CYME
Power Engineering Software and Solutions

Harmonic Analysis

Perform frequency scan, and voltage and current distortion calculations on balanced and unbalanced systems

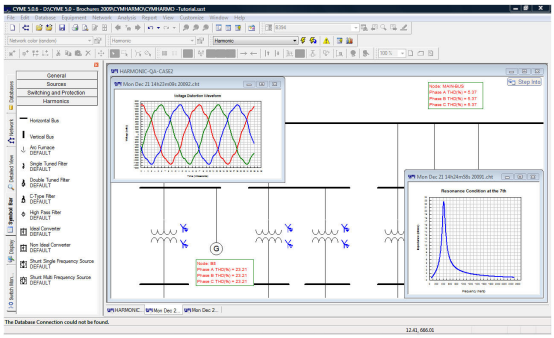
The number of electronic devices and other non-linear loads that are connected to the power system generate harmonics which affect the quality of the power to the end customers. Capacitors, which are installed to improve the system voltage and reduce losses, can create resonance if their location is not optimal. Such harmonic distortions, if un-mitigated, have a detrimental effect on the power quality as they can cause equipment malfunction, overheating of equipment and increase power losses.

The Harmonic Analysis module is an indispensable tool to help engineers evaluate the harmonic level of their electrical network and to assess different mitigation methods.

It features a number of analyses such as frequency scan, voltage and current distortion calculations, capacitor rating and filter sizing analysis, and K-Factor and Factor-K calculations. The module allows the user to model non-linear loads and other sources of harmonic currents such as converters and arc furnaces and toeasily detect resonant frequencies due to capacitor banks. With its many modeling and analytical capabilities, the Harmonic Analysis module makes it possible to accurately evaluate the impact of non-linear loads on the electrical network.

The module features both single phase and full three-phase modeling capabilities, with the flexibility to make the program easily adaptable to utility-type grids, industrial power systems and distribution feeders of any configuration. It utilizes state-of-the-art sparse matrix/vector methods with a three-phase nodal admittance network matrix representation. The Harmonic Analysis module uses the CYME robust load flow algorithm to obtain the fundamental frequency current and voltage system profile for harmonic distortion calculations and waveform display.

The Frequency scan capability included in this module is also available as an independent module. This analysis provides full impedance scan results and allows the user to see problematic areas even before installing harmonic devices.



Powering Business Worldwide

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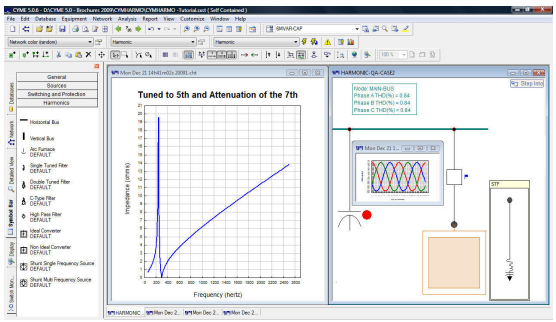
Analytical Capabilities

- Phase or sequence analysis
- Driving point and transfer point frequency scan analysis
- Harmonic voltage distortion analysis
- Harmonic current distortion analysis
- Calculation of telephonic interference indices (TIF, IT, etc.)
- Evaluate system sensitivity level
- Harmonic cancellation
- System detuning via filter sizing
- Capacitor stress analysis
- Skin effect modeling
- User defined distortion limits or as per IEEE 519™ 1992 standard
- Selection of line/cable models: series R-L, nominal Pl, transposed and un-transposed distributed parameters, and frequency-dependent
- Selection of load models: (Parallel R-L, Series R-L, CIGRE C-Type, etc.)



Capacitor Stress and Filter Sizing

The Harmonic Analysis module features stress analysis of capacitors, including those incorporated in filters, to help engineers determine whether the capacitors are rated properly according to user-defined or IEEE standard limits.

Likewise, fundamental resistor losses, fundamental and harmonic current through the reactance, and fundamental and harmonic voltage through the capacitor of filters are calculated to help engineers determine if the filters are sized properly.

Transformer K-Factor Calculation

The Harmonic Analysis module also offers the Transformer K-Factor (ANSI/IEC) and Factor-K (BS) calculation for the assessment of transformer rating with respect to the harmonic level of the system.

Equipment Library

Users can model multiple types of harmonic sources to assess the effectiveness of filters and modify them at will in order to attain acceptable level of harmonic distortion indices on your network.

Our extensive library includes equipment such as:

- Ideal and non-ideal converters
- Generic single or multiple frequency current and voltage source models. This includes a library of drives with typical harmonic spectrum as per IEEE 519.18™
- Arc furnace model
- Passive shunt filter models comprising single tuned, high-pass, double tuned and C-type
- Library of single phase and three-phase transmission line and cable models, series R-L, nominal Pl and distributed parameters
- Synchronous and induction motor models
- Single phase and three-phase transformer models allowing harmonic cancellation through their phase shift angles
- Modeling harmonic sources of nonlinear loads and power electronics equipment
- Static load modeling: parallel R-L and CIGRE C-Type
- Series and parallel RLC branch circuits to create any user defined equipment

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