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Basic Modules

PSS®SINCAL

Basic Modules for Planning and Managing Operations in Electrical Networks

These calculation methods are used for planning, designing and managing operations in electricity transmission and distribution networks as well as industrial networks. Networks examined in this way can be as complex as you want. The following basic modules are available:

- Load Flow Balanced
- Load Flow Unbalanced
- Short Circuit 3-Phase
- Short Circuit 2-Phase and Ground Circuit 2-Phase
- Ground Circuit 1-Phase

Load Flow Balanced

The balanced load flow is an effective tool for calculating operating conditions in electrical networks. This calculation method determines the power flow from the generators – through lines and transformers – to the power consumers.

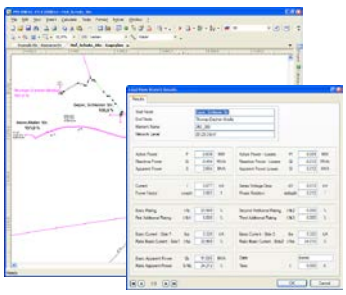

Figure 1: Branch results after load flow calculations

In PSS®SINCAL, different kinds of algorithms are available to solve the load flow problem (Current Iteration, Newton Raphson and Admittance Matrix). Particular emphasis has been placed on their robustness of the load flow procedures. Load flow problems can be solved under the most difficult conditions such as multiple feeders, generators and transformer controllers, poor supply voltage, etc.

Functional characteristics of the load flow calculations

- Load flow calculations are appropriate for all electrical networks. PSS®SINCAL can simulate transmission and distribution networks as well as industrial networks.
- Load flow calculations can handle more than one isolated network at the same time.
- Any number of infeeders and generators are supported.
- Voltage controllers can calculate the optimal tap position while automatically taking into account voltage ranges.
- Load flow can handle phase shifting transformers.
- Permissible operating ranges (P/Q) can be defined for generators and infeeders. PSS®SINCAL can also use a prescribed zone exchange power to calculate power transfer between different network areas.
- Establishment and shutdown dates can be defined for any equipment considered by the load flow calculations.
- PSS®SINCAL load flow supports load types with different voltage dependancy behavior.

Load Flow Unbalanced

Unbalanced load flow calculations are enhanced symmetrical load flow calculations. Just as in balanced load flow calculations, the unbalanced load flow calculates the flow of power from the generators – over lines and transformers – to the power consumers. In this case, however, the calculations are done for individual phases.

The network is still created and displayed as a one-phase network. Only the connection type is defined to create an unbalanced network.

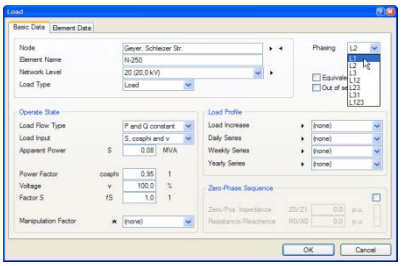

Figure 2: Selecting a phase for a load

For enhanced unbalanced network element modeling, negative- and zero-phase sequence data need to be entered in addition to the positive-phase-sequence data.

PSS®SINCAL prepares the results of the unbalanced load calculations (currents, voltages) for individual phases. The results for nodes and terminals also show the symmetry factor.

Short Circuit

Short circuit calculations are required for assessing the correct ratings for the network (maximum fault currents) and also for protection coordination (minimum fault currents).

PSS®SINCAL can calculate one-phase ground faults, two-phase short circuit and ground faults, as well as three-phase short circuits for individual nodes or entire sub-networks. This means the current distribution in the network can be determined for any fault condition.

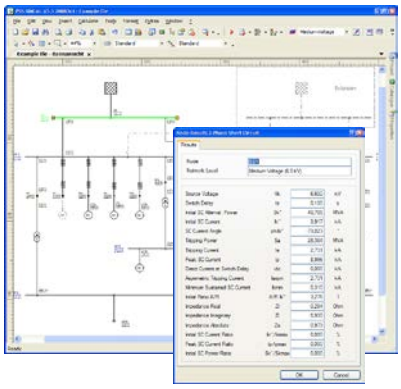

Figure 3: Node results for a three-phase short circuit

PSS®SINCAL calculates electricity values for current, voltage and power for one-, two- and three-phase short circuits according to the following standards:

- VDE 0102/1.90 – IEC 909
- VDE 0102/2002 – IEC 909/2001
- IEC 61363-1/1998
- ANSI
- G74
- with preload conditions from load flow calculation

Even though the method of calculation based on relevant standards is the most popular way to ascertain the correct ratings for networks, the load flow superposition method is actually a better way to determine minimum fault currents. This is especially the case when the fault current is in the same order of magnitude as the load current.

Key features of short circuit simulation:

- Calculations with symmetrical components
- Arc impedances can be considered
- Key values are Ik", ip, Ia, Sk", Uo, Z0/Z1
- Ip can be calculated either according to radial or meshed networks or the equivalent frequency method
- Block generators are implemented according to the standards in two different ways (two simple elements with additional data or only one combined element "generator unit")
- Neutral grounding

Phase shifts in transformers

- Calculations throughout all network levels at the same time
- Calculations of all currents and voltages in the whole network for a single fault location
- Calculations of faults at every node in specified network levels simultaneously
- Various reports for all nodes, all fault locations and all network levels
- Network graphics colored according to calculation limits e.g. 1-sec current for lines or short circuit currents at the busbars

Calculation Results

The results of all the calculation can be displayed in the network diagram and on tabulars. PSS®SINCAL can even provide some special results as diagrams (e.g. for voltage curves).

All the calculation methods have predefined reports to let you document input data and calculation results in detail.

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