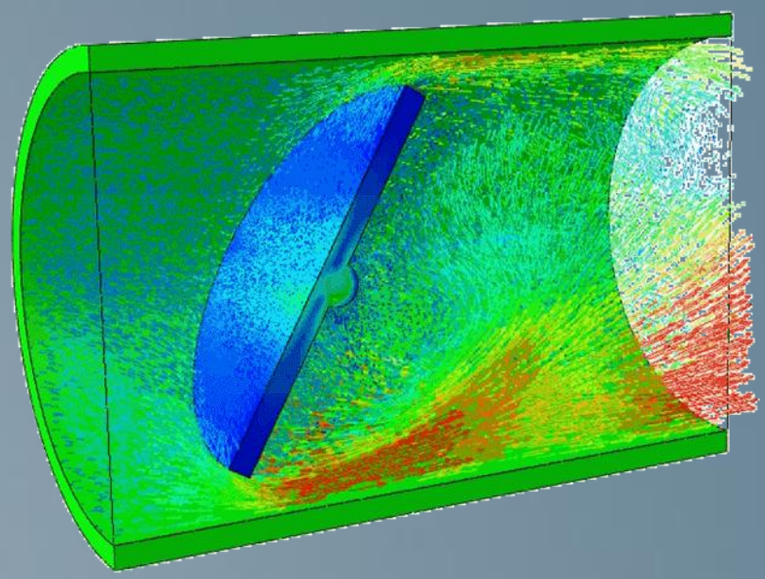
DASSAULT SYSTEMES

Fluid Mechanics Simulation Essentials

R2014X



3D i V+R

3DEXPERIENCE

About this Course

Course objectives

Upon completion of this course you will be able to:

- Set up and create CFD, CHT and FSI models in the **3D**EXPERIENCE Platform
- Perform CFD analyses
- Perform FSI analyses
- Perform CHT analyses
- Postprocess CFD, FSI and CHT results

Targeted audience

Simulation Analysts

Prerequisites

None

2 days

Day 1

- Lesson 1 — Review of CFD Fundamentals
- Lesson 2 — Overview of Flow Simulation
- Lesson 3 — Getting Started with Flow Simulation
- Workshop 1 — Getting Started with the **3D**EXPERIENCE Platform
- Lesson 4 — Geometry for CFD Simulations
- Lesson 5 — Meshing for CFD Simulations
- Lesson 6 — Material and Section Properties
- Workshop 2 — Fluid Flow and Heat Transfer in a Pipe Junction

Day 2

- Lesson 7 — Defining Flow Simulation Scenarios
- Lesson 8 — Flow Conditions
- Workshop 3 — External Flow over a Rigid Baffle
- Lesson 9 — Turbulence Modeling
- Lesson 10 — Modeling Techniques
- Lesson 11 — Co-simulation Analysis
- Workshop 4 — External Flow over a Flexible Baffle
- Workshop 5 — Conjugate Heat Transfer (CHT) Co-simulation Analysis of a Heated Fin
- Lesson 12 — Running Simulations and Postprocessing

Join the Community!

How can you maximize the robust technology of Abaqus FEA and Isight?

Connect with peers to share knowledge and get technical insights

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

Legal Notices

Revision Status

Lesson 1	2/14	Updated for R2014X
Lesson 2	2/14	Updated for R2014X
Lesson 3	2/14	Updated for R2014X
Lesson 4	2/14	Updated for R2014X
Lesson 5	2/14	Updated for R2014X
Lesson 6	2/14	Updated for R2014X
Lesson 7	2/14	Updated for R2014X
Lesson 8	2/14	Updated for R2014X
Lesson 9	2/14	Updated for R2014X
Lesson 10	2/14	Updated for R2014X
Lesson 11	2/14	Updated for R2014X
Lesson 12	2/14	Updated for R2014X

Workshop 1	2/14	New for R2014X
Workshop 2	2/14	Updated for R2014X
Workshop 3	2/14	Updated for R2014X
Workshop 4	2/14	New for R2014X
Workshop 5	2/14	New for R2014X

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: Overview of Flow Simulation

Lesson content:

- What is the **3D**EXPERIENCE Platform?
- **3D**EXPERIENCE Platform Architecture
- **3D**EXPERIENCE Platform Interface
- Flow Simulation in the **3D**EXPERIENCE Platform
- Model Preparation
- Materials
- Meshing
- CFD Analysis
- Fluid-Structure Interaction (FSI)
- Conjugate Heat Transfer (CHT)
- High Performance Visualization

1 hour

Lesson 3: Getting Started with Flow Simulation

Lesson content:

- Connecting to the **3D**EXPERIENCE Platform
- **3D**EXPERIENCE Platform Interface
- Importing and Exporting Data
- Exploring Data
- Flow Simulation in the **3D**EXPERIENCE Platform
- Flow Simulation Workflow
- Fluid Scenario Creation App Interface
- Finite Element Model Representation
- Fluid Model Set-up
- Fluid Scenario Set-up
- Results Visualization
- Managing Data
- Simulation Conventions

1.5 hour

Lesson 4: Geometry for Flow Simulations

Lesson content:

- Fluid Model Set up Overview
- Setting up FEM Rep
- Setting up Fluid Domain
- Geometry Preparation

1 hour

Lesson 5: Meshing for Flow Simulations

Lesson content:

- Basics
- Meshing in the **3D**EXPERIENCE Platform
- CFD Meshing Using the Mesher
- Hex-dominant Meshing
- Octree Tetrahedron Meshing
- Tetrahedron Filler Meshing
- Sweep 3D Meshing
- Surface Meshing
- Visualizing the Mesh
- Checking the Mesh
- Groups

1 hour

Lesson 6: Materials and Section Properties

Lesson content:

- Understanding Materials
- Working with Materials
- Available Materials
- Applying a Material
- Creating a New Material
- Adding New Domains
- Editing a Material Domain
- Simulation Domains
- Material Behaviors in Simulation Domain
- Section Properties
- Working with Orphan Meshes

1 hour

Lesson 7: Defining Flow Simulation Scenarios

Lesson content:

- FEM Rep for Flow Simulation
- Fluid Scenario Set up Overview
- Flow Regime
- Initial Conditions
- Flow Analysis Procedures
- Incompressible Flow Analysis Procedure
- Natural Convection Analysis
- Solution Algorithm
- Linear Equation Solvers
- Pressure Equation Solvers
- Momentum Equation Solvers
- Equation Solver Output

1 hour

Lesson 8: Flow Conditions

Lesson content:

- Boundary Conditions
- Body Force
- Heat Source

1 hour

Lesson 9: Turbulence Modeling

Lesson content:

- What is Turbulence?
- Is the Flow Turbulent?
- Turbulence Modeling
- How Realistic does the Solution Look?
- Activating Turbulence Models
- Near-Wall Modeling
- Turbulence Initial Conditions
- Turbulence Boundary Conditions
- Primary Turbulence Variables and Turbulence Flow Features

1 hour

Lesson 10: Modeling Techniques

Lesson content:

- Deforming Mesh
- Output
- Monitoring a CFD Calculation

1 hour

Lesson 11: Co-simulation Analysis

Lesson content:

- Creating Co-simulation Analyses
- Navigating Analysis Cases in Co-simulation
- Co-simulation Interface
- Fluid-Structure Interaction Co-simulation
- Conjugate Heat Transfer Co-simulation
- Co-simulation Attributes
- Stability: Fluid-Structure Interaction Co-simulation
- Stability: Conjugate Heat Transfer Co-simulation

1 hour

Lesson 12: Running Simulations and Postprocessing

Lesson content:

- Running Simulations
- Accessing Results
- Contour Plots
- Isosurfaces
- Vector Plots
- View Cuts
- Stream Toolset (Instantaneous Particle Traces)
- Rendering Settings
- Display Groups
- Creating Reports

1 hour