Pipe Networks

PSS®SINCAL

Pipe Network Simulation for Water, Gas and District Heating

PSS®SINCAL is a powerful tool for planning and calculating supply networks for the various fields – for water as well as gas, district heating and electricity. So it is the perfect tool for suppliers of multiple energy sources – such as, for example, municipal utilities companies.

The user interface and the access and exchange functions are the same for all fields, letting you administer and maintain them simultaneously.

PSS®SINCAL Water

PSS®SINCAL for water supply networks calculates flow conditions in any number of meshed networks with different pressure levels for Newtonian fluids in filled pipes.

Calculation procedures to determine the run time and water quality have been integrated into the program.

PSS®SINCAL calculates the pressure, amount of flow and flow speeds and operational points of controllers and pumps. PSS®SINCAL even creates pressure-curve diagrams.

PSS®SINCAL Gas

PSS®SINCAL Gas calculates flow conditions in any number of meshed networks with different pressure levels. The same calculation methods as in PSS®SINCAL Water exist for Gas, and there is an equally wide range of results.

PSS®SINCAL District Heating

PSS®SINCAL District Heating can simultaneously calculate forward and return flow in any number of meshed heating networks, with no limit to the number of loops. Controller stations can be used to couple primary and secondary networks.

In addition to showing the pressure, the results identify amounts of flow and flow speeds, the pressure difference between forward and return flow, operational points of the pumps, temperature and heating power. PSS®SINCAL even creates pressure diagrams.

Simulation Methods for Pipe Networks

PSS®SINCAL can determine steady-state flow relationships quickly and conveniently in any number of meshed supply networks for Newtonian fluids in filled pipes. The algorithms are based on the Hardy-Cross method.

Available calculation methods:

- Steady-state calculation method
- Geostationary procedure
- Water tower level calculations
- Contingency analysis

Steady-State Calculation Method
PSS®SINCAL steady-state calculations determine the pressure and flow distribution in the network from the entries for the operating points of individual network elements. Then PSS®SINCAL uses the flow rate of the

material in the lines to calculate the run time and mixture of the material for all nodes.

PSS®SINCAL determines the following information for the entire network:

- Pipe lengths
- Pipe volumes
- Sum of supply sources and consumption
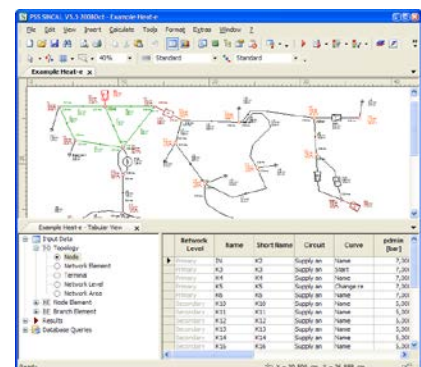- Minimum and maximum values
- Losses from leaks

Figure 1: Steady-state simulation of a district-heating network

PSS®SINCAL provides the results in the network diagram and in Tabular View, as well as in diagrams and reports.

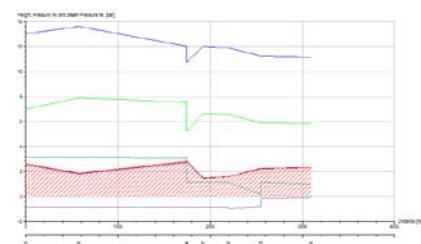When segment data are defined, PSS®SINCAL automatically creates profile curve diagrams.

Figure 2: Profile curve for district heating

Geostationary Procedure

Steady-state calculations are combined to created geostationary calculations. The changes between individual steady-state calculations are prescribed as factors of the time series or operating series.

During the individual steady-state calculations, PSS®SINCAL uses factors from the series to change the steady-state operating points of the network elements.

Geostationary calculations let you simultaneously calculate and then compare different steady-state operational incidents.

Defining time-independent (operating series) and time-dependent (time series) series let you:

- Simulate and compare different operational incidents

- Simulate short-term sequences over a period of time

- Simulate long-term growth over a period of time

- Simulate filling and removal

Water Tower Level Calculation

If water from/in the water tower inflows/outflows, another geodetic height of the water level in the water tower results because of the cross section of the water tower. The water level in the water tower causes another supply pressure at the water tower node.

The calculation time and the step width can be selected individually. In order to define the function of the water tower volume in dependence of the height of the water level, characteristics can be entered (form of the water tower).

The results of PSS®SINCAL water tower level calculations provide the parameters for height, pressure, volume and flow. These can be displayed either as diagrams or directly in the network diagram.

Contingency Analysis

The goal of contingency analysis is to evaluate the network condition when the following elements malfunction:

- Individual elements

- Elements that can operate only together
  (function groups)

- Overloaded elements

Contingency analysis is based on steady-state calculations. Malfunctions are normally created automatically. They can, however, also be prescribed manually.

- n - 1 criteria for network operation

- Breaks in supplies

- Overload conditions during network element malfunctions

- Impossible network conditions during network element malfunctions

- Priorities of network development measures

- Influences on consumer contractual agreements