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