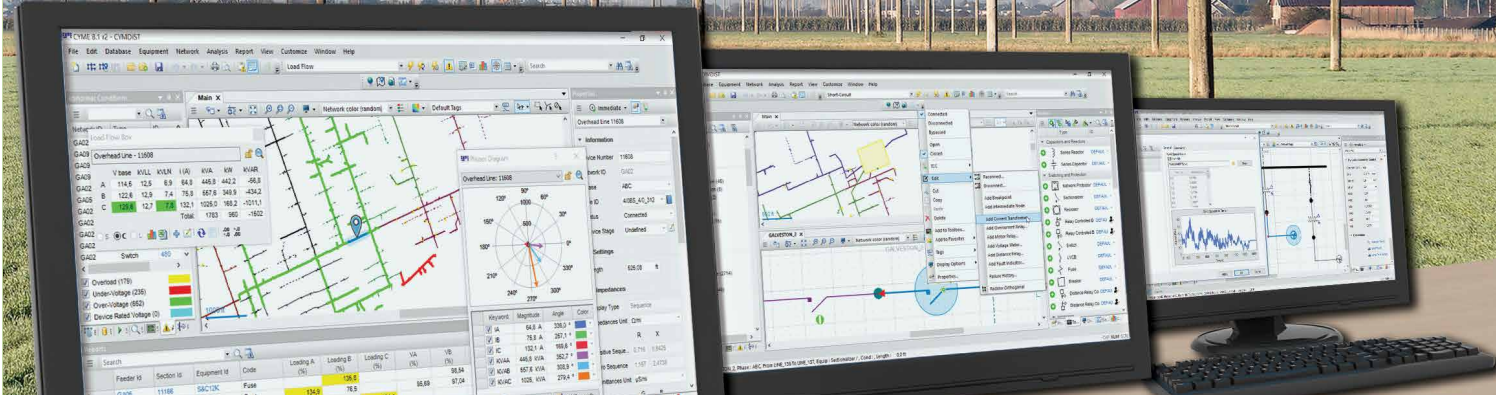


CYME

Power Engineering Software and Solutions

Distribution System Analysis



Reliable modeling, analytic and planning tools to improve the performance of the distribution system

The evolution of the distribution systems now requires the engineers to perform from planning analyses to expert simulations supporting operations, including protection studies and DER interconnection assessments.

The CYME software is a focused and powerful tool to model the whole distribution system and address the simulation needs for capacity, contingency, power quality and optimization analyses.

Distribution System Analysis

CYMDIST is the distribution system analysis base package of the CYME software. It bundles all the modeling and analysis tools required to perform the various types of simulations involved in electric distribution system planning. The calculation engines support balanced or unbalanced distribution models that are built with any combination of phases and operated in radial, looped or meshed configurations.

The following analyses are included in the CYMDIST package:

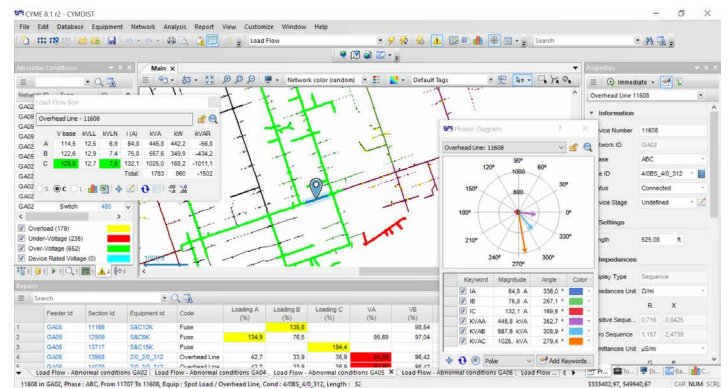
- Unbalanced load flow
- Load allocation and estimation
- Fault analysis:
 - Short-circuit/fault flow
 - Fault locator
- Series and simultaneous fault
- Voltage sag

- Load balancing
- Optimal capacitor placement and sizing
- Motor starting
- Batch analysis

Optional modules can be added to CYMDIST to extend the functionality to perform more in-depth and specialized analyses. New modules are developed regularly to meet the evolving needs of the distribution engineers.

Accurate modeling and representation

The modeling capabilities of the network editor of the CYME software include the detailed representation of all portions of a distribution network, including the MV primary system, the LV secondary system (radial or meshed) as well as the subtransmission system.



EATON

Powering Business Worldwide

Simulations with CYMDIST

The CYMDIST base package is a comprehensive tool providing distribution engineers with key applications to perform system planning studies, simulations and analysis on a daily basis.



At the core of the software are extensive libraries, detailed models and algorithms in line with industry best practices and standards; and based on innovative engineering technologies. Its fully customizable graphical user interface provides the representation, results and reports at the level of detail needed.

Load flow

The steady-state performance of the power system under various operating conditions is simulated using the load flow analysis of CYMDIST. It is the basic analysis tool for the planning, design and operation of any electrical power system.

- Unbalanced and balanced voltage drop – It features an iterative technique that is specifically designed and optimized for radial or weakly meshed systems; and includes a full three-phase unbalanced algorithm that computes phase voltages.
- Unbalanced Newton-Raphson load flow – Takes into account for underground secondary networks (urban grid systems or spot networks), low voltage installations, and sub-transmission systems tied to the distribution systems.

The comprehensive analysis results include voltage, current, power factor, losses, abnormal conditions and unbalanced factors. The results can be viewed for the whole system or for individual locations.

Load allocation and estimation

This analysis assists in developing an accurate load model by allocating feeder demands across the network based on transformer connected capacity, consumption/billing data or existing calculated load data.

Fault analysis

Comprised of a number of applications, the fault analysis functions in CYMDIST support in the assessment of issues related to faults in the distribution system.

It includes three short-circuit calculation methods: Conventional, ANSI, IEC 60909© and IEC 61363©. All methods are based on multiphase models to solve complex balanced/unbalanced, single/two/three phase systems and radial/highly meshed power systems.

The fault analysis applications of CYMDIST also include:

- Series fault analysis – Evaluates open circuit or asymmetrical line impedance conditions on the distribution system.
- Simultaneous fault analysis – Studies the impact of having faults at different locations simultaneously on the network.
- Fault locator – Evaluates possible locations of a fault on the network.
- Voltage sag analysis – Studies the impact of a sudden reduction of voltage magnitude caused by network faults, or other disturbances such as motor starting or overloads.



Load balancing

The load balancing analysis is used to determine which loads or lateral taps can be reconnected to different phases so as to minimize kW losses or balance the current, the load, or the voltage. It reports a series of individual changes to the network and the objectives improvement with each change.

Optimal capacitor placement and sizing

This analysis helps in determining the ideal location and size of shunt capacitors banks to reduce kW losses or to improve the system voltage while maintaining a desired power factor. The user can provide guidance regarding the size, number and appropriate locations of the capacitor banks, and approve whether the recommended banks should be installed or not.

Alternately, the analysis can provide an exhaustive list of all possible capacitor placement locations with associated impacts on voltages and kW losses.

Motor starting

The motor starting functionality of CYMDIST determines the impact of induction or synchronous motors starting on the system by evaluating voltage flicker. An estimation tool also provides the largest single- or three-phase motor size for all locations based on the maximum voltage dip allowed.

Batch analysis

The batch analysis function allows users to run multiple user-defined scenarios on a selection of studies, self-contained files and multiple networks available in the database. Each scenario is configurable and can include several analysis simulations; each of these using configurable parameters.

This function is even more powerful when coupled with the Advanced Project Manager module and/or the Automated Network Forecast Analysis module to run analyses on user-defined project scenarios.

Additional Modules

The CYME software comprises several add-on modules for detailed modeling and in-depth simulations bringing the analysis of any power system to a whole new level.

The modeling modules allow creating a very detailed model of the distribution system from subtransmission to the customer meter, including secondary networks.

The CYME advanced analysis modules help engineers to perform system-wide distribution capacity planning studies, assess distributed generation interconnection impact, improve system reliability and optimize grid efficiency.

Modeling

Enhanced Substation Modeling

This module enables the accurate representation of all the major components of a distribution substation as well as any sub-network, such as a vault, a switching cubicle or an industrial facility. The simulations then take into account the effects of these installations on the overall distribution system to produce results that closely reflect reality.

Low Voltage Secondary Distribution

This module supports the detailed modeling and simulation of the radial secondary distribution system with single-phase center tap transformers and service drop cables. It allows comprehensive analysis to calculate technical losses and identify overloaded equipment down to the customer meter.

Secondary Grid Network Analysis

With this module, heavily meshed electrical network systems, such as low-voltage secondary networks and spot networks, can be modeled and analyzed. This includes complete vaults with their transformers, protective devices such as network protectors with complete relay settings and cables.

Geographic Overlay

Additional geographic data can be useful to the engineers. With this module, raster or vector map files can be imported and viewed as multiple layers underneath the representation of the distribution system. This includes the network connection information, assets, resources, etc.; but also land register, rights of ways, hydrography, topography, land cover, land use, population density, etc.

Online Maps Service

With this service, map images from online map providers (Google™ and MapQuest™ Open) can be displayed as layers in the background of the geographic view of the distribution system to easily locate specific equipment and devices using street addresses and GPS coordinates.

Planning

Advanced Project Manager

This module is equipped with tools to help engineers work with multiple scenarios and plan their long-term projects in the most effective manner. It offers a multi-level database structure which retains all modifications, making any project sharing and team work easy.

Automated Network Forecast Analysis

With this module, the users can create, view and manage growth and modification scenarios for any selected network point and time period. Simulations can be performed in a batch mode to help the engineer identify the impacts of the future changes on the whole distribution system.

Techno-Economic Analysis

This module facilitates the evaluation of the feasibility and the profitability of a project, based on the factual system model, leading to a realistic planning in line with technical, service reliability and investment objectives.

Distributed Energy Resources (DER)

Integration Capacity Analysis

This module is a productivity tool that efficiently and consistently calculates the maximum generation or load capacity that can be installed independently at each point of a distribution system without adversely impacting its reliability and power quality.

DER Impact Evaluation

Generation interconnection system impact studies can be executed within minutes with this module through the automation of a series of repetitive, time-consuming and error-prone verifications. It performs a comprehensive system impact study that integrates several criteria-based verifications and multiple scenarios in order to flag abnormal conditions.

Network Disturbance Assessment

To evaluate the power quality disturbances produced by an equipment on a power source's signal by determining if the equipment passes different power quality tests. Based on the standard "Technical Rules for the Assessment of Network Disturbance" published by a German-Austrian-Swiss-Czech working group.

EPRI DRIVE™

Seamlessly integrated into the CYME software graphical user interface, the EPRI DRIVE™ module combines the engineering effort of the EPRI DRIVE™ engine with CYME's detailed distribution system model to return hosting capacity calculation results within a familiar environment.

Operation

Distribution State Estimator

With a refined algorithm at its core, this module can process the various measurements of a detailed network model to estimate the power flow and voltages of the system and determine the most adequate solution. The analysis solves for radial, looped and meshed networks.

Contingency Assessment and Restoration

This module is a comprehensive tool to study the impact of contingencies on the distribution system in order to assess the robustness of the networks by identifying potential problems with outages and planning maintenance; and find an optimal switching plan for power restoration.

Load Flow Contingency (N-p)

Operating in conjunction with the CYME power flow analysis, this module supports the creation of contingency events (N-p) and single or multiple-outage scenarios, and compare results with a base case base case in order to assess the system's capacity and resilience.

Advanced Fault Locator

Reports all the possible fault locations taking into account multiple monitoring points with several readings, fault indicator statuses and field measurements extracted from COMTRADE files.

Distribution System Analysis

Reliable modeling, analytic and planning tools to improve the performance of the distribution system

Protection

Protective Device Analysis

This module encompasses a series of different simulations to help engineers make the right selection of overcurrent protective devices and to properly adjust their settings such that the impact caused by any short-circuit or equipment failure is minimized. It is a powerful tool that can help engineers design and verify their protection scheme, and to address different coordination issues in any power system network.

Arc Flash Hazards Analysis

Designed to analyze and promote the electrical safety for employees working on or near electrical equipment, this module computes the necessary parameters required to assess the risk level and adopt the adequate safety procedures, thus minimizing the risks of burns and injuries.

Distance Protection

To analyze the operation of distance protection relays under normal and fault conditions. Helps in the design and verification of protection schemes, and to address different coordination issues in any power system network.

Power Quality

Reliability Assessment

The module computes reliability indices for the overall system and their corresponding protection zones, as well as customer point indices. The predictive model can be calibrated based on historical data. The module is fully integrated in the CYME software and provides a high degree of flexibility for analyzing distribution system configurations.

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

© 2018 Eaton All Rights Reserved
Printed in Canada
Publication No. BR 917 045 EN
February 2018

Harmonic Analysis

To evaluate the impact of non-linear loads on the network to help engineers find mitigation methods to harmonics issues in the system.

It features both single-phase and three-phase modeling capabilities, with the flexibility to assess utility-type grids, industrial power systems and distribution feeders of any configuration.

Optimization

Volt/VAR Optimization

This module allows finding the optimal configuration of the installed capacitors, the in-line regulator and the transformers with LTC in a distribution system. The calculations take into account constraints on the network as well as objectives such as peak shaving, reduce system losses and improve voltage profile in order to optimize system efficiency.

Optimal Voltage Regulator Placement

To perform network optimization through voltage regulation by finding the optimal location and tap settings for voltage regulators.

Optimal Recloser Placement

Working with the Reliability Assessment module, it takes into account objectives and criteria, studies the reliability indices, and evaluates the expected improvement to find the optimal locations for reclosers.

Network Configuration Optimization

To reconfigure radial networks to an optimal topology through load transfers in order to reduce losses, mitigate violations or balance feeder lengths.

Time-Series

Long-Term Dynamics

This module executes time-series simulations to study the impact of irradiance variations, wind fluctuations and load variations on network controls such as regulators, load tap changers and switched capacitors. It also enables the time-domain simulation of smart inverters and battery energy storage systems.

Steady-State Analysis with Load Profiles

To execute time-series load flow analysis based on the profiles modeled from a combination of historical consumption patterns and real-time monitoring data, such as SCADA, AMI, MDM, AMR, etc.

Transient Stability Analysis

To simulate the dynamic behavior of distribution systems with distributed generation under various transient events (fault application/clearing, large motor starting, disconnection of co-generation units, islanding, etc.).

Scripting

CYME Scripting Tool with Python®

Python® scripting has been integrated into the CYME power system analysis software for the users to extend the customization of the CYME capabilities based on specific needs. The latest data model is always available so the scripting can take advantage of the CYME analyses, but also allow the users to create their own algorithms and analyses.