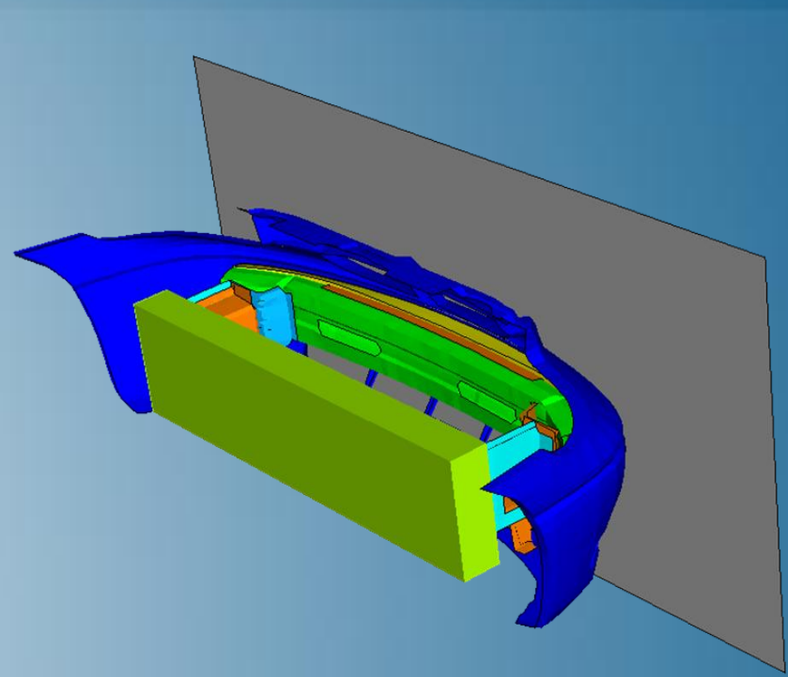
DASSAULT SYSTEMES

Abaqus/Explicit: Advanced Topics

2017



3DEXPERIENCE

About this Course

Course objectives

Upon completion of this course you will be able to:

- Use the explicit dynamics method effectively, including the application of general contact, mass scaling, and adaptive remeshing
- Use Abaqus/Explicit and Abaqus/Standard together to solve difficult problems, including results transfer and co-simulation
- Model high-strain-rate deformation and failure
- Filter output

Targeted audience

Simulation Analysts

Prerequisites

This course is recommended for engineers with experience using Abaqus

3 days

Day 1

- Lecture 1 Overview of Abaqus/Explicit
  - Workshop 1 Conditional Stability of Abaqus/Explicit
- Lecture 2 Elements
- Lecture 3 Contact Modeling
  - Workshop 2 Impact of a Dodge Caravan Bumper Against a Rigid Barrier

Day 2

- Lecture 4 Quasi-Static Analyses
  - Workshop 3 Quasi-static Analysis of a Rubber Bushing
- Lecture 5 Constraints and Connections
- Lecture 6 Impact and Postbuckling Analyses
  - Workshop 4 Crushing of a Tube

Day 3

- Lecture 7 — Material Damage and Failure
- Lecture 8 — Importing and Transferring Results
  - Workshop 5 — Bird Strike Simulation
- Lecture 9 — Managing Large Models
- Lecture 10 — Output Filtering

Additional Material

- Appendix 1 Explicit Dynamics Algorithm
- Appendix 2 Features of General Contact & Contact Pairs
- Appendix 3 Abaqus/Standard to Abaqus/Explicit Co-simulation
  - Workshop 6 Beam Impact Co-simulation

SIMULIA

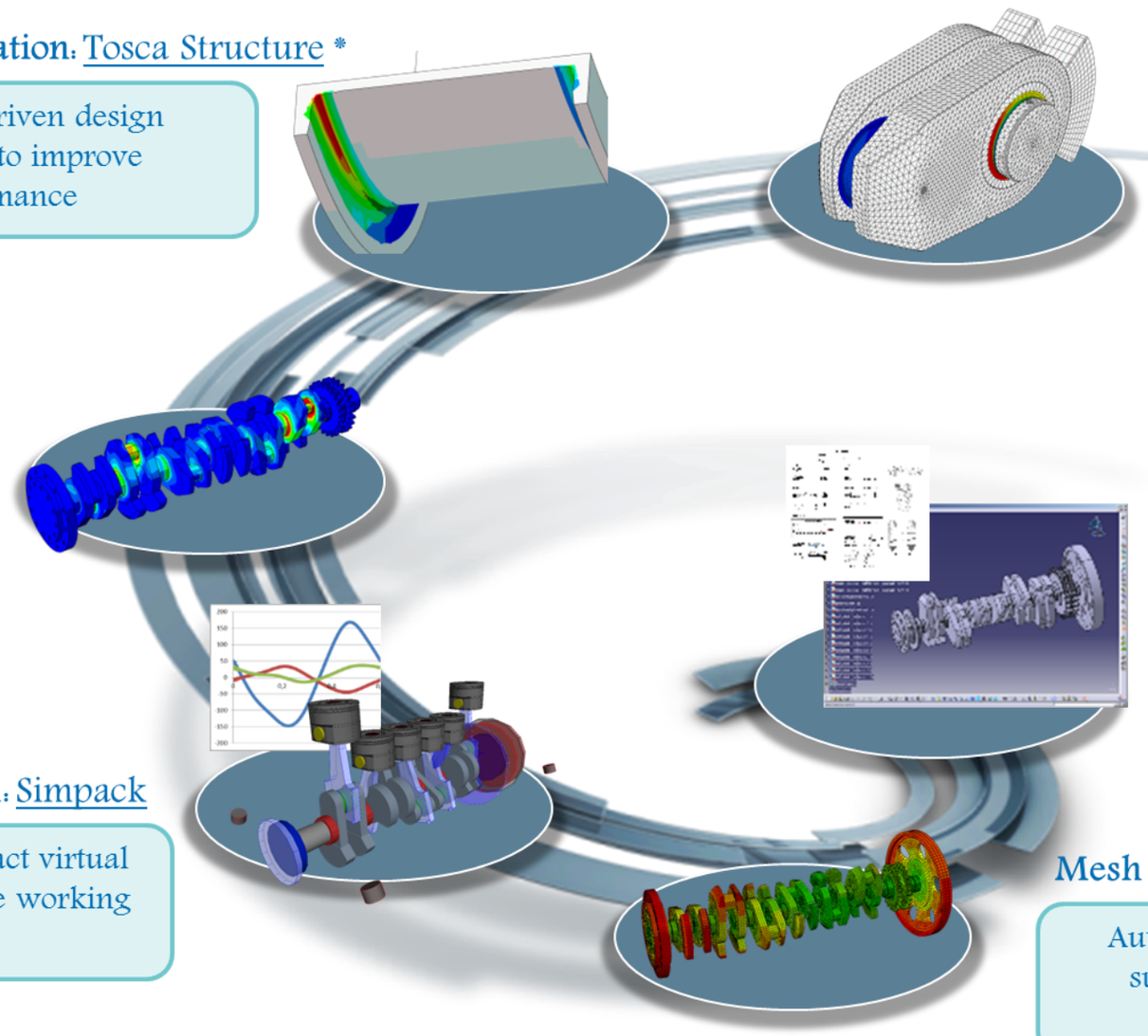
- SIMULIA is the Dassault Systèmes brand for Realistic Simulation solutions
- Portfolio of established, best-in-class products
  - Abaqus, Isight, Tosca, fe-safe, Simpack

Design Optimization: Tosca Structure *

Simulation-driven design refinement to improve performance

Durability Assessment: fe-safe *

Accurate life estimation to achieve certification



FEA Stress Analysis: Abaqus *

Detailed stress analysis using extracted load history from MBS

CAD Geometry: CATIA

Fully parameterized 3D geometry; FEA model generation via associative interface

Multibody Simulation: Simpack

System analysis to extract virtual load history of complete working cycle

Mesh Calibration: Isight *

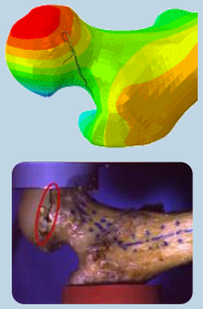
Automated mesh calibration: sufficient mesh quality for accurate results

* Included in extended licensing pool

SIMULIA's Power of the Portfolio

Abaqus

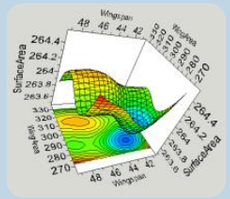
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization



Realistic Human Simulation
High Speed Crash & Impact
Noise & Vibration

Isight

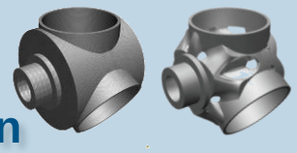
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments



Material Calibration
Workflow Automation
Design Exploration

Tosca

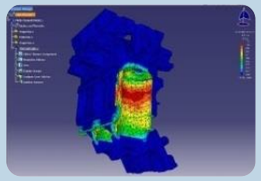
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization



Conceptual/Detailed Design
Weight, Stiffness, Stress
Pressure Loss Reduction

fe-safe

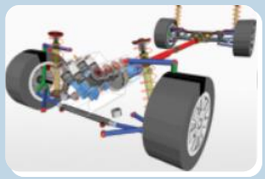
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics



Safety Factors
Creep-Fatigue Interaction
Weld Fatigue

Simpack

- 3D Multibody Dynamics Simulation
- Mechanical or Mechatronic Systems
- Detailed Transient Simulation (Offline and Realtime)



Complete System Analyses
(Quasi-)Static, Dynamics, NVH
Flex Bodies, Advanced Contact

Join the Community!

How can you maximize the robust technology of the SIMULIA Portfolio ?

Connect with peers to share knowledge and get technical insights

Go to www.3ds.com/slc
to log in or join!

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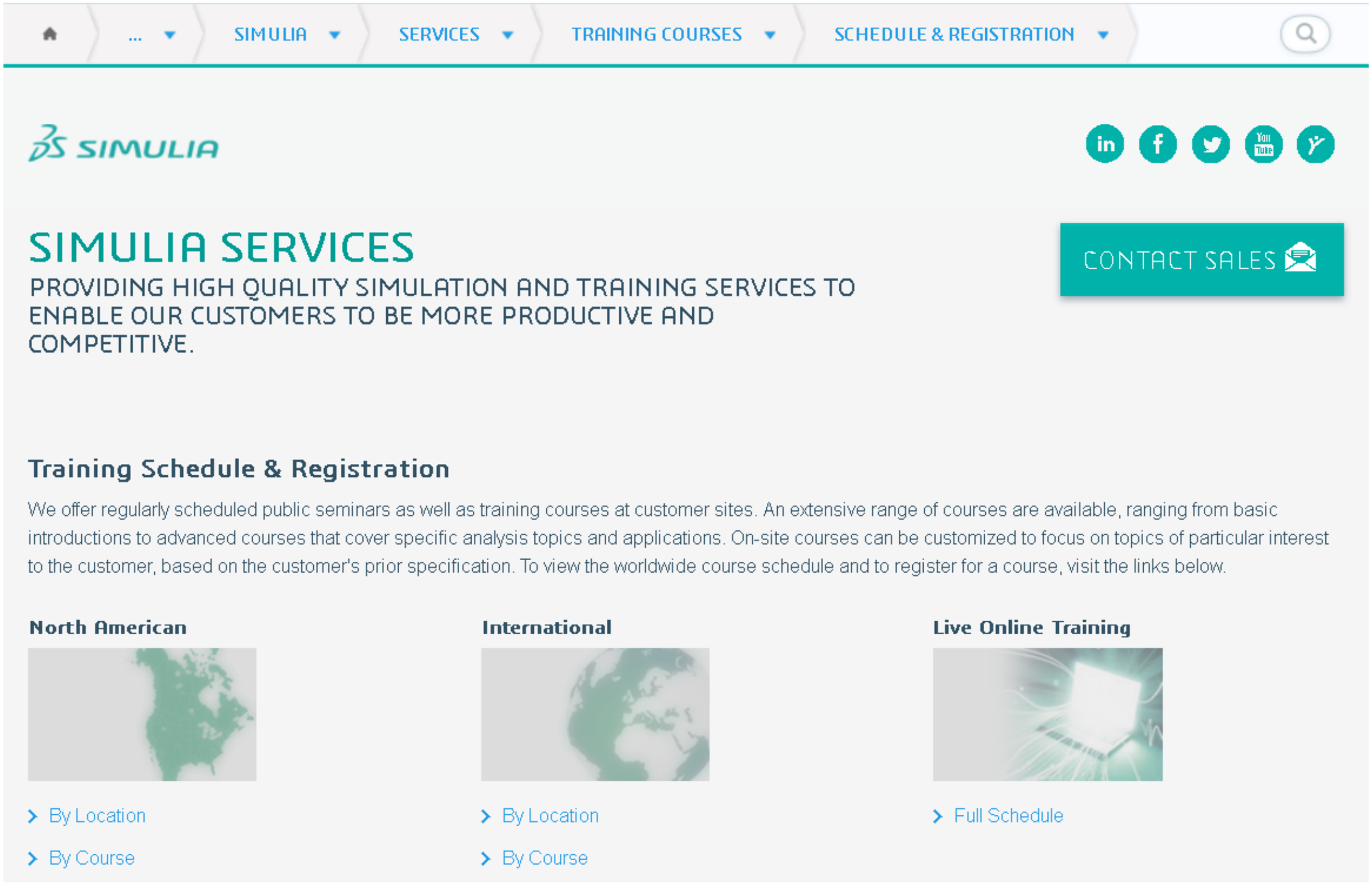

Legal Notices

Revision Status

Lecture 1	11/16	Updated for Abaqus 2017
Lecture 2	11/16	Updated for Abaqus 2017
Lecture 3	11/16	Updated for Abaqus 2017
Lecture 4	11/16	Updated for Abaqus 2017
Lecture 5	11/16	Updated for Abaqus 2017
Lecture 6	11/16	Updated for Abaqus 2017
Lecture 7	11/16	Updated for Abaqus 2017
Lecture 8	11/16	Updated for Abaqus 2017
Lecture 9	11/16	Updated for Abaqus 2017
Lecture 10	11/16	Updated for Abaqus 2017

Appendix 1	11/16	Updated for Abaqus 2017
Appendix 2	11/16	Updated for Abaqus 2017
Appendix 3	11/16	Updated for Abaqus 2017
Workshop 1	11/16	Updated for Abaqus 2017
Workshop 2	11/16	Updated for Abaqus 2017
Workshop 3	11/16	Updated for Abaqus 2017
Workshop 4	11/16	Updated for Abaqus 2017
Workshop 5	11/16	Updated for Abaqus 2017
Workshop 6	11/16	Updated for Abaqus 2017

Lesson 1: Overview of Abaqus/Explicit

Lesson content:

- What is Explicit Dynamics?
- Abaqus/Explicit vs. Abaqus/Standard
- Some Challenging Problems
- Defining an Abaqus/Explicit Procedure
- Stable Time Increment
- Bulk Viscosity Damping
- Energy Balance
- Monitoring Diagnostic Messages
- Output
- Workshop Preliminaries
- Workshop 1: Conditional Stability of Abaqus/Explicit (IA)
- Workshop 1: Conditional Stability of Abaqus/Explicit (KW)

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

2 hours

Lesson 2: Elements

Lesson content:

- Introduction
- Solids Elements
- Shell and Membrane Elements
- Beam and Truss Elements
- Special-Purpose Elements and Techniques
- Element Distortion Control
- Hourglassing, Locking, and Other Issues
- Second-order Accuracy

1.5 hours

Lesson 3: Contact Modeling

Lesson content:

- Introduction to Contact in Abaqus/Explicit
- Basic Features of General Contact
- General Contact Surfaces
- General Contact Output
- Limitations of General Contact
- Workshop 2: Impact of a Dodge Caravan Bumper Against a Rigid Barrier (IA)
- Workshop 2: Impact of a Dodge Caravan Bumper Against a Rigid Barrier (KW)

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

2.5 hours

Lesson 4: Quasi-Static Analyses

Lesson content:

- Introduction
- Quasi-Static Simulations Using Explicit Dynamics
- Loading Rates
- Energy Balance in Quasi-Static Analyses
- Mass Scaling
- Viscous Pressure
- Summary
- Workshop 3: Quasi-static Analysis of a Rubber Bushing (IA)
- Workshop 3: Quasi-static Analysis of a Rubber Bushing (KW)

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

1.5 hours

Lesson 5: Constraints and Connections

Lesson content:

- Introduction
- Rigid Bodies
- Surface-Based Coupling Constraints
- Connector Elements
- Surface-Based Ties
- Offset Tied Interfaces
- Mesh-Independent Fasteners
- Cohesive Connections
- Virtual Crack Closure Technique
- Tips

2.5 hours

Lesson 6: Impact and Postbuckling Analyses

Lesson content:

- Impact Analysis
- Geometric Imperfections for Postbuckling Analyses
- Workshop 4: Crushing of a Tube (IA)
- Workshop 4: Crushing of a Tube (KW)

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

2 hours

Lesson 7: Material Damage and Failure

Lesson content:

- Progressive Damage and Failure
- Damage Initiation
- Damage Evolution
- Element Removal
- Damage in Fasteners

1.5 hours

Lesson 8: Importing and Transferring Results

Lesson content:

- Introduction
- Import from Abaqus/Explicit to Abaqus/Standard
- Import from Abaqus/Standard to Abaqus/Explicit
- Import from Abaqus/Explicit to Abaqus/Explicit
- Additional Import Modeling Issues
- Limitations
- Workshop 5: Bird Strike Simulation (IA)
- Workshop 5: Bird Strike Simulation (KW)

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

2 hours

Lesson 9: Managing Large Models

Lesson content:

- Introduction
- Simplifying the Model
- Parallel Execution
- Techniques for Reducing CPU Time
- Submodeling
- Restart
- Parts and Assemblies
- Tips

1.5 hours

Lesson 10: Output Filtering

Lesson content:

- Introduction
- What is aliasing?
- Preventing aliasing
- Abaqus/Viewer postprocessing filters
- Filter options
- Filter distortions
- References

1.5 hours

Appendix 2: Contact Pairs

Appendix content:

- Contact Pairs

1 hour

Appendix 3: Co-simulation

Appendix content:

- Introduction
- Examples
- Co-simulation modeling
  - General concepts
  - Keyword interface
  - Interactive interface
- Postprocessing
- Substructuring
- Technology notes
- Workshop 6: Beam Impact Co-simulation (IA)
- Workshop 6: Beam Impact Co-simulation (KW)

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

3 hours