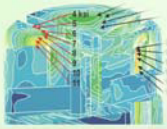
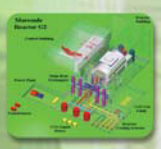
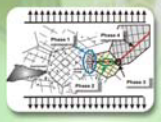
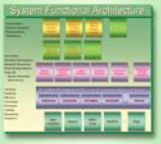



Modeling and Simulation Group



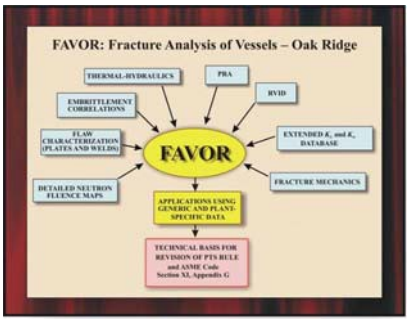
Fracture Analysis of Vessels: Oak Ridge – FAVOR

Computational Structural Fracture Mechanics Team

The ORNL Modeling and Simulation Group (MSG) develops sophisticated numerical solutions for a wide range of scientific, engineering, and operational applications. MSG's core competency is computational physics and engineering, and within our Computational Structural Fracture Mechanics Team we have developed the Fracture Analysis of Vessels: Oak Ridge (FAVOR) software suite. Originally developed for the U. S. Nuclear Regulatory Commission, FAVOR is designed to conduct structural integrity analyses of aging and embrittled nuclear reactor pressure vessels subjected to transient loading conditions.

Main Characteristics

FAVOR uses the finite-element method to generate one-dimensional time-dependent thermal and stress distributions through the wall thickness of an axisymmetric structure subjected to complex time-varying boundary conditions. FAVOR contains a comprehensive library of weight functions, thus providing the capability to generate stress-intensity factors for a range of realistic three-dimensional finite- and infinite length internal and external surface breaking flaw geometries as required for performing fracture mechanics analyses.



FAVOR's Architecture Design

FAVOR probabilistic fracture mechanics analyses are based on Monte Carlo techniques (i.e., many deterministic analyses are performed on stochastically generated structures to determine the probability that a vessel will fail when subjected to a defined loading condition at a particular time in the operating life of the structure). FAVOR has been extended to cover a broader range of events that include normal operational transients (start-up, shut-down, and leak-test) as well as conditions such as PTS. FAVOR performs deterministic and risk-informed probabilistic fracture analyses of boiling water reactors (BWRs) and PWRs subjected to heat-up and / or cool-down transients. FAVOR has been successfully ported to a parallel computing platform.

NRC Regulatory Applications of FAVOR

- Best-estimate and uncertainty assessments for informed regulatory decisions leading to recently implemented alternative Pressurized-Thermal-Shock (PTS) Rule 10 CFR 50.61a.
- Evaluation of technical bases of industry proposal for risk-informed update of plant operating limits defined in 10 CFR 50 Appendix G.

FAVOR's robust highly integrated capabilities make it the ideal analysis tool for a broad range of R&D, industrial, homeland defense, and military applications. We welcome the opportunity to discuss your potential applications and ways FAVOR can contribute to a solution.

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