Modeling Contact with Abaqus/Standard

Abaqus 2018
Course objectives
Upon completion of this course you will be able to:

- Define general contact and contact pairs
- Define appropriate surfaces (rigid or deformable)
- Model frictional contact
- Model large sliding between deformable bodies
- Resolve overclosures in interference fit problems

Targeted audience
Simulation Analysts

Prerequisites
This course is recommended for engineers with experience using Abaqus/Standard
Day 1

- Lecture 1  Introduction
- Lecture 2  Contact Workflow
  - Workshop 1  Compression of a Rubber Seal
- Lecture 3  Surface-based Contact
  - Workshop 2  Lap Joint Analysis
- Lecture 4  Contact Logic and Diagnostics Tools
  - Workshop 3  Bolted Flange Analysis
Day 2

- Lecture 5 Contact Properties
  - Workshop 4 Disk Forging Analysis
- Lecture 6 Interference Fits
  - Workshop 5 Interference Fit Analysis
  - Workshop 6 Syringe Analysis (optional)
- Lecture 7 Additional Features
  - Workshop 7 Pipe Reel Analysis
- Lecture 8 Modeling Tips
  - Workshop 8 Bolted Flange Analysis: Infinitesimal Sliding
  - Workshop 9 Snap Fit Analysis
  - Workshop 10 Analysis of a Radial Shaft Seal (optional)
Additional Material

- Appendix 1  Node-to-Surface Formulation
- Appendix 2  Contact Elements
- Appendix 3  Dynamic Contact using Implicit Integration
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Portfolio of established, best-in-class products
- Abaqus, Isight, Tosca, fe-safe, Simpack

- **Design Optimization. Tosca Structure** *
  - Simulation-driven design refinement to improve performance

- **FEA Stress Analysis. Abaqus** *
  - Detailed stress analysis using extracted load history from MBS

- **Multibody Simulation. Simpack**
  - System analysis to extract virtual load history of complete working cycle

- **Durability Assessment. fe-safe** *
  - Accurate life estimation to achieve certification

- **CAD Geometry. CATIA**
  - Fully parameterized 3D geometry; FEA model generation via associative interface

- **Mesh Calibration. Isight** *
  - Automated mesh calibration; sufficient mesh quality for accurate results

* Included in extended licensing pool
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Lesson content:

- Defining General Contact
- Defining Contact Pairs
- Defining Surfaces for Contact Pairs
- Workshop Preliminaries
- Workshop 1: Compression of a Rubber Seal (IA)
- Workshop 1: Compression of a Rubber Seal (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.
Lesson 3: Surface-based Contact

Lesson content:
- Contact Formulations
- Contact Discretization
- Contact Enforcement Methods
- Relative Sliding Between Bodies
- Contact Output
- Summary
- Workshop 2: Lap Joint Analysis (IA)
- Workshop 2: Lap Joint Analysis (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.

2 hours
Lesson 4: Contact Logic and Diagnostics Tools

Lesson content:

- Newton Method
- The Contact Algorithm
- Contact Diagnostics: Visual
- Contact Diagnostics: Text
- Workshop 3: Bolted Flange Analysis (IA)
- Workshop 3: Bolted Flange Analysis (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.

2 hours
Lesson 5: Contact Properties

Lesson content:

- Pressure-Overclosure Models
- Friction Models
- Friction Enforcement
- Workshop 4: Disk Forging Analysis (IA)
- Workshop 4: Disk Forging Analysis (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.
Lesson content:

- Initial Overclosure
- Strain-free Adjustments
- Interference Fit Problems
- Interference Fit Techniques for General Contact
- Interference Fit Techniques for Contact Pairs
- Interference Fit Example
- Precise Specification of Clearances
- Geometric Smoothing for Curved Surfaces
- Workshop 5: Interference Fit Analysis (IA)
- Workshop 5: Interference Fit Analysis (KW)
- Workshop 6: Syringe Analysis (IA)
- Workshop 6: Syringe Analysis (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.

3 hours
Lesson 7: Additional Features

Lesson content:

- Beam Contact
- Tie Constraints
- Rigid Bodies and Contact
- Analytical Rigid Surfaces
- Pre-Tensioning of Cross-Sections
- Pressure Penetration
- Contact in Linear Perturbation Procedures
- Workshop 7: Pipe Reel Analysis (IA)
- Workshop 7: Pipe Reel Analysis (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.
Lesson 8: Modeling Tips

Lesson content:

- Initial Rigid Body Motion
- Overconstraint
- Contact with Quadratic Elements
- Unsymmetric Matrices in Finite-Sliding Problems
- Dynamic Instabilities
- Modeling Corners and Edges
- Workshop 8: Bolted Flange Analysis: Infinitesimal Sliding (IA)
- Workshop 8: Bolted Flange Analysis: Infinitesimal Sliding (KW)
- Workshop 9: Snap Fit Analysis (IA)
- Workshop 9: Snap Fit Analysis (KW)
- Workshop 10: Analysis of a Radial Shaft Seal (IA)
- Workshop 10: Analysis of a Radial Shaft Seal (KW)

Both interactive (IA) and keywords (KW) versions of the workshop are provided. Complete only one.

2 hours
Appendix 1: Node-to-Surface Formulation

Appendix content:

- Discretization
- Finite Sliding: Surface Considerations
- Small Sliding Characteristics
- Small Sliding: Local Contact Plane
- Small Sliding: Surface Considerations
Appendix 2: Contact Elements

**Appendix content:**

- Surface-Based vs. Contact Element Approach
- Contact Elements
- Contact Element Output
- Contact Element Visualization
Appendix 3: Dynamic Contact using Implicit Integration

Appendix content:

- Time Integration Issues
- Implicit Dynamics
- Damping
- Impact Problems