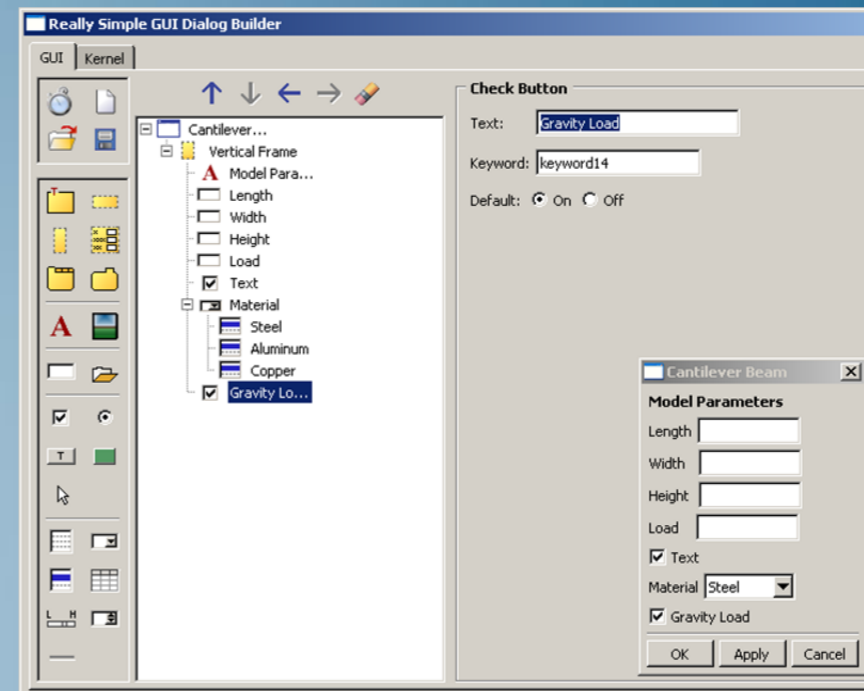


Advanced Abaqus Scripting

Abaqus 2019



About this Course

Course objectives

- ▶ Help students to develop a high level understanding of the Abaqus scripting capabilities and gain some proficiency.
- ▶ Organize and present the deeper technical details of Python and the Abaqus Scripting Interface.
- ▶ Expose the strengths and weaknesses of Abaqus scripting.
- ▶ Encourage the student to use scripting in new ways.

This advanced seminar will take a deeper dive into:

- ▶ The Abaqus Scripting Interface (ASI)
- ▶ The core functionality of the Python language and libraries

Targeted audience

Simulation Analysts

Prerequisites

Experience scripting with Python and Abaqus is recommended.



2 days

Day 1

- ▶ Lecture 1
 - Python Core Language: Advanced Topics
 - Workshop 1
 - Practice Using a Few More Python Basics
 - Working with Exceptions
 - Workshop 2

- ▶ Lecture 2
 - Functions, Modules, Packages & Performance
 - Workshop 3
 - A Brief Look at the NumPy Module

- ▶ Lecture 3
 - Manipulating Strings and Files
 - Workshop 4
 - Parsing Files
 - Workshop 5
 - Input and Output with the Shelve Module

- ▶ Lecture 4
 - Object Oriented Programming
 - Workshop 6 (Optional)
 - Classes
 - Workshop 7 (Optional)
 - Special Method Attributes

Day 2

- ▶ Lecture 5
 - Workshop 8
- ▶ Lecture 6
 - Automating a Bottle Top Load Analysis
 - Study a Plug-in to Convert Flat Mesh into Cylindrical Shape
- ▶ Lecture 7
 - Miscellaneous Topics
 - Basic Scripting Style Considerations
- ▶ Lecture 8
 - Stretching Horizons

Additional Material

▶ Appendix 1

- Workshop 12
- Workshop 13

Optional Topics

Job Monitoring

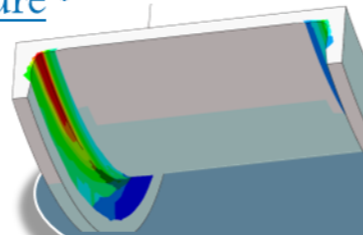
Working with the keywordBlock Object

SIMULIA

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

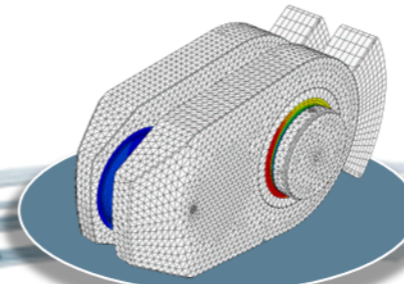
Design Optimization: Tosca Structure *

Simulation-driven design refinement to improve performance



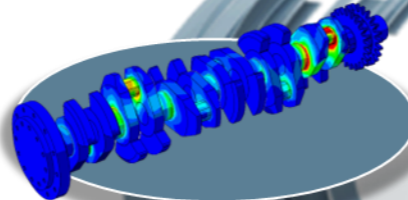
Durability Assessment: fe-safe *

Accurate life estimation to achieve certification



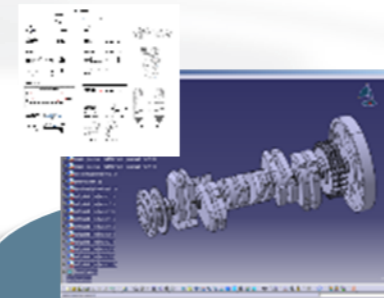
FEA Stress Analysis: Abaqus *

Detailed stress analysis using extracted load history from MBS



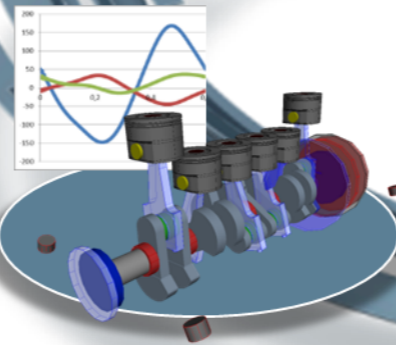
CAD Geometry: CATIA

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



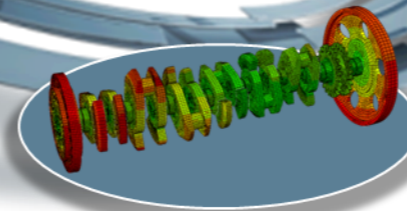
Multibody Simulation: Simpack

System analysis to extract virtual load history of complete working cycle



Mesh Calibration: Isight *

Automated mesh calibration; sufficient mesh quality for accurate results

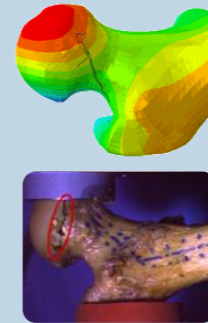


* Included in extended licensing pool

SIMULIA's Power of the Portfolio

Abaqus

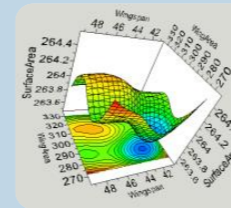
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization



Realistic Human Simulation
High Speed Crash & Impact
Noise & Vibration

Isight

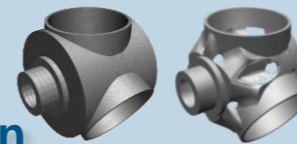
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments



Material Calibration
Workflow Automation
Design Exploration

Tosca

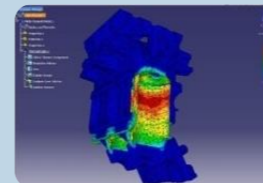
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization



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

fe-safe

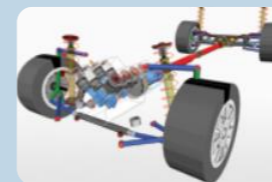
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics



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	12/18	Updated for Abaqus 2019
Lecture 2	12/18	Updated for Abaqus 2019
Lecture 3	12/18	Updated for Abaqus 2019
Lecture 4	12/18	Updated for Abaqus 2019
Lecture 5	12/18	Updated for Abaqus 2019
Lecture 6	12/18	Updated for Abaqus 2019
Lecture 7	12/18	Updated for Abaqus 2019
Lecture 8	12/18	Updated for Abaqus 2019
Appendix 1	12/18	Updated for Abaqus 2019
Workshop 1	12/18	Updated for Abaqus 2019
Workshop 2	12/18	Updated for Abaqus 2019
Workshop 3	12/18	Updated for Abaqus 2019
Workshop 4	12/18	Updated for Abaqus 2019
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Workshop 6	12/18	Updated for Abaqus 2019
Workshop 7	12/18	Updated for Abaqus 2019
Workshop 8	12/18	Updated for Abaqus 2019
Workshop 9	12/18	Updated for Abaqus 2019
Workshop 10	12/18	Updated for Abaqus 2019
Workshop 11	12/18	Updated for Abaqus 2019
Workshop 12	12/18	Updated for Abaqus 2019
Workshop 13	12/18	Updated for Abaqus 2019

Lesson 1: Python Core Language – Advanced Topics

Lesson content:

- ▶ Quick Overview of Python and ASI Basics
- ▶ Operators and Expressions
- ▶ List Comprehension
- ▶ Utility Functions
- ▶ Workshop Preliminaries
- ▶ Workshop 1: Practice Using a Few More Python Basics
- ▶ Control Flow: Exceptions
- ▶ Workshop 2: Working with Exceptions



3 hours

Lesson 2: Functions, Modules, Packages & Performance

Lesson content:

- ▶ Functions
- ▶ Modules
- ▶ Python Packages
- ▶ Performance in Python
- ▶ Workshop 3: A Brief Look at the NumPy Module



2 hours

Lesson 3: Manipulating Strings and Files

Lesson content:

- ▶ String Processing
- ▶ Input and Output
- ▶ Example: Parsing a File
- ▶ Manipulating Programs
- ▶ Workshop 4: Parsing Files
- ▶ Workshop 5: Input and Output with the Shelve Module



3 hours

Lesson 4: Object Oriented Programming

Lesson content:

- ▶ Philosophy of Object Oriented Programming
- ▶ Object Oriented Programming in Python
- ▶ Special Method Attributes
- ▶ Workshop 6 (optional): Classes
- ▶ Workshop 7 (optional): Special Method Attributes



3 hours

Lesson 5: Abaqus Scripting Interface – Postprocessing

Lesson content:

- ▶ Exploring your Data
- ▶ The ODB Object
- ▶ Working with Display Groups
- ▶ Writing to the ODB
- ▶ Examples
- ▶ Workshop 8: Create a New Custom Field Output Variable



2.5 hours

Lesson 6: Abaqus Scripting Interface – Preprocessing

Lesson content:

- ▶ Common Preprocessing Tasks
- ▶ Workshop 9: Automating a Bottle Top Load Analysis
- ▶ Plug-ins
- ▶ Workshop 10 (Optional): Study a Plug-in to Convert Flat Mesh into Cylindrical Shape



2 hours

Lesson 7: Miscellaneous Topics

Lesson content:

- ▶ Custom Data
- ▶ Scripting Ideas for Productivity
- ▶ Workshop 11: Basic Scripting Style Considerations
- ▶ Setting Abaqus Defaults
- ▶ C++ instead of Python



3 hours

Lesson 8: Stretching Horizons

Lesson content:

- ▶ Embedding and Interfacing with Legacy Applications
- ▶ Interfacing via COM Architecture
- ▶ A Few Words about GUI Customization
- ▶ Process Automation with Isight



45 minutes

Appendix 1: Optional Topics

Appendix content:

- ▶ Advanced Data Types
- ▶ Running Python
- ▶ Callback Functions
- ▶ Workshop 12: Job Monitoring
- ▶ Working with Keyword Block Objects
- ▶ Workshop 13: Working with the keywordBlock Object
- ▶ Parameter Studies



45 minutes