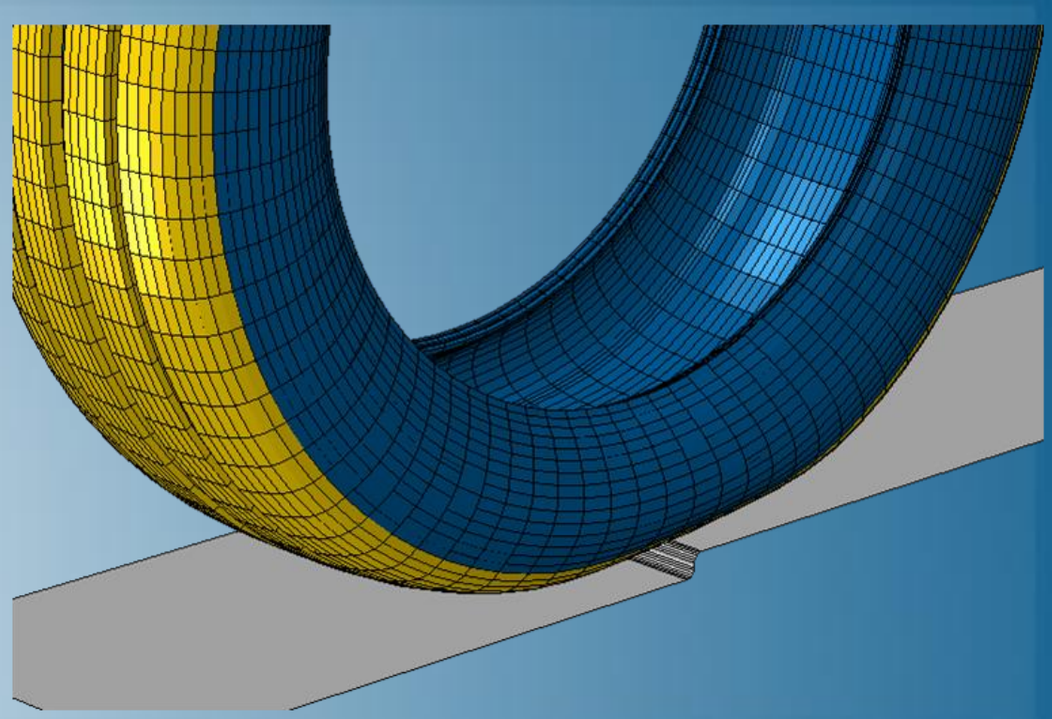
Tire Analysis with Abaqus: Advanced Topics

2017



3DEXPERIENCE

About this Course

Course objectives

Topics covered in this course include:

- Steady-state rolling using Eulerian techniques in Abaqus/Standard
- Hydroplaning simulation using Coupled Eulerian-Lagrangian technique
- Efficient steady-state dynamics analysis
- Transient analysis using Abaqus/Explicit
- Substructuring and submodeling

Targeted audience

This course is recommended for tire analysts with experience using Abaqus

Prerequisites

Tire Analysis with Abaqus: Fundamentals

1 day

Day 1

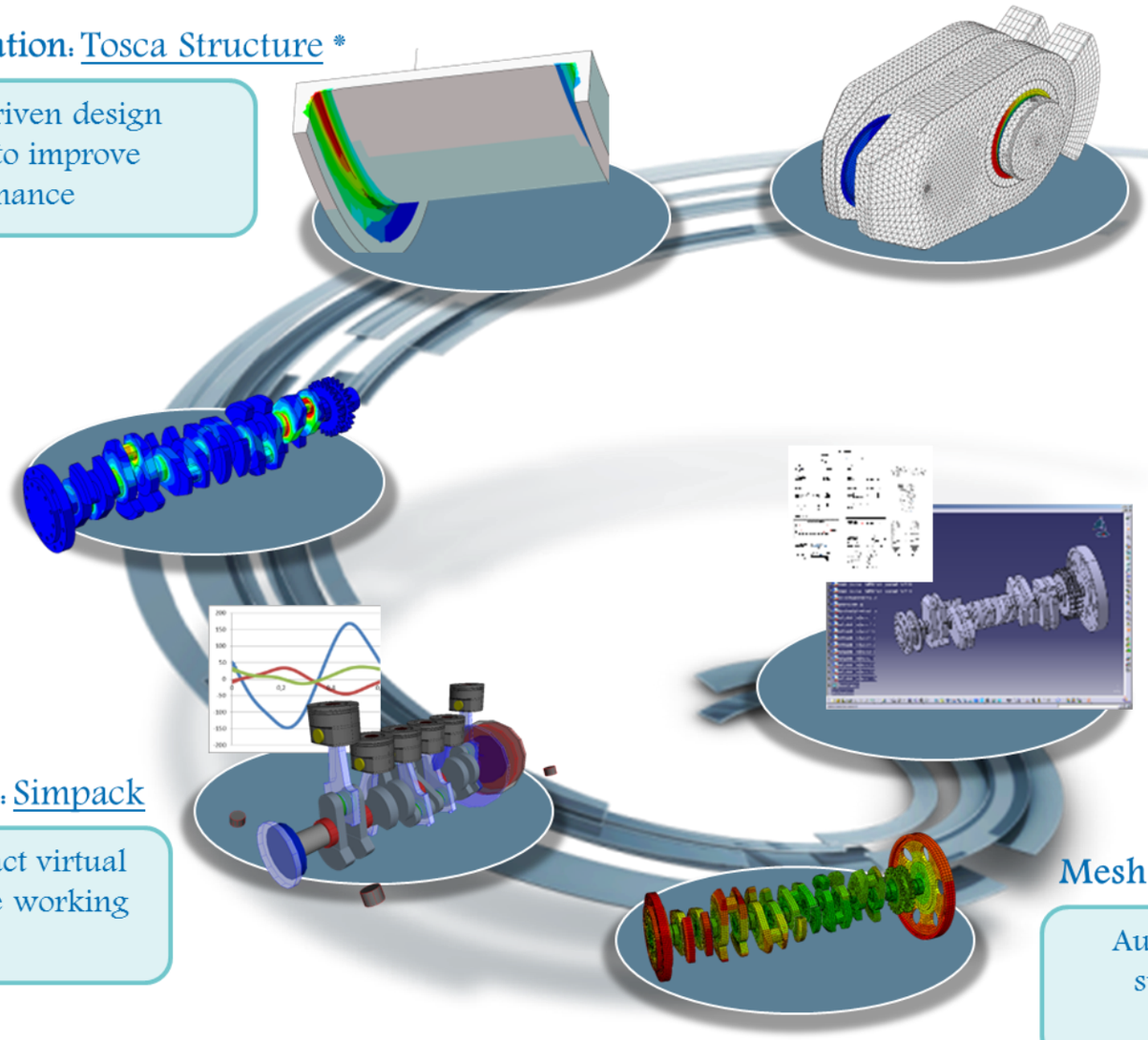
- Lecture 1 — Steady-State Rolling Analysis
- Workshop 1 — Steady-State Rolling Analysis of a Tire
- Lecture 2 — Transient Dynamic Analysis
- Workshop 2 — Transient Rolling Analysis of a Tire
- Lecture 3 — Linear Dynamics, Acoustics and Substructures
- Lecture 4 — Submodeling

Additional Material

- Appendix 1 Co-simulation

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 *

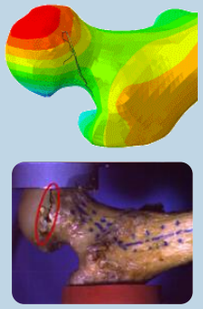
Automated mesh calibration: sufficient mesh quality for accurate results

* Included in extended licensing pool

SIMULIA's Power of the Portfolio

Abaqus

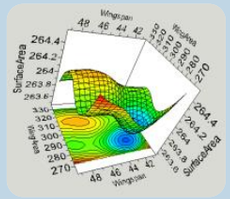
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization



Realistic Human Simulation
High Speed Crash & Impact
Noise & Vibration

Isight

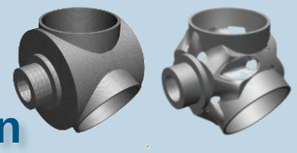
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments



Material Calibration
Workflow Automation
Design Exploration

Tosca

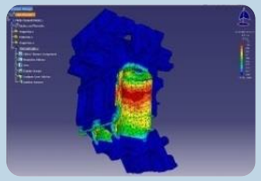
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization



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

fe-safe

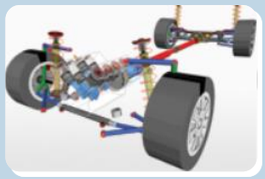
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics



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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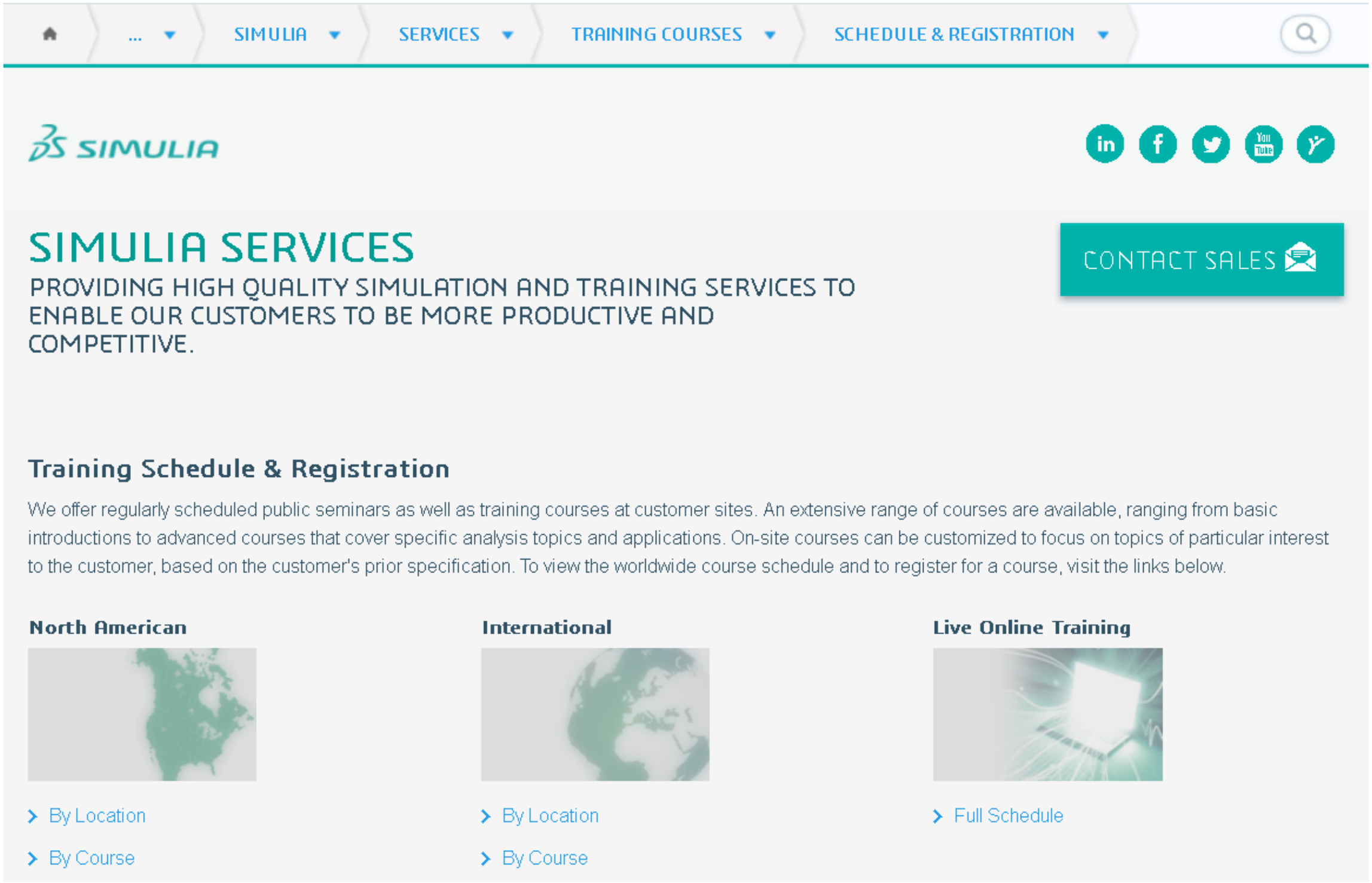

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Revision Status

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
Appendix 1	11/16	Updated for Abaqus 2017
Workshop 1	11/16	Updated for Abaqus 2017
Workshop 2	11/16	Updated for Abaqus 2017

Lesson 1: Steady-State Rolling Analysis

Lesson content:

- Steady-State Transport (SST) Analysis
- Model Definition and Analysis
- Mullins Effect
- Viscoelasticity
- Limitations
- Steady-State Rolling Example
- Tread Wear
- Workshop Preliminaries
- Workshop 1: Steady-State Rolling Analysis of a Tire

2.5 hours

Lesson 2: Transient Dynamic Analysis

Lesson content:

- Introduction
- Time Integration Algorithm
- Automatic Time Incrementation
- Damping
- Bulk Viscosity Damping
- Material Damping
- General Contact
- Interface between Abaqus/Explicit and Abaqus/Standard
  - Example : Impact of rolling tire with curb
- Introduction to CEL
- Modeling Tire Hydroplaning/Aquaplaning
- Workshop 2: Transient Rolling Analysis of a Tire

2.5 hours

Lesson 3: Linear Dynamics, Acoustics and Substructures

Lesson content:

- Goals of Steady-State Dynamics
- Overview of Steady-State Dynamic Procedures
- The Subspace Projection Method
- Example: Steady-State Analysis of a Tire on a Bumpy Road
- Rotational Effects
- Example: Vibration characteristics of rolling tires
- Overview of Acoustics Features
- Acoustic Rotational Effects
- Example: Coupled Structural Acoustic Analysis of a Stationary Tire Filled with Air
- Example: Coupled Structural Acoustic Analysis of a Moving Tire
- Concept of Substructuring
- Advantages of Substructuring
- Substructure Generation and Usage
- Dynamic Substructuring
- Application of Substructuring to Tires

1.5 hours

Lesson 4: Submodeling

Lesson content:

- Concept of Submodeling
- Motivation for Submodeling
- Fundamental Assumptions
- Implementation
- Transfer of Data
- Prescribed Values
- Example: Submodel Analysis of a Tire Footprint

1 hour

Appendix 1: Co-simulation

Appendix content:

- FTire Co-simulation

15 minutes