

# PSS® SINCAL

## Frequency-Dependent Modules

### Enhanced Analysis of Frequency-Dependent Procedures in Electrical Networks

These calculation methods help you to examine frequency behavior in electrical networks.

The following frequency-dependent modules are available:

- Harmonics
- Ripple Control
- Eigenvalues/Modal Analysis

#### Harmonics

PSS® SINCAL's Harmonics module calculates harmonics distribution in electrical networks as well as frequency response.

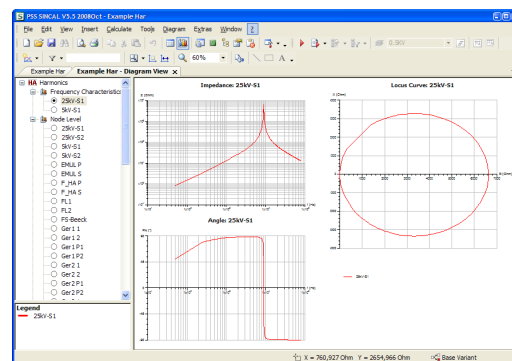


Figure 1: Harmonics diagrams

Several different methods such as, for example, TIF, THFF or EDC can be used to calculate harmonic currents and voltages in the network. In addition to the graphic output of frequency responses for specific nodes, PSS® SINCAL also displays network impedances at the complex level and harmonics levels for all nodes and network levels with the appropriate limit values.

Simulation of a resonance network is possible with very easy inputs. Current and voltage infeeders are allowed for odd-numbered

harmonics anywhere in the network.

PSS® SINCAL provides several different filters.

#### Functional characteristics of the harmonics calculations

- PSS® SINCAL provides three different methods for defining the dependency of the network elements on frequency. These consider the skin and proximity effects.
- Three phase harmonic voltage and current distribution (unbalanced harmonic short circuit)
- Voltage and current harmonic distortion
- Determination of harmonic distortion factors. Several different methods such as, for example, TIF, THFF or EDC can be used to evaluate calculated harmonic currents and voltages in the network.
- In harmonics calculations, PSS® SINCAL also considers transformer vector groups to let you calculate how the 5<sup>th</sup> and 7<sup>th</sup> harmonics cancel one another, if you have a YY0 transformer and another one rotated 30 degrees, when you have two 6-pulse bridges.

#### Ripple Control

PSS® SINCAL Ripple Control calculations determine the ripple control level of infeeder currents of ripple control transmitters. You can select any ripple control frequency you want and PSS® SINCAL will convert all impedances to the ripple control frequency. The program treats inductive and capacitive parts of equipment impedances separately.

PSS® SINCAL stores the results of the ripple-control calculations in the network database. If you wish, the results can be displayed on the screen in the network diagram. PSS® SINCAL has data screen forms and Tabular View for enhanced evaluations.

## Eigenvalues/Modal Analysis

The program PSS<sup>®</sup>NETOMAC – which is integrated in PSS<sup>®</sup>SINCAL – is used to determine eigenvalues.

In large electrical systems, the relationships between generators, network and closed-loop control devices are becoming more and more complex.

Modern processes that describe the behavior of the system in a simple and clear manner are needed to analyze interaction between these complex operating media.

For this purpose, an analysis of system eigenvalues is used.

Compared to the traditional simulation approach, these methods provide more information on system behavior with re-

spect to the following system conditions:

- Damping
- Frequency behavior
- Observability
- Controllability and mutual influencing

Special fields of application for eigenvalue analysis are intersystem oscillations, voltage stability, modeling of dynamic equivalents, controller design, sub-synchronous resonances and harmonics effects.

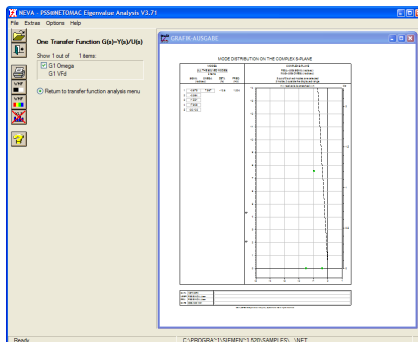


Figure 2: Evaluating eigenvalues with the NEVA user interface

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