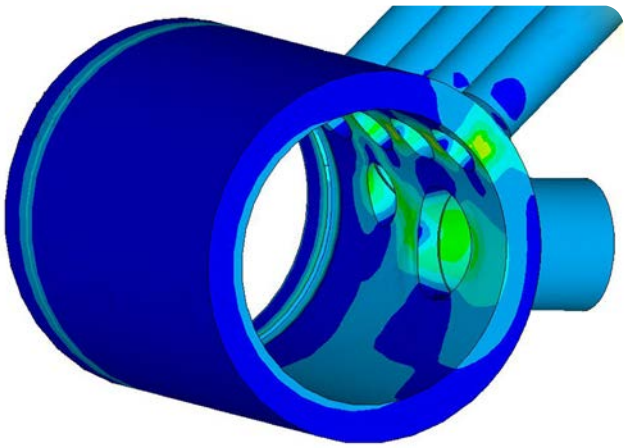
Elastic Plastic Analysis

Overview

BWXT Canada Ltd. (BWXT) has experience in the inelastic design of pressure vessel components, using Limit Analysis design approach according to ASME Code Section III, NB- 3228.1/Section VIII, Div. 2, 5.2.3 Plastic Analysis according to Section III, NB-3228.3 / Section VIII, Div. 2, 5.2.4 and other non-code design considerations. Due to its ability to isolate primary stresses, elastic-plastic analysis uses the available load carrying capacity of a structure in the best way possible without compromising the overall safety of the structure against failure by excessive deformation. Inelastic analysis techniques can also be used to qualify degraded components and assess severe loads not originally comtemplated in a component design.



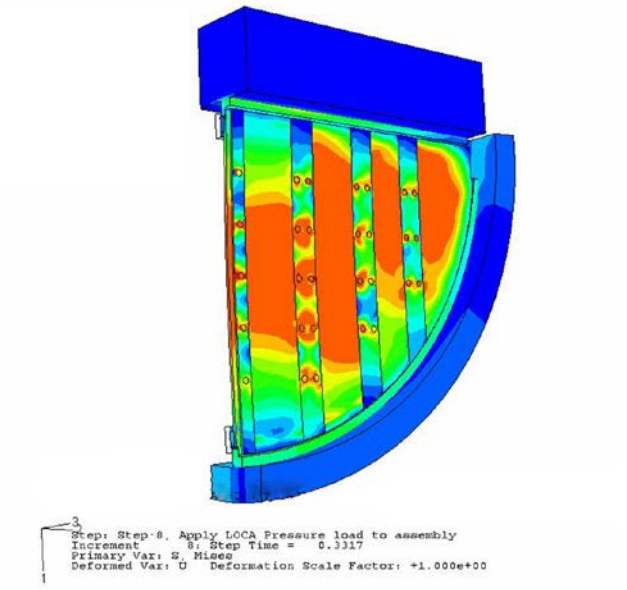
FE model of residual stress in a complex header assembly

Applications

For many components, the use of inelastic analysis results in a much more efficient design than that which can be achieved with elastic methods or "design by rule". This can mean less weight, less weld volume and even lower thermal stresses and better fatigue life, depending on the specific geometry and loads on a structure. These techniques can also be used in some cases to requalify a pressure vessel component that has undergone significant erosion, repair or overpressurization.

Examples of elastic-plastic analysis performed at BWXT include:

- Design and justification of partially reinforced and unreinforced access openings
- Design of elliptical vessel heads
- Design of vessel/nozzle intersections
- Evaluation of welded and floating divider plates under design and accident loads
- Elastic-plastic cyclic analysis of divider plates
- Elastic-plastic design of tubesheets and other perforated structures
- Modeling of a hydraulic tube expansion process
- Elastic-plastic gasket modeling



Elastic-plastic analysis a vessel divider plate under pipe rupture load

BWXT Canada Ltd.

Capability and Tools

BWXT has a variety of methods available to perform inelastic analysis with proven commercial Finite Element (FE) codes (ANSYS, ABAQUS). Capabilities include:

- Primary stress or limit analysis through elastic iterations
- Elastic-perfectly plastic limit or primary stress analysis
- Plastic analysis, including hardening and non-linear geometric effects
- Analysis of anisotropic and perforated structures
- Explicit FE analysis for highly non-linear problems
- Inelastic transient and fatigue analysis

The analysis method can be selected based on the nature of the problem to be analyzed and the preference of the client.

NUCLEAR ENERGY GOVERNMENT SERVICES ADVANCED TECHNOLOGIES

BWXT Canada Ltd. is a subsidiary of BWX Technologies, Inc. (BWXT). Headquartered in Lynchburg, Va., BWXT is a leading supplier of nuclear components and fuel to the U.S. government; provides technical, management and site services to support governments in the operation of complex facilities and environmental remediation activities; and supplies precision manufactured components and services for the commercial nuclear power industry.

Products and services described herein are provided by BWXT Canada Ltd., a BWXT subsidiary.

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