Electromagnetic Analysis with Abaqus

Abaqus 2020
Course objectives
Upon completion of this course you will be able to:

- Set up and create electromagnetic models with Abaqus
- Perform low frequency eddy current analyses with Abaqus
- Perform transient eddy current analyses with Abaqus
- Perform magnetostatic analyses with Abaqus

Targeted audience
Simulation Analysts

Prerequisites
This course is recommended for engineers with experience using Abaqus
Day 1

- **Lesson 1**  Introduction to Computational Electromagnetics
- **Lesson 2**  Geometry, Material Properties, Elements and Meshing
  - Workshop 1  Heating of a Rod: Problem setup
  - Workshop 2  Sphere in a Magnetic Field: Problem setup
- **Lesson 3**  Loads and Boundary Conditions
- **Lesson 4**  Output and Transfer of Results
  - Workshop 1 (cont’d)  Heating of a Rod: Thermal Response
  - Workshop 2 (cont’d)  Sphere in a Magnetic Field: Electromagnetic Response
  - Workshop 3  Magnetostatic Analysis of a Solenoid Valve
  - Workshop 4  Magnetic Pulse Forming of a Metallic Tube
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

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<th><strong>Abaqus</strong></th>
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| - Routine and Advanced Simulation  
- Linear and Nonlinear, Static and Dynamic  
- Thermal, Electrical, Acoustics  
- Extended Physics through Co-simulation  
- Model Preparation and Visualization | - Process Integration  
- Design Optimization  
- Parametric Optimization  
- Six Sigma and Design of Experiments | - Non-Parametric Optimization  
- Structural and Fluid Flow Optimization  
- Topology, Sizing, Shape, Bead Optimization | - Durability Simulation  
- Low Cycle and High Cycle Fatigue  
- Weld, High Temperature, Non-metallics | - 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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Lesson 1: Introduction to Computational Electromagnetics

Lesson content:

- Motivation
- Basics of Electromagnetism
- Computational Electromagnetics in Abaqus
- Workflow of an Electromagnetic Analysis
- Examples
Lesson 2: Geometry, Material Properties, Elements and Meshing

Lesson content:

- Geometry Creation
- Material Properties
- Element Technology
- Meshing
- Workshop Preliminaries
- Workshop 1: Heating of a Rod: Problem setup
- Workshop 2: Sphere in a Magnetic Field: Problem setup
Lesson 3: Loads and Boundary Conditions

Lesson content:

- Introduction
- Loads
- Boundary Conditions
- Symmetry
- Motion
Lesson content:

- Analysis Procedures
- Co-simulation
- Sequential Mapping
- Output
- Workshop 1 (cont’d): Heating of a Rod: Thermal Response
- Workshop 2 (cont’d): Sphere in a Magnetic Field: Electromagnetic Response
- Workshop 3: Magnetostatic Analysis of a Solenoid Valve
- Workshop 4: Magnetic Pulse Forming of a Metallic Tube