Introduction to Abaqus/CFD for Multiphysics Applications
Course objectives
Upon completion of this course you will be able to:

- Set up and create CFD and FSI models with Abaqus
- Perform CFD analyses with Abaqus
- Perform FSI analyses with Abaqus
- Postprocess CFD and FSI results

Targeted audience
Simulation Analysts

Prerequisites
None
Day 1

- Lecture 1: Review of CFD Fundamentals
- Lecture 2: Introduction
- Lecture 3: Getting Started with Abaqus/CFD
- Workshop 1: Unsteady flow across a circular cylinder
- Lecture 4: CFD Modeling Techniques – Part 1
- Workshop 2: Fluid flow through a pipe with a constriction
Day 2

- Lecture 5  CFD Modeling Techniques – Part 2
- Lecture 6  Getting Started with FSI Using Abaqus/CFD
- Workshop 1 Unsteady flow across a circular cylinder (continued)
- Workshop 3 Antilock braking system
- Lecture 7  FSI Modeling Techniques
- Workshop 3 Antilock braking system
- Lecture 8  Postprocessing CFD/FSI Analyses
- Workshop 4  Heat transfer analysis of a component-mounted electronic circuit board
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Lesson 1: Review of CFD Fundamentals

Lesson content:

- Overview
- What is CFD?
- Numerical Simulation of Physical Phenomena
- Computational Solid Mechanics (CSM) vs. Computational Fluid Dynamics (CFD)
- CFD Basics
- Governing Equations
- Diffusion and Advection
- Flow Features
- Heat Transfer in Fluid Dynamics
- Non-dimensional Quantities in CFD
- Initial and Boundary Conditions
- Solution Methodology
- Turbulence Modeling
- References

1.5 hours
Lesson 2: Introduction

Lesson content:

- Multiphysics
- Abaqus Multiphysics
- Extended Multiphysics
- Multiphysics Coupling
- Abaqus/CFD
- Fluid-Structure Interaction (FSI)
- Native FSI using Abaqus
- Target Applications
- System and Licensing Requirements
- Execution Procedure

2 hours
Lesson content:

- CFD Simulation Workflow
- Setting up CFD Analyses
- Case Study 1: Flow around a Rigid Circular Cylinder
- Case Study 2: Flow around an Oscillating Rigid Circular Cylinder
- Modeling Heat Transfer
- Modeling Turbulence
- Workshop Preliminaries
- Workshop 1: Unsteady flow across a circular cylinder

2 hours
Lesson 4: CFD Modeling Techniques – Part 1

Lesson content:

- Material Properties
- Meshing
- Incompressible Flow Analysis Procedure
- Solution Algorithm
- Linear Equation Solvers
- Pressure Equation Solvers
- Momentum Equation Solvers
- Equation Solver Output
- Workshop 2: Fluid flow through a pipe with a constriction

2 hours
Lesson content:

- Initial Conditions
- Boundary Conditions
- Primary Turbulence Variables and Turbulence Flow Features
- Turbulence Modeling
- Body Forces
- Heat Sources
- Porous Media Modeling
- User Subroutines
- Output
- Deforming Meshes
- Monitoring a CFD Calculation
Lesson content:

- Setting up FSI Analyses
- Case Study 3: Flow around a Spring-loaded Rigid Circular Cylinder
- FSI Analyses with Shells/Membranes
- Conjugate Heat Transfer Analyses
- Workshop 1 (continued): Unsteady flow across a circular cylinder
Lesson content:

- FSI Analysis Workflow
- FSI Analysis Attributes
- Conjugate Heat Transfer
- Workshop 3: Antilock braking system
Lesson 8: Postprocessing CFD/FSI Analyses

Lesson content:

- Abaqus/CAE Tips
- Isosurfaces
- View Cuts
- Vector Plots
- Stream Toolset (Instantaneous Particle Traces)
- Workshop 4: Heat transfer analysis of a component-mounted electronic circuit board

2 hours