JTopmeret™ JADE™ Two-Phase Fluid Modeling Software

JTopmeret is based on GSE Systems’ proven two-phase network software tool for modeling thermal-hydraulic fluid systems. Originally designed for nuclear power balance of plant systems, it has excellent applicability to two-phase systems such as fossil steam, feedwater, and boiler systems, as well as combustion turbines. JTopmeret can also be used for single-phase applications such as compressor stations, plant safeguard, and service systems.

A model in JTopmeret is constructed with simple building blocks such as nodes, flows, heat exchangers, and turbines using the fundamental principles of mass, momentum, and energy balances. JTopmeret provides a fast and stable solution for pressures and flows by simultaneously solving the mass, momentum, and state equations in a matrix. By separating the energy balances of the gas and liquid phases and using the gas/liquid interfacial heat and mass transfer, JTopmeret makes no assumptions of thermal equilibrium. As a result it accurately simulates system thermodynamic responses in a wider range of plant conditions.

As a part of GSE’s JADE environment, JTopmeret shares our single graphical user interface and offers the portability of a truly platform independent software tool.

Features

JTopmeret provides true high-fidelity simulation for nuclear and fossil power plants, combined cycle units, and gas compressor stations. The result is realistic operator training and effective engineering evaluation.

Expanded modeling capability through

- Use of a two-phase (gas and liquid), multi-component (N2, O2, H2, CO2, SO2, NOx, etc), non-thermal equilibrium model
- Mass, momentum, and energy balances for each phase
- Comprehensive heat transfer correlations for all heat transfer regimes (natural and forced convections, nucleate boiling, condensation)
- Support for run-time laminar/turbulent flow regimes cross-over
- Inherent critical flow calculations on gas/liquid flows provide accurate results for both initial and post transient scenarios
- Separate temperature modeling for solids, including metal/concrete walls, heat exchanger tubes, turbine metals, etc.
- Activity tracking of up to 9 different species including decay chains

Efficient model development and testing with:

- Use of JADE’s single GUI allowing system drawings to be viewed on any instructor, trainee, or engineer’s JStation
- Automatic constants calculation for flow admittance and pump characteristic coefficients
- Automatic generation of database, constants, initial conditions, and program code
- Portability across Microsoft, Linux, and UNIX operating systems

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GSE Systems
www.gses.com/simulation
JTopmeret Benefits

- The modeling tool provides a simulator with expanded capabilities for more effective operator training
- Its sophisticated model can be used for plant transient performance evaluations
- Realistic real-time response facilitates DCS or control system design modification and optimization avoiding extended plant outages

Implementation

JTopmeret icon libraries contain all the basic building blocks for fluid system models. The user can easily develop a flow network by dragging and dropping the predefined icons and connecting the icons with flow paths drawn by moving the mouse pointer. Some of the predefined icons include:

- Valves
- Pumps
- Tanks
- Turbines
- Heat Exchangers
- Heat fluxes
- Nodes & Boundaries
- Transmitters

To improve coding efficiency and provide consistent results, we have automated code and database generation, deriving all the segments necessary to simulate the pressures, flows, masses, densities, enthalpies, and temperatures. JTopmeret also generates the database for the run-time executive system, including values for all the constants and initial values for the variables. The user friendly autogeneration program provides extensive diagnostic messages, as well as internal checks so that errors in the configuration of the system are discovered at the generation time and do not have to be debugged in a run-time environment.

Summary

As a part of GSE’s JADE environment, JTopmeret two-phase graphical modeling software allows engineers to accurately simulate and maintain complex thermal-hydraulic network systems. The use of JTopmeret for such systems not only significantly expands the simulation but provides realistic dynamic responses. This results in more in-depth, effective operator training and engineering evaluations.