Introduction to Abaqus Scripting

2017
Course objectives

- Help students to develop a high level understanding of the Abaqus scripting capabilities.
- Organize and present the 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.

Targeted audience

Simulation Analysts

Prerequisites

None
Day 1

- Lecture 1  Overview of Scripting in Abaqus
  - Workshop 1  Creating a Basic Abaqus Script
- Lecture 2  Why Python?
  - Workshop 2  Running Python
- Lecture 3  Python Core Language Part 1
  - Workshop 3  Python Types, Operators, and Expressions
  - Workshop 4  Investigating Python Objects
- Lecture 4  Python Core Language Part 2
  - Workshop 5a  Defining functions
  - Workshop 5b  Defining a Function for a Series Calculation (optional)
  - Workshop 6  Modules
Day 2

- Lecture 5  Abaqus Scripting Interface Basics
  - Workshop 7  Creating a Macro and Getting Input interactively

- Lecture 6  Abaqus Object Model
  - Workshop 8  Working with the Session Object

- Lecture 7  Postprocessing with Abaqus Scripting
  - Workshop 9  Working with the ODB Object
  - Workshop 10  Linear Superposition

- Lecture 8  Miscellaneous Topics
  - Workshop 11  Creating Kernel and GUI Scripts
  - Workshop 12  Setting Abaqus Defaults
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

- 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
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

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Lesson 1: Overview of Scripting in Abaqus

Lesson content:

- Overview
- Terminology
- Types and Languages for Customizing Abaqus
- Abaqus Python Resources
- Examples
- Abaqus Scripting Interface Basics
- Workshop Preliminaries
- Workshop 1: Creating a Basic Abaqus Script

75 minutes
Lesson content:

- High Level Description of the Language
- Why Python?
- Growing Python Universe
- Running Python
- Lexical Convention and Syntax
- Workshop 2: Running Python
Lesson 3: Python Core Language Part 1

Lesson content:

- Types Overview
- Principal built-in types
- Operators and Expressions
- Workshop 3: Python Types, Operators, and Expressions
- Objects
- Workshop 4: Investigating Python Objects

3 hours
Lesson 4: Python Core Language Part 2

Lesson content:

- Control Flow
- Functions
- Workshop 5a: Defining functions
- Workshop 5b: Defining a Function for a Series Calculation (optional)
- Modules
- Namespaces
- Exceptions
- Common Issues for New Users
- Workshop 6: Modules

3 hours
Lesson 5: Abaqus Scripting Interface Basics

Lesson content:

- Abaqus PDE
- Abaqus Namespaces
- Abaqus Macro Scripts
- Abaqus Python Style Guide
- Getting Input Interactively
- Workshop 7: Creating a Macro and Getting Input interactively

1.5 hours
Lesson content:

- Introduction to Object Oriented Programming
- Abaqus Object Model Basics
- The Session Object
- The Mdb Object
- Exploring Your Data
- Abaqus Data Types
- Abaqus Modules
- Workshop 8: Working with the Session Object

2.5 hours
Lesson content:

- The Odb Object
- Writing to the Odb
- Examples
- Workshop 9: Working with the ODB Object
- Workshop 10: Linear Superposition
Lesson content:

- Plug-ins
- Really Simple GUI (RSG)
- Job Monitoring
- Custom Data
- Setting Abaqus Defaults
- Workshop 11: Creating Kernel and GUI Scripts
- Workshop 12: Setting Abaqus Defaults
Appendix content:

- Data Types
- Objects
- Common Issues for New Users
- Setting Abaqus Defaults
- Copy of Objects
- Custom Data
- Abaqus PDE Extras
- Object Oriented Programming: Inheritance

30 minutes