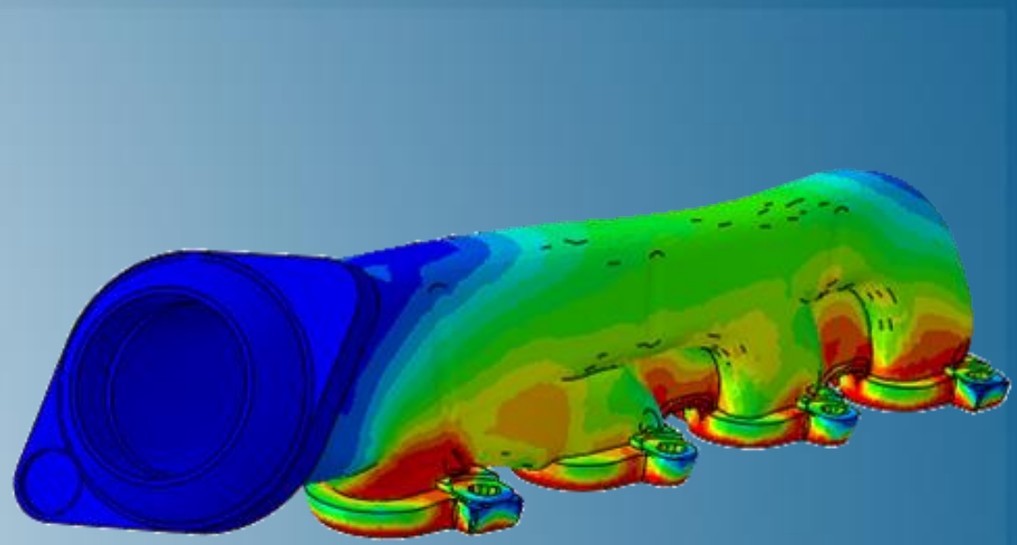
FSI Simulation with Abaqus and Third-party CFD Codes

Abaqus 2019



3DEXPERIENCE®

About this Course

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

1 day

Day 1

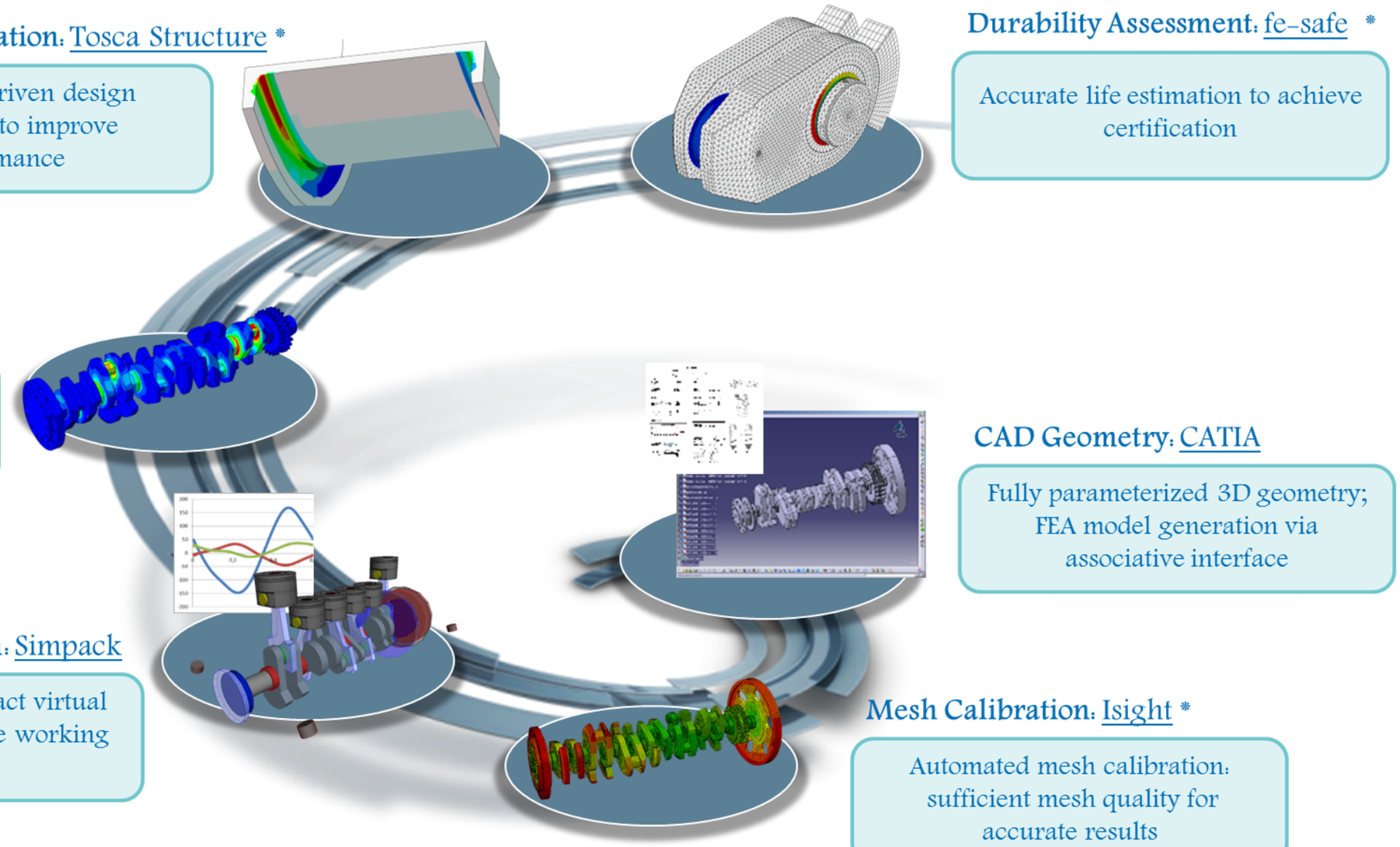
- Lecture 1 — Introduction
- Lecture 2 — Technical Details
- Lecture 3 — Conducting an FSI Simulation using Abaqus and STAR-CCM+
  - Workshop 1 — Antilock Braking System (Abaqus + STAR-CCM+)
- Lecture 4 — Classifying FSI Applications
  - Workshop 2 — Steady-State Flow in an Exhaust Manifold (Abaqus + STAR-CCM+)
- Lecture 5 — Miscellaneous Topics

Additional Material

- Appendix 1 An Overview of CFD for Structural Analysts

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 *

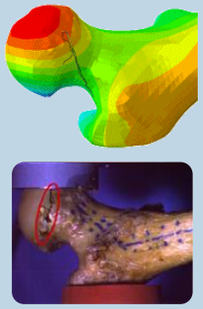
Automated mesh calibration: sufficient mesh quality for accurate results

* Included in extended licensing pool

SIMULIA's Power of the Portfolio

Abaqus

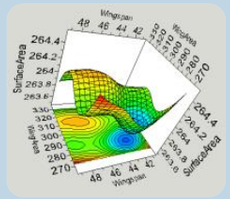
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization



Realistic Human Simulation
High Speed Crash & Impact
Noise & Vibration

Isight

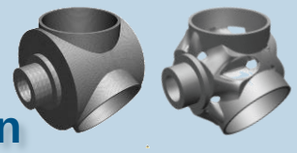
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments



Material Calibration
Workflow Automation
Design Exploration

Tosca

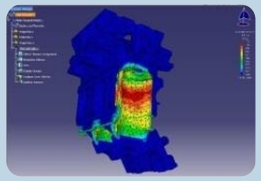
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization



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

fe-safe

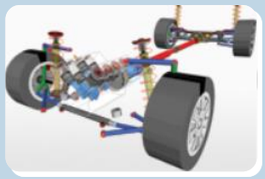
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics



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!

SIMULIA

Let the SIMULIA Learning Community be *Your* Portal to 21st Century Innovation

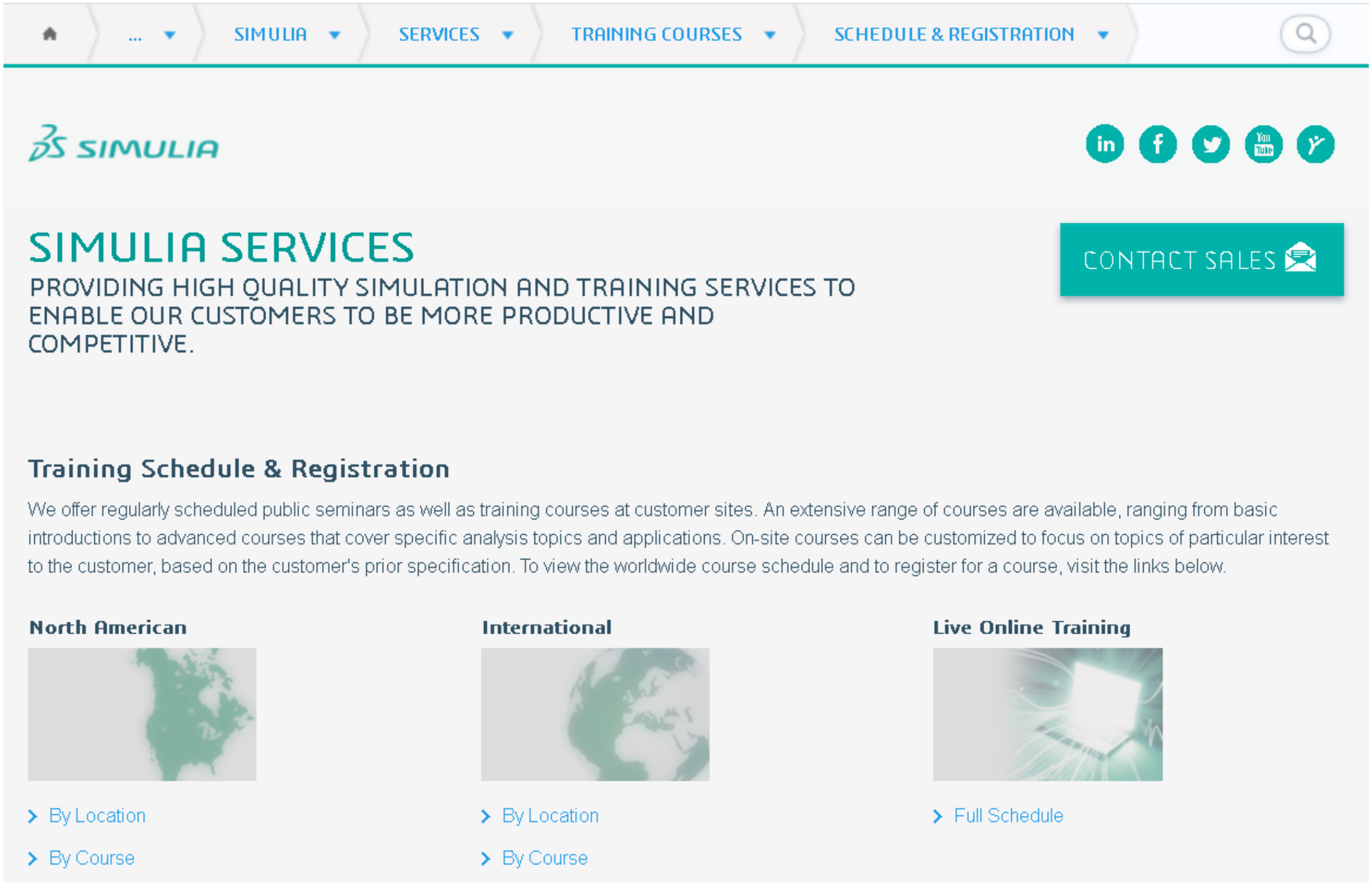
Discover new ways to explore how to leverage realistic simulation to drive product innovation. Join the thousands of Abaqus and Isight users who are already gaining valuable knowledge from the SIMULIA Learning Community.

For more information and registration, visit **3ds.com/simulia-learning**.
Connect. Share. Spark Innovation.

DASSAULT SYSTEMES | The **3D**EXPERIENCE Company

SIMULIA Training

http://www.3ds.com/products-services/simulia/services/training-courses/



Legal Notices

Revision Status

Lecture 1	5/19	Updated for Abaqus 2019
Lecture 2	5/19	Updated for Abaqus 2019
Lecture 3	5/19	Updated for Abaqus 2019
Lecture 4	5/19	Updated for Abaqus 2019
Lecture 5	5/19	Updated for Abaqus 2019
Appendix 1	5/19	Updated for Abaqus 2019
Workshop 1	5/19	Updated for Abaqus 2019
Workshop 2	5/19	Updated for Abaqus 2019

Lesson 1: Introduction

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

40 minutes

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

40 minutes

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+)

1.5 hours

Lesson 4: Classifying FSI Applications

Lesson content:

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

2.5 hours

Lesson 5: Miscellaneous Topics

Lesson content:

- Co-Simulation Director
- The *CO-SIMULATION option
- Restart Analysis
- Convergence
- Workflow between CSS and Solvers
- Manually Starting the CSS Director Process

45 minutes

Appendix 1: An Overview of CFD for Structural Analysts

Appendix content:

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

45 minutes