

Tire Analysis with Abaqus: Fundamentals

Abaqus 2018







About this Course

Course objectives

In this course you will learn about:

- Choosing appropriate elements
- Methods of modeling reinforcement
- Contact modeling details pertinent to tire modeling
- Fundamentals of material modeling-stress and strain measures, material directions
- Linear elasticity, hyperelasticity and viscoelasticity
- Efficient axisymmetric to three-dimensional model generation and results transfer

Targeted audience

This course is recommended for tire analysts with experience using Abaqus

Prerequisites

None



Day 1

- Lecture 1 Tire Modeling Tools in Abaqus
- Lecture 2 Axisymmetric Model Building
 - Workshop 1 Modeling a Tire Cross-section
- Lecture 3 Symmetric Model Generation and Results Transfer

- Lecture 4 Three-dimensional Model Building
 - Workshop 2 Three-dimensional Tire Models
 - Workshop 3 Visualization of Three-dimensional Tire Models
- Lecture 5 Elements and Reinforcement
- Lecture 6 Modeling Contact
- Lecture 7 Rubber Models for Tire Analysis

SIMULIA

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



* Included in extended licensing pool

SIMULIA's Power of the Portfolio



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 <u>www.3ds.com/slc</u> to log in or join!





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.**

SIMULIA Training

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

| ▲ … ▼ SIMULIA ▼ SERVICES ▼ TRAINING COURSES ▼ | SCHEDULE & REGISTRATION • |
|--|---------------------------|
| ZS SIMULIA | in f 😏 🛅 🍞 |
| SIMULIA SERVICES PROVIDING HIGH QUALITY SIMULATION AND TRAINING SERVICE ENABLE OUR CUSTOMERS TO BE MORE PRODUCTIVE AND COMPETITIVE. | S TO |

Training Schedule & Registration

We offer regularly scheduled public seminars as well as training courses at customer sites. An extensive range of courses are available, ranging from basic introductions to advanced courses that cover specific analysis topics and applications. On-site courses can be customized to focus on topics of particular interest to the customer, based on the customer's prior specification. To view the worldwide course schedule and to register for a course, visit the links below.

North American



- > By Location
- > By Course

International



> By Location

> By Course

Live Online Training



> Full Schedule

The software described in this documentation is available only under license from Dassault Systèmes or its subsidiaries and may be used or reproduced only in accordance with the terms of such license.

This documentation and the software described in this documentation are subject to change without prior notice.

Dassault Systèmes and its subsidiaries shall not be responsible for the consequences of any errors or omissions that may appear in this documentation.

No part of this documentation may be reproduced or distributed in any form without prior written permission of Dassault Systèmes or its subsidiaries.

© Dassault Systèmes, 2017

Printed in the United States of America.

Abaqus, the 3DS logo, and SIMULIA are trademarks or registered trademarks of Dassault Systèmes or its subsidiaries in the US and/or other countries.

Other company, product, and service names may be trademarks or service marks of their respective owners. For additional information concerning trademarks, copyrights, and licenses, see the Legal Notices in the SIMULIA User Assistance.

| Lecture 1 | 11/17 | Updated for Abaqus 2018 |
|-------------|-------|-------------------------|
| Lecture 2 | 11/17 | Updated for Abaqus 2018 |
| Lecture 3 | 11/17 | Updated for Abaqus 2018 |
| Lecture 4 | 11/17 | Updated for Abaqus 2018 |
| Lecture 5 | 11/17 | Updated for Abaqus 2018 |
| Lecture 6 | 11/17 | Updated for Abaqus 2018 |
| Lecture 7 | 11/17 | Updated for Abaqus 2018 |
| Workshop 1a | 11/17 | Updated for Abaqus 2018 |
| Workshop 1b | 11/17 | Updated for Abaqus 2018 |
| Workshop 1c | 11/17 | Updated for Abaqus 2018 |
| Workshop 1d | 11/17 | Updated for Abaqus 2018 |
| Workshop 1e | 11/17 | Updated for Abaqus 2018 |
| Workshop 2 | 11/17 | Updated for Abaqus 2018 |
| Workshop 3 | 11/17 | Updated for Abaqus 2018 |

Lesson 1: Tire Modeling Tools in Abaqus

- Introduction
 - Prerequisites for the course (basic Abaqus/CAE and analysis knowledge)
- ▶ Tire Analysis Capabilities
- How Tires are Made
 - Green tire vs. cured tire
 - Effect on rebar specification in analysis models



Lesson 2: Axisymmetric Model Building

- Why Start with Axisymmetry?
- Creation of Rim, Carcass, Ply and Belt Geometries
- Workshop Preliminaries
- Workshop 1a: Modeling a tire cross-section
 Modeling the tire cross-section
- Reinforcement Modeling
- Material Properties and Assignment
- Workshop 1b: Modeling a tire cross-section
 Tire properties and rebar definitions
- Contact and Constraints

- Boundary Conditions and Loads
- Steps and Output Requests
- Workshop 1c: Modeling a tire cross-section Contact, loads, and boundary conditions
- Meshing
- Workshop 1d: Modeling a tire cross-section Axisymmetric mesh
- Job Submission
- Results Visualization
- Workshop 1e: Modeling a tire cross-section Axisymmetric tire analysis



Lesson 3: Symmetric Model Generation and Results Transfer

- Introduction
- Smooth/Ribbed Tires: Symmetric Model Generation
- Smooth/Ribbed Tires: Symmetric Results Transfer
- Treaded Tires



Lesson 4: Three-dimensional Model Building

- Introduction
 - What is SMG/SRT? (flattened model requirement, etc.)
- 3D Model Definition
 - Element types (general vs. cylindrical)
 - Circumferential discretization
 - Model generation (road, tread surface)
- Step and Output Requests
 - Equilibrating step
 - 2-step approach to footprint analysis (displacement control followed by load control)
- Contact, Boundary Conditions, and Loads
- Job Submission and Results Visualization
- Tire Wizard Plug-In
- Workshop 2: Three-dimensional Tire Models
- Workshop 3: Visualization of Three-dimensional Tire Models



Lesson 5: Elements and Reinforcement

Lesson content:

- Introduction
- Element Selection
- Modeling Reinforcement
- Rebar Layers
- Embedded Elements

www.3ds.com | © Dassault Systèmes

Lesson 6: Modeling Contact

- Overview of Contact
- Contact Discretization
- Contact Enforcement
- Finite Sliding of Deformable Bodies against Each Other
- Finite Sliding of Deformable Bodies against Rigid Bodies
- Additional Features
- Friction Basics



Lesson 7: Rubber Models for Tire Analysis

- Introduction
- Stress and Strain Measures
- Material Directions
- Temperature and Field Variable Dependence
- Hyperelasticity