FLOWNEX®

SIMULATION ENVIRONMENT **PROCESS**

Flownex® SE determines pressure drop [flow] and heat transfer [temperature] for the connected components of a complete system in steady state and transient, e.g. pumps or compressors, pipes, valves, tanks and heat exchangers.

TYPICAL USES:

ANALYSIS

- Simulation.
- Performance assessment.
- Modification assessment.
- Fault root cause assessment.

DESIGN

- System sizing.
- Component sizing.
- Determining operating ranges.
- Flow, temperature, pressure, power consumption, etc.
- Testing of control philosophy.

TRAINING

- System behavior examination.
- Performing basic flow and heat transfer calculations.
- Thermohydraulic principles and properties referencing.

BRINGING NUCLEAR QUALITY AND STANDARDS TO SYSTEM SIMULATION

Flownex® is developed in an ISO 9001:2008 quality assurance system and NQA1 supplier approved environment.

"I am not aware of any other tool with which I could have obtained the required results in such a short time span. Part of the success must undoubtedly be attributed to the prompt and high level support provided by Flownex® International almost daily in answering all my questions and offering suggestions throughout this very technically challenging simulation. The support fee has been paid for with this one project!"

Hannes van der Walt
Senior Thermal & Process Engineer
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MINIMISE TIME-TO-PRODUCTION / SPEED UP COMMISSIONING
DETERMINE BEFOREHAND THE ENERGY CONSUMPTION OF A PROCESS

PIPE SYSTEMS
(LIQUID/GAS & HEATING/COOLING)

- Calculation of pressure drop for gases or liquids.
- Pump, valve and pipeline sizing.
- Pump performance adjustment for viscosity.
- Sizing of control valves and orifices.
- Design of liquid/gas distribution systems.

- Flow balancing in branching networks.
- Analysis of transient events like pressure wave (water hammer/surge) propagation.
- Control philosophy development and testing using the built-in PLC function block diagrams.
- Sizing of pressure safety valves.

- Simulation of a valve failure event.
- Calculation of heating or cooling requirements for various processes.
- Heat loss/pickup calculations.
- Insulation sizing.

- Pipework velocities, pressure drops.
- Calculation of NPSH and prediction of cavitation.
- Water hammer.
- Sizing of safety relief valves.
- Cooling tower response.

COOLING WATER SYSTEMS

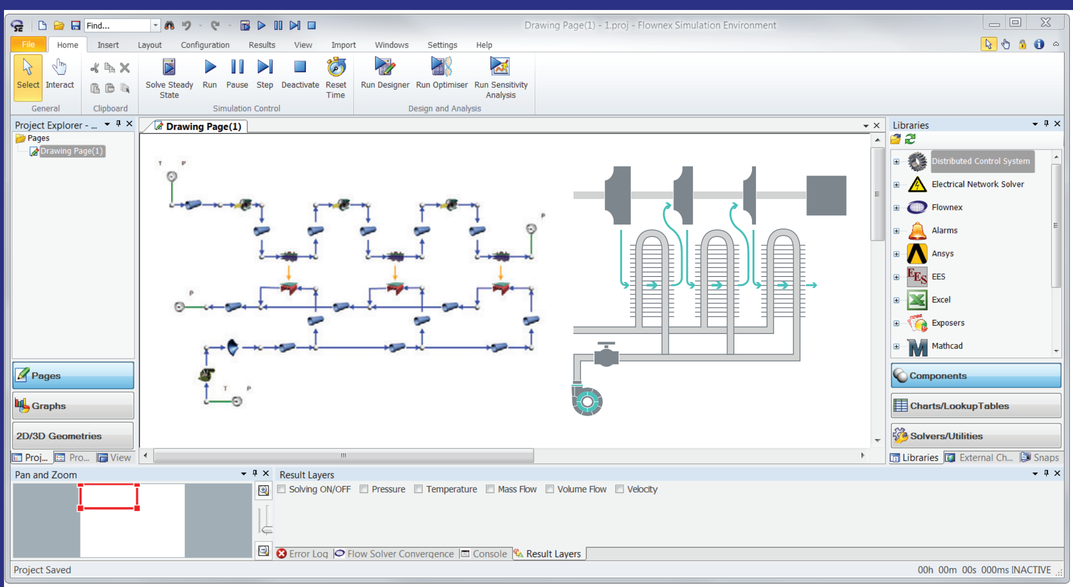
- Pipeline, valve and pump sizing.
- Water hammer.
- Cooling tower response.
- Heat exchanger sizing.
- Water reticulation flow balancing and energy efficiency.

FIRE PROTECTION SYSTEMS

- Pump, pipe and tank sizing.
- Sizing of nozzles and orifices.
- Flow balancing.

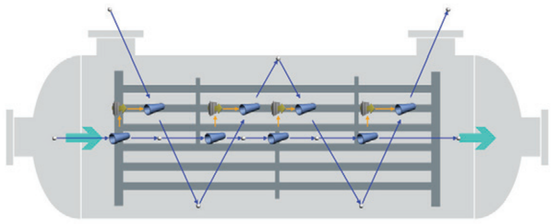
COMPRESSED AIR SIMULATION

- Reticulation system design and pipe sizing.
- Compressor selection.
- Energy optimization.
- Heat exchanger sizing (inter- and after coolers).



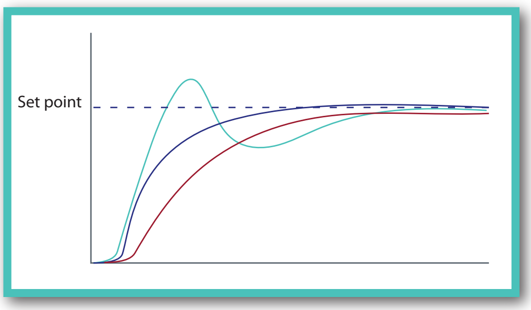
HEAT EXCHANGERS

- Calculating heat transfer and pressure drop for various geometries: finned tube, shell and tube, tube-in-tube, plate heat exchangers.
- Calculating the heating or cooling requirement for various processes: evaporation, condensation or temperature control.
- Calculation of natural circulation evaporator recirculation rate.
- Simulation of transient behavior for startup, shut-down or process upset conditions.
- Calculation of temperatures and boiling pressure drop.
- Calculation of metal temperature change rates during transients.



SLURRIES, PASTES & NON-NEWTONIAN FLUIDS

- Calculation of Non-Newtonian fluid pressure drop.
- Balancing of flow in branching pipe networks.
- Assessment of pressure pulse transients.



INTEGRATED SYSTEMS ANALYSIS

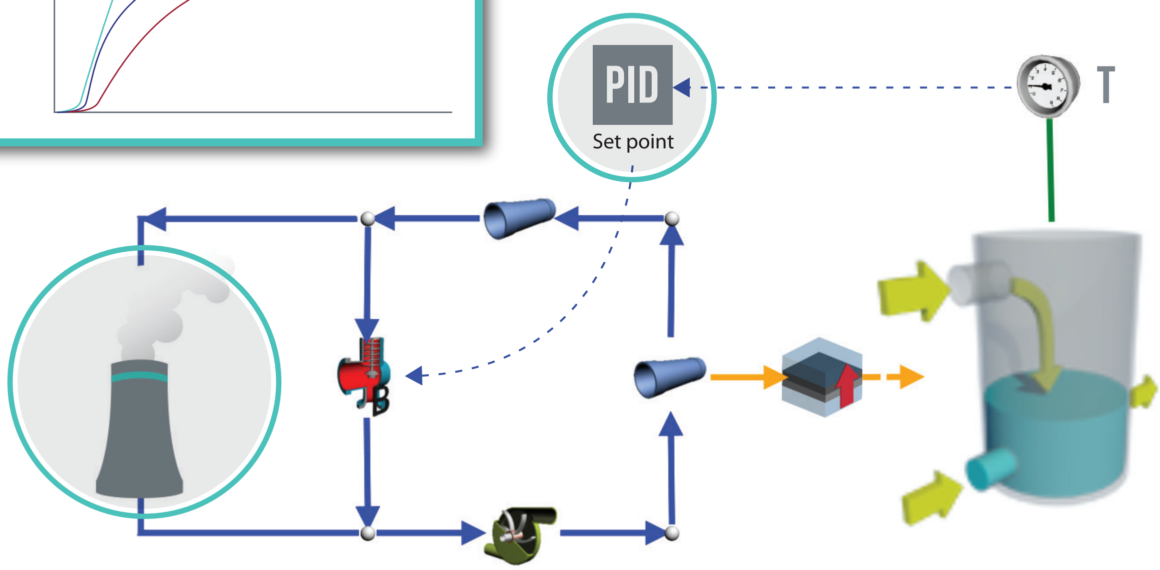
- Liquefied natural gas (LNG) storage and handling.
- Interaction between pipeline flow/pressure and the pump/turbine set including its control.
- Cryogenic system thermal fluid analysis using two-phase flow tanks, pressure drop, heat transfer, incondensable gas mixtures etc.
- Simulation of refrigeration systems for cryo-genic cooling during natural gas liquefaction.
- Natural gas liquefaction.
- Design of gas venting and inventory control systems.
- Simulation of gas turbine driven pipeline booster pumps.
- Simulation or system integration of gas turbine driven compressors for natural gas liquefaction.
- Pipe system pressure control design.

HYDRAULIC SYSTEMS

- Pump selection and pipe sizing.
- Flow distribution.

TEMPERATURE CONTROL LOOP DESIGN

- Calculate heat exchange process dynamics.
- Tune PID controllers before commissioning.
- Assess the sensitivity to environment temperature.



STEAM SYSTEMS

SUPER HEATER & MAIN STEAM PIPING

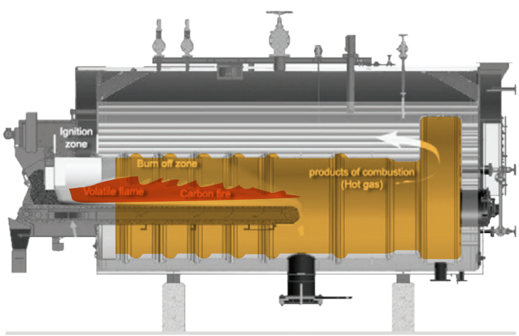
- Calculation of metal temperatures and change rates.
- Commissioning assistance.
- Pipe sizing.

STEAM TURBINE & SUPPORTING SYSTEMS

- Start-up and shutdown simulation.
- Turbine trip control simulation.
- Gland steam system analysis.
- Lubrication system analysis.

ONCE-THROUGH BOILERS

- Flow balancing.
- Assessment of boiling stability.
- Calculation of flow/boiling regimes.
- Assessment of control.



NATURAL CIRCULATION BOILERS

- Calculation of recirculation rate and steam production.
- Prediction of dry out.

FEED WATER

- Root cause analysis of pump NPSH problems.
- Analysis of feed water heater tube breaks.
- Cavitation/phase change detection.

COOLING WATER CIRCUITS

- Flow balancing.
- Pump and pipe sizing.
- Energy optimization.
- Heat load calculations.
- Heat exchanger sizing.
- Water reticulation system design.
- Water hammer analysis and prevention.
- Environment - cooling tower - plant matching.

BOILER FUEL OIL DISTRIBUTION

OIL & PETROCHEMICAL CASE STUDY

CHALLENGE: Uniform fuel distribution and acceptable performance at low temperature due to oil viscosity. Therefore, in order to force the flow to be similar in each branch, the resistance path for each branch should be similar. With the pump in the incorrect position and many high primary resistances in the line (due to long pipe runs), this resulted in increased pressure drop, triggering larger pumping power which is required to balance flow at the branches further away from the pump.

SOLUTION: Using Flownex® ensured that Steinmüller could set up an accurate model of an existing fuel oil distribution network. It was discovered that due to the large diameter ratio of the supply manifold and fuel oil spray nozzle, a high enough back pressure was created to pressurize the whole manifold.

Heat loss from the pipes to ambient conditions was also taken into account, for the viscosity of oil changes drastically with temperature, especially in the low-temperature range. The heat transfer properties of the pipe and insulation layers were taken into account, and appropriate free convection heat transfer correlations were implemented to predict the temperature distribution accurately throughout the system.

Steinmüller

FLARES & BURNERS

- Calculation of gas consumption rates.
- Pressure-, temperature- and composition-dependent combustion modeling.
- Calculation of conjugate heat transfer (convective, conductive and radiative heat transfer).
- Calculation of heat-up or cool-down times.
- Natural or forced draft stack sizing.
- Fan sizing.
- System integration: simulation of flare control and interaction with the main pipe system.

SOME FLOWNEX® LICENSE HOLDERS

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GASCO
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