Abaqus/CAE: Geometry Import and Meshing
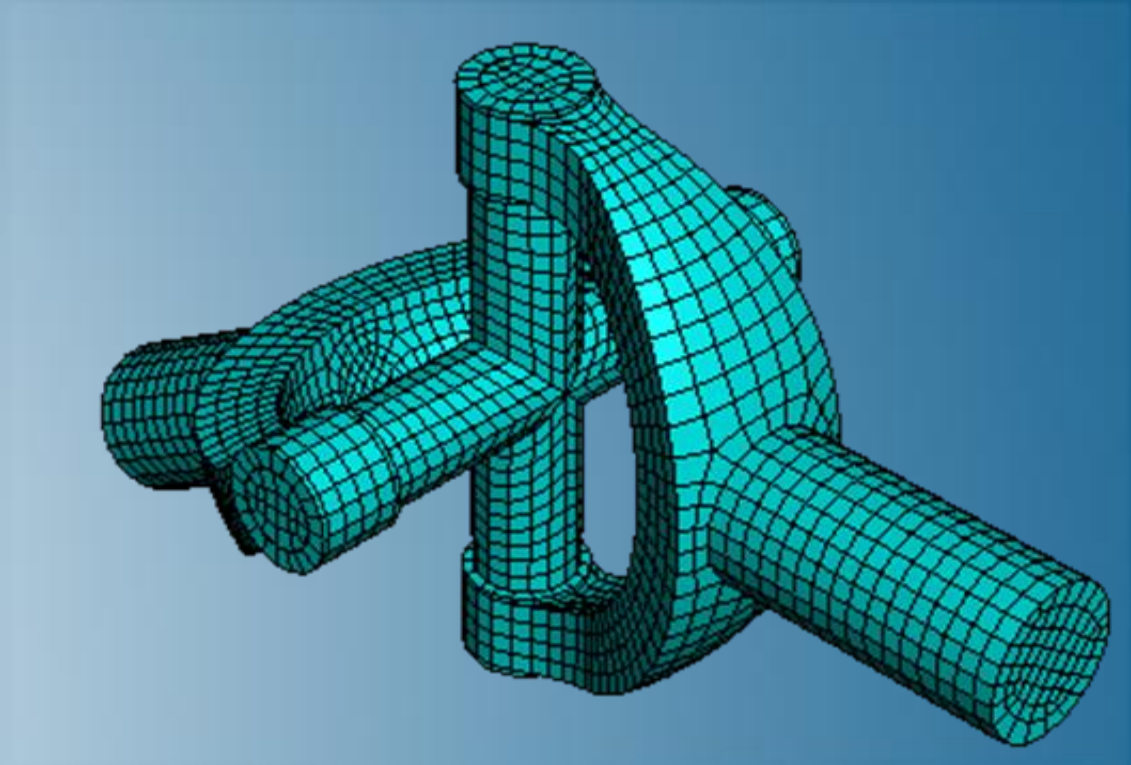
2017

About this Course

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

▷ Import, edit, and repair CAD geometry.

▷ Import and edit orphan meshes.

▷ Use virtual topology to ease the meshing of complicated geometry.

▷ Partition geometry to enable different meshing techniques.

Targeted audience
Simulation Analysts

Prerequisites
None

2 days

Day 1

▷ **Lecture 1**   Geometry Import and Repair

- Demonstration 1   Geometry Import and Repair: Lens Model

- Demonstration 2   Geometry Import, Diagnostics, and Defeaturing

- Workshop 1   Geometry Import and Repair: Machine Part

- Workshop 2   Geometry Repair: Piston Model

- Workshop 3   Creating a Shell From a Thin Solid

▷ **Lecture 2**   Orphan and Native Meshes

- Demonstration 3   Importing and Editing an Orphan Mesh

- Demonstration 4   Virtual Topology: Piston Model

- Demonstration 5   Virtual Topology: U-Joint Model

- Workshop 4   Importing, Editing, and Extracting Geometry from a Mesh

- Workshop 5   Virtual Topology: Bracket Model

Day 2

▷ **Lecture 3**   Meshing and Partitioning

     ▫ Demonstration 6   Partitioning and Mixed Meshing

     ▫ Demonstration 7   Sweep Meshing Techniques

     ▫ Workshop 6   Hex Meshing Intersecting Pipes

     ▫ Workshop 7   Hex Meshing a Cardan Joint

     ▫ Workshop 8   Additional Geometry Repair and Meshing Exercises

▷ **Lecture 4**   Bottom-Up Meshing

     ▫ Demonstration 8   Bottom-Up Meshing

     ▫ Workshop 9   Bottom-Up Meshing

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 *

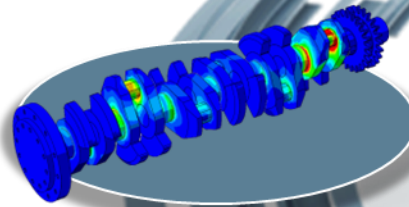Simulation-driven design refinement to improve performance
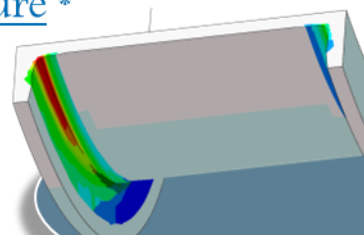
Durability Assessment: fe-safe *

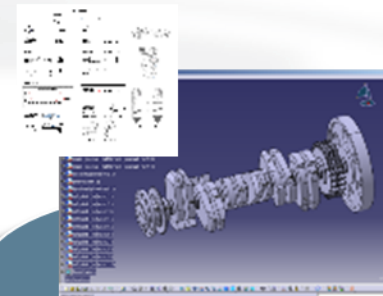Accurate life estimation to achieve certification
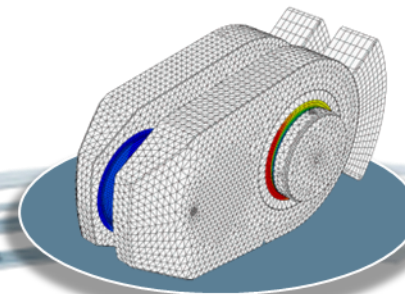
FEA Stress Analysis: Abaqus *
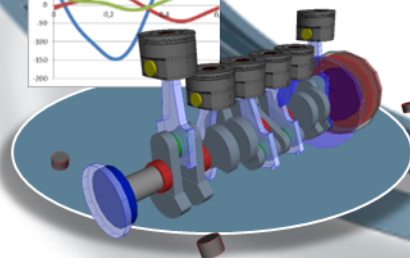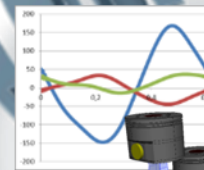
Detailed stress analysis using extracted load history from MBS

CAD Geometry: CATIA

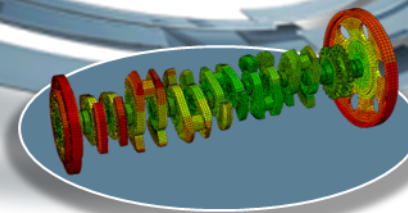Fully parameterized 3D geometry; FEA model generation via associative interface

Multibody Simulation: Simpack

System analysis to extract virtual load history of complete working cycle

Mesh Calibration: Isight *

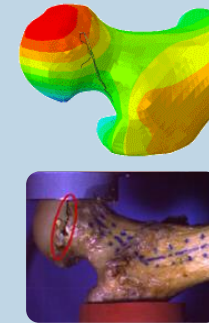Automated mesh calibration: sufficient mesh quality for accurate results

* 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
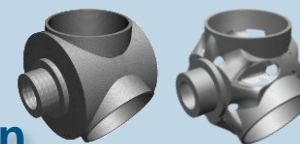High Speed Crash & Impact
Noise & Vibration

Isight
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments
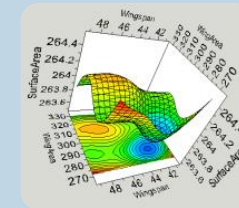
Material Calibration
Workflow Automation
Design Exploration

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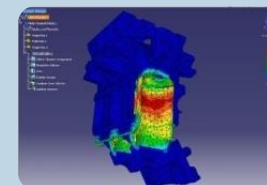- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization

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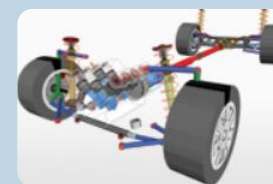Weight, Stiffness, Stress
Pressure Loss Reduction

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

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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**
Demonstration 1	**11/16**	**Updated for Abaqus 2017**
Demonstration 2	**11/16**	**Updated for Abaqus 2017**
Demonstration 3	**11/16**	**Updated for Abaqus 2017**
Demonstration 4	**11/16**	**Updated for Abaqus 2017**
Demonstration 5	**11/16**	**Updated for Abaqus 2017**
Demonstration 6	**11/16**	**Updated for Abaqus 2017**
Demonstration 7	**11/16**	**Updated for Abaqus 2017**
Demonstration 8	**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**
Workshop 7	**11/16**	**Updated for Abaqus 2017**
Workshop 8	**11/16**	**Updated for Abaqus 2017**
Workshop 9	**11/16**	**Updated for Abaqus 2017**

Lesson 1: Geometry Import and Repair

Lesson content:

- Introduction
- Geometry Import
- CAD Associative Import
- CAD Standalone Import
- Neutral Geometry Formats
- Geometry Repair
- Query and Diagnostics Tools
- Geometry Import Flowchart
- Example
- Shell Midsurface Creation
- Workshop Preliminaries
- Demonstration 1   Geometry Import and Repair: Lens Model
- Demonstration 2   Geometry Import, Diagnostics, and Defeaturing
- Workshop 1   Geometry Import and Repair: Machine Part
- Workshop 2   Geometry Repair: Piston Model
- Workshop 3   Creating a Shell From a Thin Solid

4 hours

Lesson 2: Orphan and Native Meshes

Lesson content:

▷ Introduction

▷ Dependent and Independent Part Instances

▷ Orphan Meshes

▷ Mesh Editing

▷ Creating Geometry from an Orphan Mesh

▷ Combined Orphan and Native Meshes

▷ Mesh Generation Techniques

    ☐ Free meshing

    ☐ Swept meshing

    ☐ Structured meshing

▷ Virtual Topology

▷ Demonstration 3: Importing and Editing an Orphan Mesh

▷ Demonstration 4: Virtual Topology: Piston Model

▷ Demonstration 5: Virtual Topology: U-Joint Model

▷ Workshop 4: Importing, Editing, and Extracting Geometry from a Mesh

▷ Workshop 5: Virtual Topology: Bracket Model

3.5 hours

Lesson 3: Meshing and Partitioning

Lesson content:

▷ Enabling Various Meshing Techniques

▷ Controlling Mesh Density and Gradation

▷ Methods of Gaining More Control over the Mesh

▷ Creating and Merging Meshable Regions

▷ Hex Meshing Revolved Regions

▷ Mesh Stack Direction

▷ Parametric Modeling

▷ Assigning Element Types

▷ Verifying Mesh Quality

▷ Mass and Mesh Queries

▷ Midside Nodes

▷ Demonstration 6: Partitioning and Mixed Meshing

▷ Demonstration 7: Sweep Meshing Techniques

▷ Workshop 6: Hex Meshing Intersecting Pipes

▷ Workshop 7: Hex Meshing a Cardan Joint

▷ Workshop 8: Additional Geometry Repair and Meshing Exercises

4 hours

Lesson 4: Bottom-Up Meshing

Lesson content:

▷ Introduction

▷ Basic Features

▷ Example

▷ Summary

▷ Demonstration 8: Bottom-Up Meshing

▷ Workshop 9: Bottom-Up Meshing

75 minutes