MC149
Static, Elastic Finite Element Analysis (FEA) Approaches to Address ASME Section VIII Division 2 Part 5 Design Requirements

- Outline of Elastic Finite Element Solution Approaches
  - Why do we need to run a finite element analysis?
    - Pressure Vessels / Heat Exchangers
    - Piping (B31.3 304.7.2)
  - Getting Code compliant reports from finite element calculations
  - Man-time Estimates for work (how long will it take to perform these calculations)
  - Typical Steps in an analysis
  - Model Validation
    - Strain gages
    - Acoustic emission
    - Deformation measurement
    - Calculation verification
  - Commercial Issues
    - What documents must be signed and stamped
    - Interacting with the Inspector
    - Nameplates
- Identifying what needs to be included in the model
- Combining FEA solution results with Part IV Design by Rule Results
- Reasons to perform FEA Analysis
  - Code Compliance
  - Determine Design Parameters
    - O-ring sealing
    - Mechanical fits/grooves
    - Design-by-Rule non-compliance

- Mesh and Model Generation
  - Element Types

- Requirements for a good mesh
  - Using mesh independent approach
  - Adaptive Meshing
  - Boundary Conditions
  - Material Models
- Establishing Load Cases to Address Code Requirements
  - Primary Load Requirements
  - Buckling Requirements
    - How does pressure impact buckling?
  - Local Stress Limits
  - Secondary Load Requirements
  - Thermal Considerations
  - Ratcheting
  - Fatigue
  - Methods for Evaluating Fatigue
- When can the rules in 5.3.3 for Local Strain Limits Control the Design
- Simple and Complex Approaches to Fatigue
- Flanges and Clamps
- How must elastic solutions be post-processed
- Concerns with elastic analysis based on tests (Over-conservatism in high λ range)
- Elastic analysis and fatigue in large D/T branch connections
- Report Preparation
- Addressing Specialty Rules for Common Situations
  - Local Stresses in Nozzle Necks
  - Ratcheting
  - Multiple nozzles in single connection
  - Designing for unknown loads
- Summary & Wrap-up