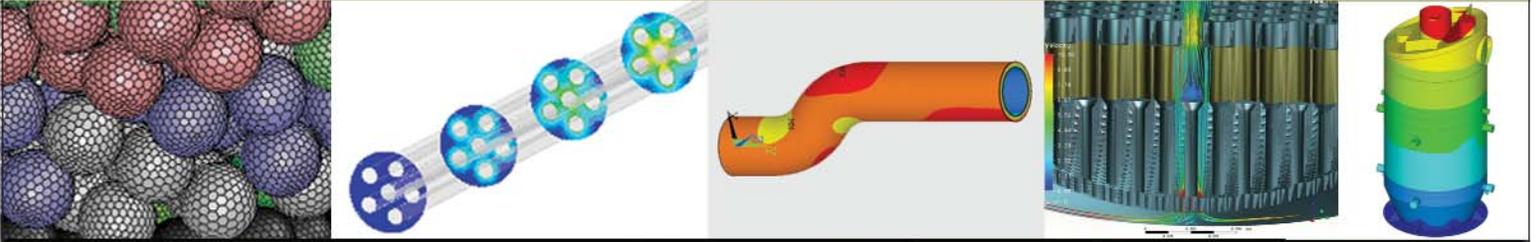
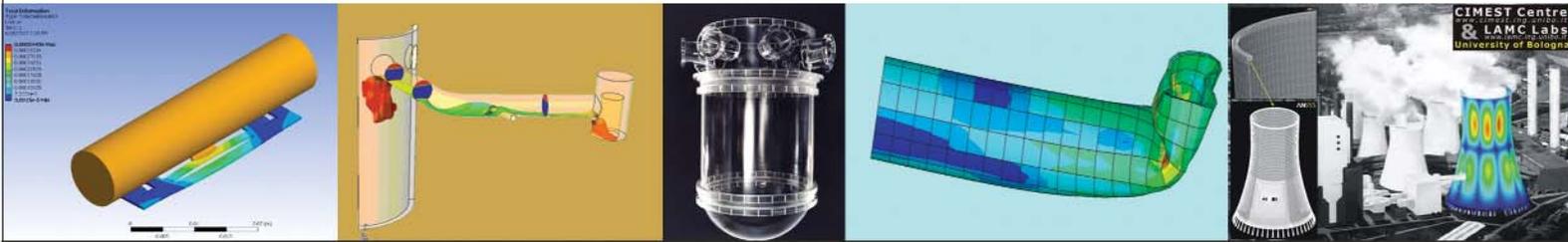




# Engineering Simulation Solutions for the **nuclear energy** Industry



With the unequalled depth and unparalleled breadth of engineering simulation solutions from ANSYS, companies in the nuclear industry are transforming their engineering practices into innovations that work to meet safety and performance requirements for current and future reactors. Today, 97 of the top 100 industrial companies on the “*FORTUNE* Global 500” invest in engineering simulation as a key strategy to win in a globally competitive environment. They choose ANSYS as their simulation partner, deploying the world’s most comprehensive multiphysics solutions to solve their complex engineering challenges. The engineered scalability of our solutions delivers the flexibility customers need, within an architecture that is adaptable to the processes and design systems of their choice. No wonder the world’s most successful companies turn to ANSYS – with a track record of almost 40 years as an industry leader — for the best in engineering simulation.



## Challenges and Solutions

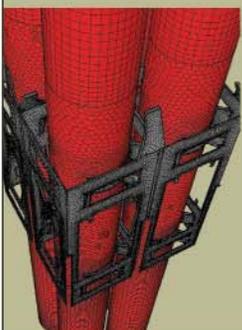
**D**riven by the continuing need for electricity, mounting environmental concerns and stringent governmental safety regulations, the nuclear power industry faces maintenance, power uprating and life extension needs for existing nuclear plants that are near the end of their original operating licenses. At the same time, designers and engineers are proposing and deploying innovative nuclear plant designs to meet increased demand. For nearly 40 years, engineers in the nuclear industry have used simulation products from ANSYS as indispensable tools for assessing and profitably running safe, efficient and reliable plant processes and operations. A key ingredient to the value of simulation in the nuclear power industry is its ability to significantly and safely reduce the time and expense involved in the design, optimization, trouble-shooting and repair of nuclear power components and systems.

### Designing New Options

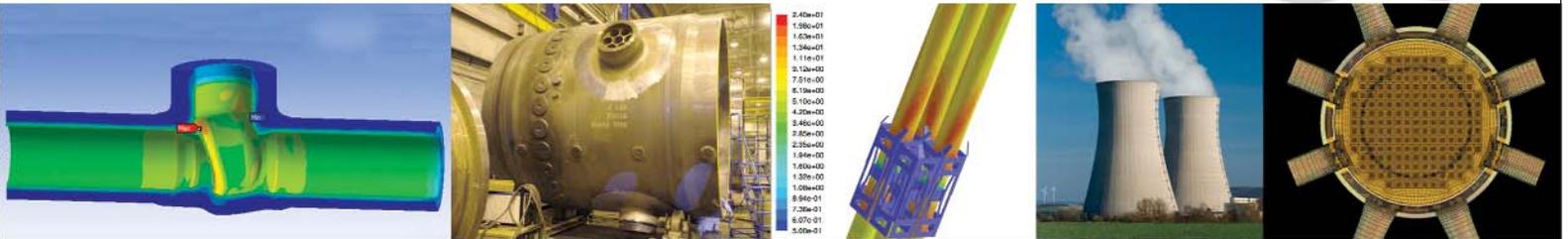
New nuclear power plant designs require reduced development and operation costs, improvements in performance and greater reliability as compared to their predecessors. Simplified plant designs and the use of modularity often lead to reduced capital costs and construction times. Continuous improvements to reactor core thermal margins and performance, coupled with advances that improve fuel reliability, allow utilities to maximize the availability of the power plant. Engineering simulation combined with parameterization and optimization tools enable broad evaluation capabilities for alternative designs.

### Nuclear Reactor Safety

Safe production of nuclear power is perhaps one of the biggest issues facing nuclear engineers that design and operate nuclear power plants. Whether the concerns are structural integrity, erosion, fouling, loss of coolant, seismic events, jet strike or abnormal operational transients, designers continue to improve equipment performance and engineered safety system features, incorporate passive safety designs when possible and evaluate appropriate containment strategies. The portfolio of engineering simulation tools from ANSYS, which includes structural mechanics, explicit dynamics, thermohydraulics, fluid dynamics and electromagnetics, enables regulatory compliance evaluation.



# Nuclear energy



“ At USNRC, we are using FLUENT software to analyze potential nuclear plant accidents. While the likelihood that any of these events would ever happen is extremely small, the analyses are an important component of ongoing research in the nuclear industry. Full scale testing of such events would be extremely costly and potentially dangerous. Computational fluid dynamics provides a great way to take a look at these phenomena at a minimal cost and with no risk. ”

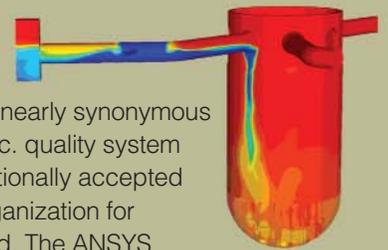
Chris Boyd  
Reactor Engineer  
United States Nuclear  
Regulatory Commission

## Storage, Transport and Disposal of Waste

One important operation that requires additional safety consideration is the disposal of nuclear waste products such as spent fuel. For example, many nuclear power utilities store spent fuel in containers, or casks, for up to 20 years at the reactor site. For removal, waste transport container design requires consideration of scenarios that may involve container drop, fire, collision or other accidents. The ability to predict the structural and hydrodynamic performance of the equipment subject to these scenarios is an important area in which engineering simulation tools continue to provide insight that is difficult to ascertain by other means.

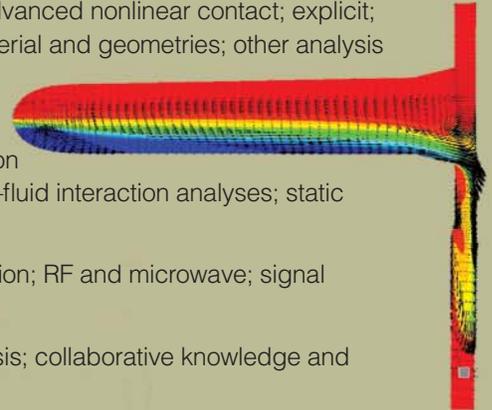
## Quality Assurance

Having its roots in nuclear power, the name ANSYS is nearly synonymous with quality within the nuclear industry. The ANSYS, Inc. quality system meets the requirements of ISO 9001:2008, the internationally accepted quality standard administered by the International Organization for Standardization headquartered in Geneva, Switzerland. The ANSYS quality system also meets the United States Nuclear Regulatory Commission (NRC) rules and regulations for quality assurance 10CFR50, Appendix B, and the American Society of Mechanical Engineers (ASME) NQA-1 consensus quality standard, both of which set forth some of the most stringent software quality rules and requirements for the development of safety-critical software. In addition, ANSYS has worked with nuclear industry clients for years to provide QA services to satisfy quality assurance regulations for the structural analysis of nuclear equipment, thus enhancing the reliability of engineering simulation software and minimizing internal quality program maintenance costs.



# Capabilities

- ▶ **Structural Mechanics Solutions:** static; dynamic; fatigue; thermal; advanced nonlinear contact; explicit; vibration; deflection; buckling; rotor dynamics; creep; nonlinear material and geometries; other analysis capabilities for mechanical and materials systems
- ▶ **Fluid Dynamics Solutions:** thermal and fluid flow analysis; single and multiphase flows with boiling, condensation, flashing evaporation or phase change; turbulence modeling; multi-fluid interaction; solid-fluid interaction analyses; static and transient analyses
- ▶ **Electronic and Electromagnetics Solutions:** I&C design and verification; RF and microwave; signal and power integrity; electromechanical systems
- ▶ **Specialized Tools:** parametric modeling; optimization; explicit analysis; collaborative knowledge and data management; customizable incorporation of third-party tools



seismic loading • soil-structure interaction • piping support design  
• bolted and threaded closure analysis • turbines • accident scenarios • fire • creep • boilers • pressure vessels • **nuclear.**  
steam dryers • reactor thermal-hydraulics • pulsating flows • boron dilution transients • pressurized thermal shock • containment flow analysis • fuel assembly and grid spacer design • power transmission • pumping, waste storage, transport and disposal • dry cask analysis • drop tests • instrumentation and control systems • sensors and actuators • fuel rod fretting

## About ANSYS, Inc.

ANSYS, Inc., founded in 1970, develops and globally markets engineering simulation software and technologies widely used by engineers and designers across a broad spectrum of industries. The Company focuses on the development of open and flexible solutions that enable users to analyze designs directly on the desktop, providing a common platform for fast, efficient and cost-effective product development, from design concept to final-stage testing, validation and production. The Company and its global network of channel partners provide sales, support and training for customers. Headquartered in Canonsburg, Pennsylvania, U.S.A., with more than 60 strategic sales locations throughout the world, ANSYS, Inc. and its subsidiaries employ approximately 1,700 people and distribute ANSYS products through a network of channel partners in over 40 countries.

Visit [www.ansys.com](http://www.ansys.com) for more information.

# ANSYS®

[www.ansys.com](http://www.ansys.com)



GSA Contract Holder

ANSYS, Inc.  
Southpointe  
275 Technology Drive  
Canonsburg, PA 15317  
U.S.A.  
724.746.3304  
[ansysinfo@ansys.com](mailto:ansysinfo@ansys.com)

Toll Free U.S.A./Canada:  
1.866.267.9724  
Toll Free Mexico:  
001.866.267.9724  
Europe:  
44.870.010.4456  
[eu.sales@ansys.com](mailto:eu.sales@ansys.com)

ANSYS, ANSYS Workbench, Ansoft, AUTODYN, CFX, FLUENT, and any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

Image courtesies: M. Bottcher (FZK-IRS), CompMechLab, Korea Atomic Energy Research Institute, NRG and GRS, FZ Rossendorf, Structural Integrity Associates, Babcock & Wilcox Canada and iStockphoto.com.

© 2009 ANSYS, Inc. All rights reserved.

MKT0000324