

GOTHIC

A Workhorse for Thermal Hydraulic Systems Analysis

GOTHIC™ is a comprehensive software package for efficient analysis of thermal hydraulic transients involving water, steam and noncondensing gases. GOTHIC is a versatile, easy to use, accurate tool for modeling a wide range of systems and events. From simple “lumped” analysis to detailed three dimensional modeling, GOTHIC combines features that quickly get you effective solutions. It is used extensively in the nuclear utility industry for safety related applications.

Example Applications

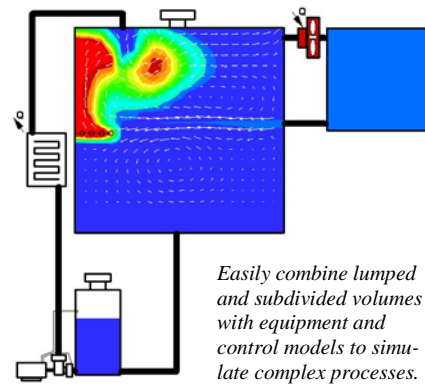
- Nuclear plant design basis accident
- Water hammer and pressure surge
- Spray cooling and heating
- Toxic gas dispersion
- Hydrogen dispersion and burn
- Building HVAC system performance
- Spent fuel storage
- Heat exchanger performance
- Evaporative cooling
- Piping system transient analysis
- Multiphase flow

Versatile

In a single code package, GOTHIC combines capabilities to model single and multi-phase flow and heat transfer in 0-, 1-, 2- or 3-dimensional analysis. Users can link in heat exchangers, fans, valves and other components to control the system behavior. No other code package provides such a wide range of capabilities.

Graphic Model Setup/Output

Prepare models using a graphical interface that features simple noding diagrams for assignment of input and a full record of input parameters in easy-to-read tables. Add, modify and delete model elements to create new models—GOTHIC keeps track of the model element associations. GOTHIC checks input for consistency and appropriate values before running your simulation.



Easily combine lumped and subdivided volumes with equipment and control models to simulate complex processes.

Work directly with your model noding diagrams to create the line, vector and contour plots you need to analyze your results. Create animations of your transient by using GOTHIC capability to generate data files for third party output analysis programs. Export data tables, noding diagrams and graphical results for import to your project documentation.

Proven Accuracy

GOTHIC has been qualified by hundreds of models and comparisons with analytic solutions and experimental results. Experimental comparison include small scale separate effects tests and large scale integrated tests for water and steam blowdown in multi compartment geometries. Many of the models are documented in the GOTHIC Qualification Report.

Benefits

GOTHIC's versatility, ease of use and accuracy mean that jobs get done correctly, on schedule and within budget.



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Features

GOTHIC models up to three separate but interacting phases:

- Vapor
- Liquid
- Drops

Physical models are included for interphase drag and heat and mass transfer to model boiling, evaporation and condensation in a wide range of flow regimes including single phase, bubbly and film/drop flows.

Each phase is tracked with its own set of mass, energy and momentum balance equations to allow modeling thermal non-equilibrium, phase slip and counter current flows. The vapor phase is made up of steam and any number of non condensing gas components. GOTHIC tracks each of the gas components to predict gas dispersion.

Thermal conduction through walls and structures in contact with the fluid can be included in the model. Select from a variety of heat transfer options to model the thermal connections between the solids and the fluid. Radiant heat transfer between conductors and between conductors and the steam is available.

Equipment elements model heat exchangers, valves, pumps, fans and other special purpose components. Trips and control variables define the operation of the equipment during the transient. Models are also available for hydrogen combustion and radioactive isotope transport and decay.

The region of interest is modeled with a combination of lumped and multidimensional volumes. Lumped volumes give average conditions in regions that can be considered well mixed or are peripheral to the problem objective. Multidimensional volumes give

detailed information on the phase, velocity, temperature and gas distribution within the system. Molecular and turbulent diffusion models are available for multidimensional analysis.

Who Uses GOTHIC

More than 25 U.S. utilities use GOTHIC for safety analysis and equipment qualification.

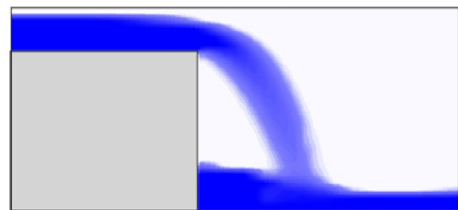
Canada has adopted GOTHIC as part of their Industry Standard Tool Set for nuclear plant analysis. Mitsubishi Heavy Industries in Japan and KOPEC in Korea use GOTHIC for containment analysis.

GOTHIC is used for the containment licensing analysis for new plant designs, including the AP-1000, ABWR, EPR and APWR.

Product Information

GOTHIC is developed and maintained by NAI under an industry approved QA program for the Electric Power Research Institute. The code package includes software and full documentation. NAI provides code support, training and analysis services with GOTHIC.

GOTHIC is available for Unix/Linux and Windows computers.



GOTHIC simulation of water flowing over a step.



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