

KEYWORDS

Computational Fluid Dynamics

CFD

Compressible Flow

Incompressible Flow

Heat Transfer

Multiphase Flow

Reactive Flow

Turbulence Models

Fluid-Structure Interaction

Uncertainty Analysis

Numerical Methods

Algorithm Development

Parallel Computing Methods

Nonlinear Modeling and Simulation

Southwest Research Institute (SwRI) has been developing, enhancing, and applying advanced computational fluid dynamics (CFD) simulation tools to the solution of clients' problems for more than 20 years. The SwRI staff brings internationally recognized expertise in algorithm development, modeling and simulation of a broad range of applied engineering problems, as well as the ability to perform fundamental analyses to discover the underlying physical processes that control a system's response. The staff utilizes a suite of CFD codes and computer resources to solve a broad spectrum of problems such as:

- First-principles analysis of complex fundamental flows
- Multiphase flow in complex pipeline systems with phase change
- External aerodynamic analysis for a range of body shapes
- Atmospheric dynamics for Earth and Mars
- Turbomachinery flows analyzing stall and surge characteristics
- Turbulent mixing of chemical species with reaction kinetics
- Explosive hazard analysis for dispersed phase mixtures
- Fluid-structure interaction with six-degrees-of-freedom dynamics
- Simulation of subsurface flow through porous and fractured materials

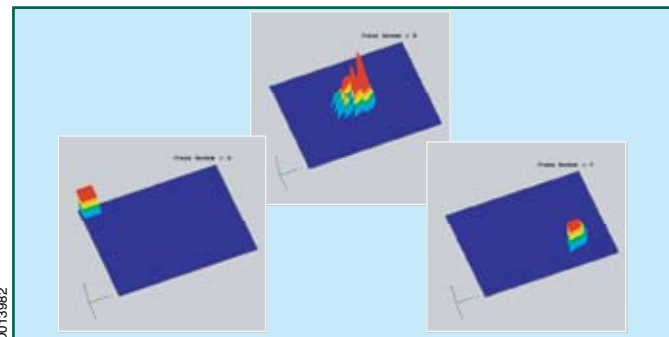
- Turbulent flows accounting for cavitation and phase change
- Particle and droplet dynamics

The Engineering Dynamics Department staff has the expertise to develop, enhance, and apply CFD codes to existing or new classes of problems that clients may need to address, and can accomplish this within the client's cost and schedule constraints. An integrated approach using physical experiments, numerical simulations, and analytical methods is routinely employed to investigate and solve complex nonlinear fluid flow and heat transfer problems.

Capabilities

SwRI maintains a suite of CFD software and computer resources which provide a broad foundation to support modeling and simulation projects of widely different sizes and scope. SwRI is a member organization of *Internet2*.

Software	Source
NSC Codes	SwRI
FLOW-3D	Flow Science
Overflow	NASA
CTH	Sandia
Multiflo	SwRI



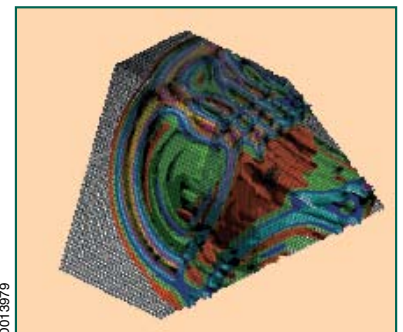
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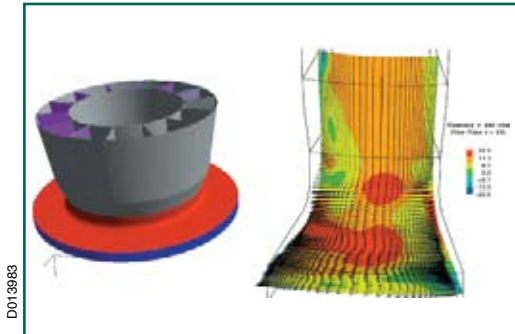
Aerodynamic simulation of airflow distribution around an aircraft during a pitching maneuver; wake region of aircraft is visualized by streamline ribbons

Evaluation of different numerical methods; unbounded versus bounded convective schemes



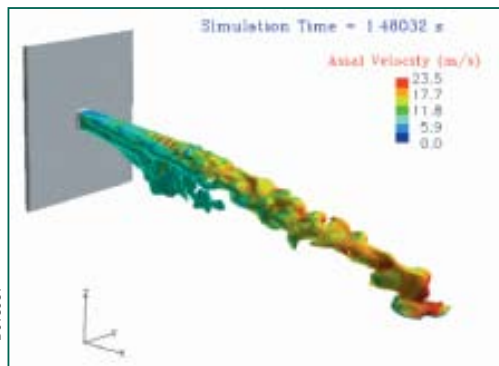
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Simulation of detonation of a condensed explosive in a rigid, liquid-filled structure; pressure field spatial distribution is visualized by contour surfaces



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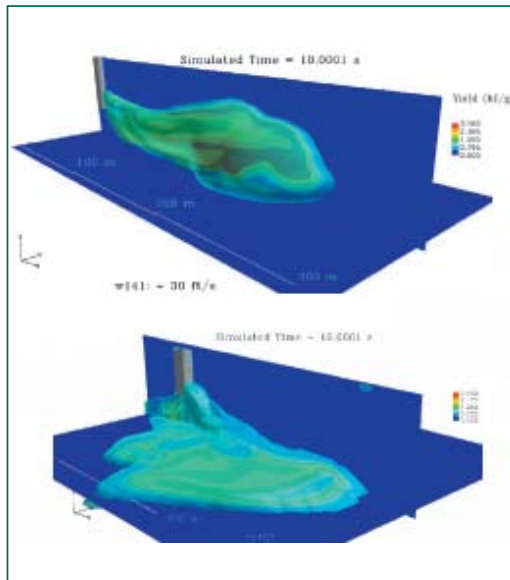
Simulation of surge onset in a centrifugal compressor impeller inlet duct, showing overall geometry with a cut plane revealing the 14-inlet ducts (left) and velocity field distribution in one inlet duct (right)



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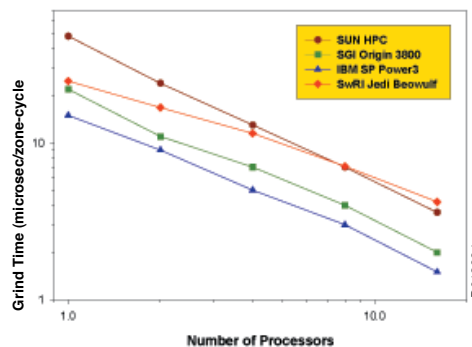
Simulation of the breakup of a liquid jet streaming into a quiescent air volume

Illustration of parallel performance for a computer code on different parallel computers



D013980

Simulation of development of a fuel/air plume with low density fuel (top) and higher density fuel (bottom) released from a tank; contours display the yield potential within the plume



D013984



Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides more than 2 million square feet of laboratories, test facilities, workshops and offices for more than 3,300 employees who perform contract work for industry and government clients.

We welcome your inquiries. For additional information, please contact:

Christopher J. Freitas, Ph.D., P.E.
 Program Manager, Computational Mechanics
 (210) 522-2137
 christopher.freitas@swri.org

Engineering Dynamics Department
 Mechanical and Materials Engineering Division
 Southwest Research Institute
 6220 Culebra Road • P.O. Drawer 28510
 San Antonio, Texas 78228-0510

Mary Ann Clarke, Ph.D.
 Research Engineer, Computational Mechanics
 (210) 522-5587
 maryann.clarke@swri.org

Southwest Research Institute Website:
www.swri.org
 Engineering Dynamics Department Website:
www.engdyn.swri.org