FSI Simulation with Abaqus and Third-party CFD Codes

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

- Evaluate FSI applications
- Create compatible CSM and CFD models for FSI
- Run FSI problems
- Understand co-simulation strategies

Targeted audience
This seminar is recommended for both structural and CFD engineers with an interest in evaluating and analyzing real world FSI applications.

Prerequisites
None
Day 1

- Lecture 1  Introduction
- Lecture 2  Technical Details
- Lecture 3  Conducting an FSI Simulation using Abaqus and STAR-CCM+
  - Workshop 1  Antilock Braking System (Abaqus + STAR-CCM+)
- Lecture 4  Classifying FSI Applications
  - Workshop 2  Stead-State Flow in an Exhaust Manifold (Abaqus + STAR-CCM+)
- Lecture 5  Miscellaneous Topics
Appendix 1  An Overview of CFD for Structural Analysts
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
<table>
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<th>Application</th>
<th>Features</th>
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| **Abaqus**  | - Routine and Advanced Simulation  
- Linear and Nonlinear, Static and Dynamic  
- Thermal, Electrical, Acoustics  
- Extended Physics through Co-simulation  
- Model Preparation and Visualization |
| **Isight**  | - Process Integration  
- Design Optimization  
- Parametric Optimization  
- Six Sigma and Design of Experiments |
| **Tosca**   | - Non-Parametric Optimization  
- Structural and Fluid Flow Optimization  
- Topology, Sizing, Shape, Bead Optimization |
| **fe-safe** | - Durability Simulation  
- Low Cycle and High Cycle Fatigue  
- Weld, High Temperature, Non-metallics |
| **Simpack** | - 3D Multibody Dynamics Simulation  
- Mechanical or Mechatronic Systems  
- Detailed Transient Simulation (Offline and Realtime) |

**Realistic Human Simulation**  
High Speed Crash & Impact  
Noise & Vibration

**Material Calibration**  
Workflow Automation  
Design Exploration

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

**Safety Factors**  
Creep-Fatigue Interaction  
Weld Fatigue

**Complete System Analyses**  
(Quasi-)Static, Dynamics, NVH  
Flex Bodies, Advanced Contact
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http://www.3ds.com/products-services/simulia/services/training-courses/

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North American
- By Location
- By Course

International
- By Location
- By Course

Live Online Training
- Full Schedule
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## Revision Status

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Lesson content:

- Multiphysics / Multiscale Simulation
- SIMULIA Multiphysics
- What is Co-Simulation?
- Co-Simulation Applications
- SIMULIA Co-Simulation
- CFD Co-Simulation with Abaqus
- Fluid-Structure Interaction
- FSI Applications
- FSI Examples
- Conjugate Heat Transfer between Solid and Fluids
- CHT Applications
- CHT Example
- FSI/CHT Co-Simulation Attributes
Lesson 2: Technical Details

Lesson content:

- What is Co-Simulation?
- Monolithic vs Segregated Solution
- Overcoming Numerical Challenges
- Definitions
- Technical Approach
- Determining the Coupling Step Size
- Common Coupling Strategies
- Updating the CFD Domain
- Software Architecture
Lesson 3: Conducting an FSI Simulation using Abaqus

Lesson content:

- Suggested Generic Workflow
- FSI Workflow using STAR-CCM+
- Workshop Preliminaries
- Workshop 1: Antilock Braking System (Abaqus + STAR-CCM+)
Lesson 4: Classifying FSI Applications

Lesson content:

- Unidirectional Coupled Analysis
- Bidirectional Coupled Analysis
- File-Based Sequential Coupling
- Estimating Coupling Strength
- Workshop 2: Stead-State Flow in an Exhaust Manifold (Abaqus + STAR-CCM+)
Lesson content:

- Co-Simulation Director
- The *CO-SIMULATION option
- Restart Analysis
- Convergence
- Workflow between CSS and Solvers
- Manually Starting the CSS Director Process
Appendix 1: An Overview of CFD for Structural Analysts

Appendix content:

- Introduction
- Governing Equations for Fluid Dynamics
- Computational Fluid Dynamics
- Fluid Properties
- CFD Modeling