ALGOR®

INTERNATIONALIZED FEA SOFTWARE
简体中文
Deutsch
English
Español
Français
Italiano
SIX LANGUAGES

Fluid Flow

Fluid flow capabilities include the determination of steady and unsteady flow patterns for incompressible, laminar, Newtonian or non-Newtonian fluid flow. These analysis capabilities are all available within FEMPRO, ALGOR's easy-to-use, single user interface for finite element modeling, results evaluation and presentation.

MODELING

A suite of modeling capabilities includes:

- InCAD technology for direct CAD/CAE data exchange with Alibre Design, Autodesk Inventor, Inovate, IronCAD, KeyCreator, Mechanical Desktop, Pro/ENGINEER, Rhinoceros, Solid Edge and SolidWorks
- full associativity with each design change for most CAD solid modelers
- CAD support for 2- and 3-D CAD universal files
- ability to automatically model the fluid medium based on a CAD solid model
- capability to model flow obstacles as distributed resistance parts
- Superdraw 2- and 3-D sketching tools
- 2- and 3-D parametric structured meshing
- automatic, unstructured 2- and 3-D meshing
- automatic, intelligent, feature-based mesh refinement and point-and-click definition of areas where a finer mesh is desired
- a midplane mesh engine for reducing thin, solid features in a CAD model to plate/shell elements with automatic handling of parts, assemblies, multi-thickness regions and mixed element type models
- an automatic, hex-dominant hybrid solid meshing tool to produce higher quality elements on the first pass and more accurate results

ANALYSIS

Fluid flow analysis capabilities include:

- support for 2- and 3-D designs
- steady and unsteady fluid flow analysis for the simulation of incompressible, viscous flows as governed by the Navier-Stokes equations
- inlet and outlet pressure load capabilities that do not require knowledge of flow rates
- turbulence capabilities that allow the prediction of turbulent flow (large changes in velocity over small distances) and laminar flow (smooth, gradual changes in velocity distribution) at the same time in the same model
- capabilities for flow through porous media
- coupled heat transfer and fluid flow analysis to accurately simulate natural, forced or mixed convection
- transfer of fluid flow results to a static stress or Mechanical Event Simulation for fluid-object interaction studies

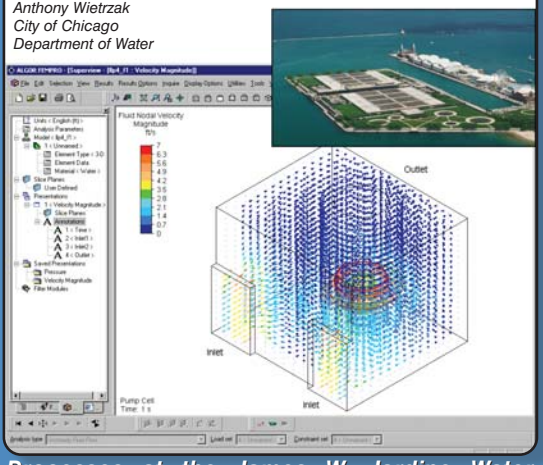
RESULTS EVALUATION AND PRESENTATION

A built-in graphics environment provides extensive results evaluation and presentation capabilities and features transparent display options, multiple-window displays, fast dynamic viewing controls and customization options including user-defined color palettes and annotations. All analysis results can be:

- displayed graphically as contours
- output in the BMP, JPG, TIF, PNG, PCX and TGA formats
- animated with AVI creation and display tools
- presented in text, HTML or PDF reports

"ALGOR's complete suite of simulation tools is enabling us to formulate modifications that improve the water purification process. The tools offered will enable us to study many phenomena on the computer and make many enhancements without the need for laboratory testing."

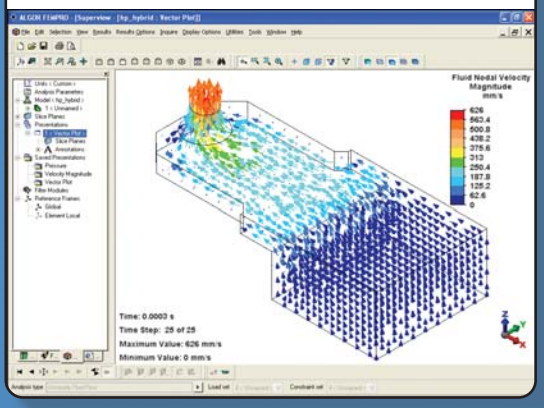
Anthony Wietrzak
City of Chicago
Department of Water



Processes at the James W. Jardine Water Purification Plant in Chicago, Illinois, the largest water treatment plant in the world, were optimized based on fluid flow analysis results.

"ALGOR's fluid flow analysis software gives me the ability to imagine and design the inside of a product that is impossible to visualize any other way."

Bill King
Hewlett-Packard



The Hewlett-Packard Company optimized ink flow in the ink feed channel of this thermal inkjet print head with unsteady fluid flow analysis to maximize print quality.

An exhaust manifold was modeled in KeyCreator (left); after specifying the surfaces for modeling the fluid medium in FEMPRO, a new part was automatically created (middle) where a steady fluid flow analysis was performed to determine velocity magnitude results (bottom right).

FLUID FLOW FEATURES

Analysis Capabilities
- Steady fluid flow
- Steady fluid flow with turbulence
- Unsteady fluid flow
- Unsteady fluid flow with turbulence
- Flow through porous media
- Multiple, independent fluids
- Natural convection (buoyancy)
- Forced convection
- Mixed convection
- Viscous flow
- Gravity-driven flow analysis
- Vortex shedding simulation
- Velocity profiling
- Residence time
- Fluid-solid interaction

Modeling
- See the FEMPRO (Part No. 3201.326) and CAD Support (Part No. 3201.331) product data sheets for the complete list of modeling features

Meshing
- See the CAD Support product data sheet (Part No. 3201.331) for the complete list of meshing features

Element Library
- Fluid 2-D element (planar, axisymmetric)
- Fluid 3-D element

Material Models
- Fluid isotropic
- Fluid orthotropic
- Fluid isotropic power-law
- Fluid orthotropic power-law

Loading and Constraints
- Forces (gravitational)
- Pressures
- Tractions
- Local coordinate system support
- Rotating reference frames
- Automatic constraints of walls
- Prescribed velocities (nodal, surface and edge)
- Fan effects

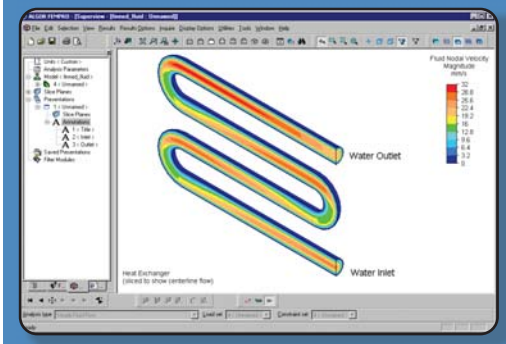
Solver Options
- Symmetric sparse
- Unsymmetric sparse
- Skyline
- Preconditioned bi-conjugate gradient iterative
- Preconditioned bi-conjugate gradient stabilized iterative
- Preconditioned conjugate gradient square iterative
- Preconditioned GMRES iterative
- Segregate
- Restart capability
- Parallel processing for multiple processors

Results Evaluation
- Result displays of:
  - Fluid flow velocity, pressure, vorticity, streaklines and streamlines
  - Reaction force, stress tensor and maximum principal and minimum principal stress resulting from the flow of fluids
  - Vector plots of fluid flow velocity
  - Particle tracking of fluid flow
  - User-supplied functions operating on calculated results, user-supplied constraints and material properties
- Automated tools for multiphysics simulation to:
  - Transfer fluid flow results to a static stress analysis or MES
  - Couple heat transfer and fluid flow analysis to accurately simulate natural, forced or mixed convection
- See the FEMPRO product data sheet (Part No. 3201.326) for additional results evaluation features

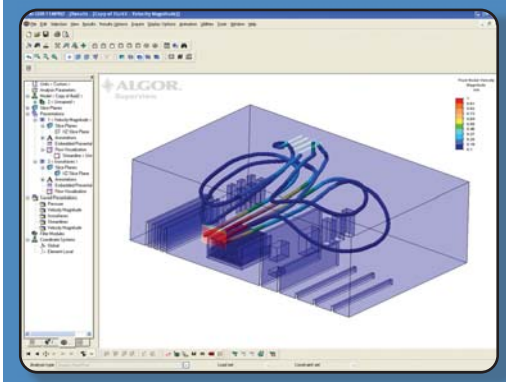
Results Presentation
- See the FEMPRO product data sheet (Part No. 3201.326) for the complete list of results presentation features

User Interface
- See the FEMPRO product data sheet (Part No. 3201.326) for the complete list of user interface features

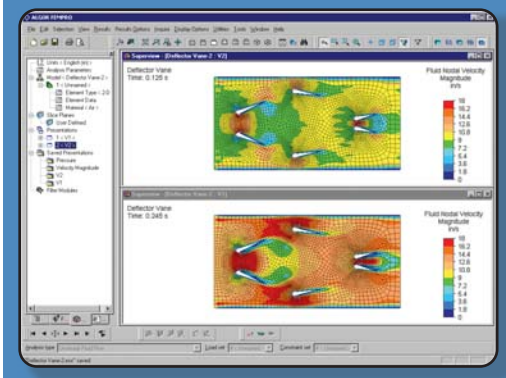
Note: For complete details on our fluid flow features, see the "Products" section of www.ALGOR.com. ALGOR's web site contains additional information about our wide range of simulation capabilities including static stress and Mechanical Event Simulation (MES) with linear and nonlinear material models, linear dynamics, fatigue, steady-state and transient heat transfer, steady and unsteady fluid flow, electrostatics, full multiphysics and piping.



A steady fluid flow analysis was performed on an aluminum heat exchanger to calculate velocities for determining the effect of forced convection on the temperature profile.



Steady fluid flow analysis was used to determine the velocity profile for fan-generated air flow within this electronic enclosure. Streamlines show the flow path over objects attached to the base.



This unsteady fluid flow analysis shows the air flow patterns for this chamber, in order to study flow mixing. Since laminar flow was most desirable, the orientation of the vanes with respect to the inlet was critical.

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