

PlantFLOW

Piping Flow Analysis using 3D Geometry Interfaces with CAD and Piping Stress Analysis

PlantFLOW calculates steady state single phase pressures, flow velocities, temperatures, and fluid properties in gas or liquid piping networks, including networks with branches and loops. PlantFLOW enables users to quickly see the big picture on overall system performance in order to optimize pipe sizes, balance flows, select and position equipment, and evaluate different valve scenarios.

PlantFLOW enables users to quickly build, modify and review results of piping flow models using real world 3D geometry with the ability to import models from plant design CAD systems or piping stress models.

Thermodynamics coupled with the Flow Equation

Why take chances with fluid mixture properties by assuming ideal gas, constant 'average' properties, or other simplifications, when fluid properties are actually changing with temperature and pressure throughout the system?

Using point-by-point calculation of thermodynamic and transport properties along with pressure and temperature changes, PlantFLOW has coupled thermodynamics with the flow equation for more accurate flow simulations, especially in systems with non-ideal mixtures. PlantFLOW will calculate if flashing or sonic choking occurs anywhere in the system, and will warn the user.

PlantFLOW has coupled the flow equation with the following thermodynamic options:

- NIST (National Institute of Standards and Technology) Supertrapp thermophysical model and 196 component fluid database, mixtures up to 15 components (<http://www.nist.gov/srd/nist4.htm>)
- AGA (American Gas Association) Report 8 thermophysical model and 20 component fluid database, mixtures up to 20 components
- ASME steam table equations
- User defined fluid library – Peng Robinson for mixtures

NIST and AGA options are primarily used for hydrocarbon and hydrocarbon related (i.e. oxygen, helium, hydrogen, nitrogen, etc.) components.

Heat Transfer

- Simple or detailed modeling of heat exchangers. Options for shell and tube, crossflow and single pass exchangers, or simple outlet temperature, or heat load type exchanger model
- Simple or complex heat transfer options for pipe insulation and environmental thermal loads

Interface with Plant Design CAD or Pipe Stress

Import piping models from Rebis® AutoPLANT® or Intergraph PDS plant design CAD systems. Bi-directional model interface with Rebis' AutoPIPE® pipe stress analysis software. Intergraph PDS interface requires Rebis' STRAIT software.

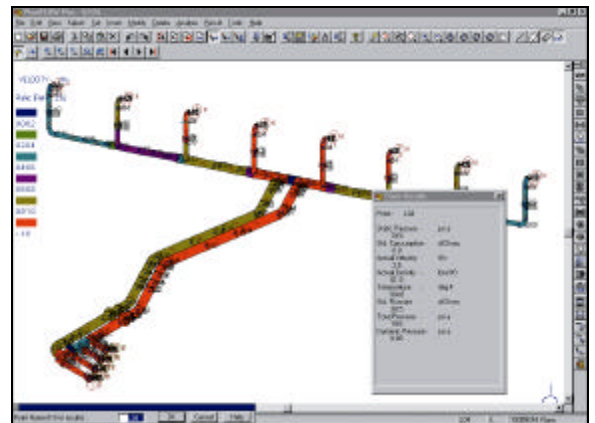
Object Based Graphics make a Difference

Graphically select sections of the piping model to insert, delete, or make global modifications to pipe diameters, valve loss, flow direction, pipe roughness, or other parameters or components across tens or hundreds of points with just one command. Turn sections of the model "On" or "Off" to evaluate different design scenarios. Graphically copy and paste repetitive sections. Unique multi-level undo/redo.

Graphical Review of Analysis Results

As an alternative to manual searches through voluminous output reports, PlantFLOW enables users to immediately visualize system performance problems which exceed user specified criteria using color coded graphics and pop-up windows with selected data. For example, graphically highlight in red all points which exceed a user specified velocity. Point and click on the graphics model to view pressure, temperature, velocity, and fluid density at any point. Check difference in pressure, velocity, or temperature between any two points in the system by clicking on them.

Unique Result Filters isolate only the results exceeding the user specified filter criteria. For example, highlight only points on 4" pipe which exceed a user specified velocity or temperature.



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3D Geometry Options

Users who don't wish to model using detailed 3D geometry can use the User Loss element to simulate multiple elbows, valves, and other component losses without having to input each component.

When detailed layout is known, 3D geometry enables users to build and visualize piping models as they actually exist and also provides the option to transfer piping flow models from CAD or piping stress. Users can visually see the difference between large and small diameter pipes, and check for elevation changes to reduce modeling errors. Closely spaced elbow/elbow and elbow/tee interaction cannot be considered without 3D elbow orientation.

Features

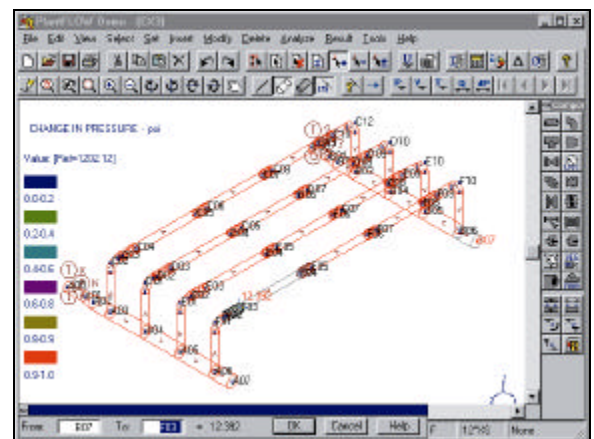
Analysis

- Darcy (with modified Colebrook White equation), Hazen-Williams, AGA, Weymouth, Panhandle A & B pipe friction models. Automatic calculation of friction factors
- Extensive library of component K-factor expressions based on Crane technical paper 410, Miller, Idelchik. User specified options for fixed loss, K-factor, Cv, or variable loss as a function of flow
- AGA-8, ASME Steam, Peng-Robinson, and NIST thermophysical models for calculation of Z-factor and other thermodynamic properties of gas or liquid mixtures. Variable fluid properties throughout system as a function of pressure and temperature
- Automatic detection of choked flow with all thermodynamic options. NIST and ASME steam options warn if flashing occurs
- Considers pressure changes due to elevation as well as static pressure and dynamic pressure (from velocity)
- Simple or complex heat transfer analysis for pipe material, insulation, and environmental thermal loads
- Heat exchanger models for shell and tube, single pass, and crossflow. Simplified exchanger models using outlet temperature or heat load
- Option to set a pressure at any point as a boundary condition
- Explicit modeling of pumps and compressors using Flow versus Head curves. Changes in temperature and fluid properties are automatically calculated. Equipment in series or parallel
- Option to calculate horsepower required by pump or compressor
- Option to calculate operating speed of pump or compressor
- Option to consider closely spaced bend-bend and bend-tee interaction coefficients

User Interface

- Import Rebis AutoPLANT, Intergraph PDS plant design CAD models. Bi-directional link with AutoPIPE pipe stress models
- Graphical copy and paste, rotate, slide assemblies. Zoom, pan, rotate, mouse point and click. Single line isometric or solid model display

- Ability to graphically select ranges of points to insert, delete, or modify components and parameters across entire sections of the model with one command
- Graphical review of analysis results using color coded graphics to highlight points which exceed user specified criteria and pop-up windows with selected data. Point and click on the model to view results at any point
- Interactive Delta mode option checks differences in pressure, velocity or temperature between any two points by clicking on them
- Undo/redo up to 99 of your last operations
- Result Filters to isolate output results. View only points which exceed user specified velocity, pressure drop, temperature, or other criteria
- Printed output report options. Graphically select what to include in output reports
- Option to turn piping sections on or off to analyze different design scenarios
- Volume and mass flow options
- Imperial, SI, metric, user defined units
- Automatically determines flow direction for each flow path in the network, and highlights points where 'negative' flows are detected
- Loss models for orifice plates, valves, straightening vanes, turbine meters, tees, wyes, elbows, strainers, expansions, and contractions
- Automatic renumbering of nodes
- Extensive, easy-to-follow, on-line Help in HTML with theory, examples, index, and hyperlinks to related topics
- Networks up to 10,000 points in Plus version



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