

Fluid Mechanics Analyst Essentials

R2017x



3DEXPERIENCE[®]



About this Course

Course objectives

Upon completion of this course you will be able to:

- ▶ Set up and create CFD and CHT models in the **3DEXPERIENCE** Platform
- ▶ Perform CFD analyses
- ▶ Perform fully coupled CHT analyses
- ▶ Postprocess CFD and CHT results

Targeted audience

This course is intended for the following roles:

- ▶ Fluid Mechanics Analyst
- ▶ Multiphysics Simulation Researcher

Prerequisites

The following course is required prior to taking this one:

- ▶ None



2 days

Day 1

- ▶ Lesson 1 Review of CFD Fundamentals
- ▶ Lesson 2 Introduction to the **3DEXPERIENCE** Platform
- ▶ Workshop 1 Getting Started with the **3DEXPERIENCE** Platform
- ▶ Lesson 3 Fluid Mechanics Analyst Role Overview
- ▶ Lesson 4 Getting Started with CFD Simulation
- ▶ Lesson 5 Geometry for CFD Simulations
- ▶ Workshop 2 Fluid Flow and Heat Transfer in a Pipe Junction
- ▶ Lesson 6 Meshing for CFD Simulations
- ▶ Lesson 7 Material and Section Properties
- ▶ Workshop 3 External Flow Over a Car

Day 2

- ▶ Lesson 8 Defining CFD Simulation Scenarios
- ▶ Lesson 9 Flow Conditions
- ▶ Workshop 4 Conjugate Heat Transfer Analysis of an Electronic Package
- ▶ Lesson 10 Turbulence Modeling
- ▶ Lesson 11 Modeling Techniques
- ▶ Workshop 5 Unsteady Flow Across a Circular Cylinder
- ▶ Lesson 12 Running Simulations
- ▶ Workshop 6 Species Transport in a Pipe Junction
- ▶ Lesson 13 Postprocessing

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Revision Status

Lesson 1	2/17	Updated for R2017x
Lesson 2	2/17	Updated for R2017x
Lesson 3	2/17	Updated for R2017x
Lesson 4	2/17	Updated for R2017x
Lesson 5	2/17	Updated for R2017x
Lesson 6	2/17	Updated for R2017x
Lesson 7	2/17	Updated for R2017x
Lesson 8	2/17	Updated for R2017x
Lesson 9	2/17	Updated for R2017x
Lesson 10	2/17	Updated for R2017x
Lesson 11	2/17	Updated for R2017x
Lesson 12	2/17	Updated for R2017x
Lesson 13	2/17	Updated for R2017x
Workshop 1	2/17	Updated for R2017x
Workshop 2	2/17	Updated for R2017x
Workshop 3	2/17	Updated for R2017x
Workshop 4	2/17	Updated for R2017x
Workshop 5	2/17	Updated for R2017x
Workshop 6	2/17	Updated for R2017x

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 Flow Conditions
- ▶ Solution Methodology
- ▶ Turbulence Modeling
- ▶ References



1.5 hours

Lesson 2: Introduction to the 3DEXPERIENCE Platform

Lesson content:

- ▶ What is the **3DEXPERIENCE** Platform?
- ▶ Architecture
- ▶ Packaging
- ▶ **3DEXPERIENCE** Platform Services
- ▶ Connecting to the Platform
- ▶ Platform Interface
- ▶ Importing and Exporting Data
- ▶ Searching Data
- ▶ Exploring Data
- ▶ Managing Data
- ▶ Compute Orchestration Services
- ▶ Simulation Conventions
- ▶ Workshop Preliminaries



1 hour

Lesson 3: Fluid Mechanics Analyst Role Overview

Lesson content:

- ▶ Fluid Mechanics Analyst Role
- ▶ CFD Simulation Workflow
- ▶ Model Preparation
- ▶ Geometry Preparation
- ▶ Materials
- ▶ Meshing
- ▶ CFD Analysis
- ▶ Co-simulation Analysis
- ▶ Results Postprocessing



1 hour

Lesson 4: Getting Started with CFD Simulation

Lesson content:

- ▶ Creating a CFD Simulation
- ▶ Fluid Scenario Creation App Interface
- ▶ Finite Element Model Representation
- ▶ Model Setup
- ▶ Scenario Setup
- ▶ Results Visualization
- ▶ Reviewing Simulation Features



1.5 hours

Lesson 5: Geometry for CFD Simulations

Lesson content:

- ▶ Model Setup Overview
- ▶ Setting up a FEM Rep
- ▶ Setting up a Fluid Volume
- ▶ Geometry Preparation



1 hour

Lesson 6: Meshing for CFD Simulations

Lesson content:

- ▶ CFD Meshing Basics
- ▶ Creating Meshes
- ▶ Managing Meshes
- ▶ Updating Meshes
- ▶ Importing and Exporting Meshes
- ▶ CFD Meshing
- ▶ Hex-dominant Mesh
- ▶ Octree Tetrahedron Mesh
- ▶ Tetrahedron Mesh
- ▶ Tetrahedron Filler Mesh
- ▶ Sweep 3D Mesh
- ▶ Surface Meshing
- ▶ Visualizing the Mesh
- ▶ Reviewing the Mesh
- ▶ Groups



1 hour

Lesson 7: Material 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 a Simulation Domain
- ▶ Section Properties
- ▶ Working with Imported Meshes



1 hour

