Siemens Xcelerator Academy: On-Demand Training

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Covers Simcenter STAR-CCM+ multiphysics simulation, geometry processing, meshing, solver settings, post processing, and other aspects of the simulation workflow. In addition, you will learn how to use HEEDS for design space exploration and analyze multiple design in a short period of time.

- 12 month subscription
- Access to cloud-based environment for hands-on lab exercises
- Access to new training content added during the subscription period
- Knowledge assessments to measure learning progress

On-Demand Training - Simcenter STAR-CCM+

Fundamentals of Simcenter STAR-CCM+ 13 Chapters

Simcenter STAR-CCM+ multiphysics simulation, geometry processing, meshing, solver settings, post processing, and other aspects of the simulation workflow.

1 Learning Experience Overview 2 Topics

1. Welcome: Navigation Overview
2. Introduction to the Learning Path

2 Stepping into the workflow 9 Topics

1. Overview of CFD in Simcenter STAR-CCM+
2. Lab: Navigating the GUI
3. Discovering the GUI (graphical user interface)
4. Describing the graphical user interface of Simcenter STAR-CCM+
5. Knowledge Check: GUI elements
6. Discussing essential concepts of Simcenter STAR-CCM+
7. Introducing the workflow for a cooling pipe
8. Lab: Workflow in Simcenter STAR-CCM+
9. Knowledge check: Overview

3 Workflow details 8 Topics

1. Introducing the workflow for a car in a wind tunnel
2. Lab: Setting up a car in a wind tunnel
3. Preparing the simulation domain of a car in a wind tunnel
4. Selecting mesh models for the car in a wind tunnel
5. Meshing the car in a wind tunnel
6. Physics setup for the car in a wind tunnel
7. Analysis of the car in a wind tunnel
8. Knowledge check: Workflow

4 Preparing imported geometry 15 Topics

1. What file types can be imported?
2. Which errors need to be fixed before proceeding?
3. Introducing the chip geometry
4. Importing and checking parts
5. Completing the geometry using operations
6. Lab: Preparing the geometry
7. The simulation domain workflow
8. Extracting the fluid volume
9. Knowledge check: Processing geometry
10. Transferring parts to regions
11. Lab: Creating the fluid region
12. Why do we want to organize parts?
13. Operations in more detail - Part 1

14. Operations in more detail - Part 2
15. Knowledge check: Operations

5 Considering the mesh setup 13 Topics

1. How does the mesh influence the solution?
2. Meshing the coldplate geometry
3. Demonstrating surface mesh setup
4. Lab: Setting up the coldplate surface mesh
5. Why is a surface mesh needed?
6. Knowledge check: Surface mesh
7. Why are prism layers important?
8. Demonstrating volume mesh setup
9. Lab: Finishing the coldplate volume mesh
10. Which mesh types are available in Simcenter STAR-CCM+?
11. How are meshes created?
12. Choosing a volume mesh type
13. Knowledge check: Volume mesh

6 Refining the mesh 11 Topics

1. Refining the coldplate mesh
2. Reviewing the coldplate mesh
3. Refining the thin parts of the coldplate
4. Lab: Refining the coldplate mesh
5. What options are there to refine mesh?
6. Special mesh refinement options
7. Knowledge check: Thin mesher
8. What makes a good mesh and how to achieve it?
9. Recommendations for the volume meshers
10. Recommendations for the prism layer mesher
11. Knowledge check: Mesh refinement

7 Setting up the physics 13 Topics

1. Physics of the coldplate
2. Selecting physics models
3. Lab: Selecting physics models
4. Knowledge check: Physics continua
5. Physics models in detail
6. Physics solvers
7. Knowledge check: Time
8. Turbulence and energy
9. Knowledge check: Turbulence
10. Setting boundary conditions and the stopping criterion
11. Lab: Applying boundary conditions
12. What are initial and boundary conditions?
13. Knowledge check: Physics

8 Analyzing data 16 Topics

1. Why should we analyze data?
2. Judging convergence based on temperature
3. Why do we need monitors?
4. Knowledge check: Data analysis
5. Visualizing temperature in a scene
6. Layering information in a scene
7. Lab: Visualizing temperature in plot and scene
8. Knowledge check: Scenes
9. Discussing the first solution
10. Lab: Adding scenes for a better visualization
11. Which interface should be selected in a scene?
12. Changing the design
13. Lab: Replacing geometry
14. Displaying and deriving parts
15. Triggering updates and exports
16. Knowledge check: Derived parts and triggers

9 Advanced analysis 17 Topics

1. When to change from steady to transient?
2. Changing from steady to transient
3. When does the simulation stop?
4. Triggering monitors
5. Setting up monitor-based stopping criteria
6. Lab: Switching to a transient simulation
7. Knowledge check: Transient analysis
8. Planning a design study for the chip
9. How can a simulation be adapted for a design study?
10. Visualizing the design study results
11. Lab: Creating a temperature sweep
12. Analyzing the design study results
13. Knowledge check: Design manager
14. Describing the scenario of ball valve lab
15. Lab: Monitoring engineering quantities in a ball valve geometry
16. Lab answer: Ball valve analysis
17. Knowledge check: Ball valve analysis

10 Moving with reference frames 20 Topics

1. Describing the fan scenario
2. Organizing large number of parts
3. Assessing the surface mesh in a scene
4. Creating and refining the volume mesh
5. Knowledge check: Fan geometry
6. Lab: Organizing and meshing geometry
7. Discussing physics models and the MRF approach
8. Setting up motion in a steady simulation
9. Lab: Moving the fan
10. Knowledge check: MRF
11. Lab: Monitoring engineering quantities
12. Lab answer 1: Expression reports and their perks
13. Lab answer 2: Avoiding pitfalls when changing units
14. Lab: Creating compelling scenes
15. Lab answer: Creating compelling scenes
16. Why visualize relative velocity in rotating systems?
17. Knowledge check: Motion visualization
18. Judging the convergence of the fan
19. Lab: Reducing the torque
20. Knowledge check: Stopping criteria

11 Effective simulations 23 Topics

1. What makes a simulation effective?
2. Is the steady simulation converged?
3. Is the transient simulation converged?
4. What can go wrong in transient simulations?
5. Knowledge check: Judge transient
6. What are mesh quality metrics?
7. Improving mesh quality
8. How to create a 2D mesh
9. Knowledge check: 2D mesh and quality
10. Introducing the nozzle
11. Lab: Meeting requirements in a subsonic nozzle
12. What should the initial solution be?
13. What are field functions?
14. Creating user field functions
15. Lab: Ramping the pressure at the inlet
16. Lab: Initializing pressure in the nozzle
17. Lab answer: Initializing pressure in the nozzle
18. Knowledge check: Field functions
19. Controlling the solver progression
20. Lab: Monitoring the flow in the nozzle

21. Lab answer: Creating monitoring plots for the nozzle
22. Detecting and locating divergence
23. Knowledge check: Reaching a solution

12 Planning the simulation workflow effectively 22 Topics

1. Planning the domain and geometry
2. What influences the solution?
3. What are boundary layers?
4. Knowledge check: Planning the domain
5. Planning the physics
6. Reference values and boundary conditions
7. Describing the scenario of the static mixer lab
8. Lab: Examining a failing bleed air distributing system
9. Lab answer: Examining a failing bleed air distributing system
10. Describing the scenario of the exhaust manifold lab
11. Lab: Predicting flow and thermal performance
12. Lab answer Part 1: Preparing the exhaust manifold
13. Lab answer Part 2: Meshing the exhaust manifold
14. Lab answer Part 3: Setting up the physics for the exhaust manifold
15. Lab answer Part 4: Setting up data analysis for the exhaust manifold
16. Knowledge check: Effective planning
17. Managing workflows
18. Knowledge check: Managing workflows
19. Finding help
20. Lab: Finding help
21. Finding Learning Events
22. Knowledge check: Finding help and learning events

13 Assessment: Fundamentals of Simcenter STAR-CCM+ 1 Topic

1. Assessment: Fundamentals of Simcenter STAR-CCM+

Heat Transfer 6 Chapters

Practice the setup of CHT and radiation simulations, consider mesh/prism mesh requirements. Difference between heat transfer coefficients in Simcenter STAR-CCM+

1 Heat Transfer Introduction 9 Topics

1. Chapter Contents: Heat Transfer Introduction
2. Heat Transfer
3. Multi-Region Meshing
4. Meshing Thin Regions
5. CHT Interfaces
6. Applying Heat Energy
7. Turbulence
8. Convergence and Data Analysis
9. Assessment: Heat Transfer Introduction

2 Workflow Heat Transfer 11 Topics

1. Chapter Contents: Workflow Heat Transfer
2. Practice: Geometry Overview
3. Practice: Prism Layer Thickness Analysis
4. Practice: Mesh Settings
5. Practice: Mesh Check
6. Practice: Physics Continua
7. Practice: Boundaries and Solvers
8. Practice: Reports and Plots
9. Practice: Results Analysis
10. Lab: Workflow Heat Transfer
11. Assessment: Workflow Heat Transfer

3 Solar Radiation 9 Topics

1. Chapter Contents: Solar Radiation

2. Solar Radiation Theory
3. Practice: Geometry Overview
4. Practice: Physics Setup
5. Practice: Radiation Patches
6. Practice: Solver Setup
7. Practice: Results Analysis
8. Lab: Solar Radiation
9. Assessment: Solar Radiation

4 Advanced Heat Transfer 10 Topics

1. Chapter Contents: Advanced Heat Transfer
2. Conduction Properties
3. Transient Flows
4. Convective Flows
5. Laminar Flows
6. Turbulence Modeling
7. Compressible Flows
8. Fan and Heat Exchanger Interfaces
9. Benchmark Cases
10. Assessment: Advanced Heat Transfer

5 Heat Transfer Coefficients 8 Topics

1. Chapter Contents: Heat Transfer Coefficients
2. Heat Transfer Coefficients
3. Mesh Considerations
4. Worked Example: Pipe
5. Comparison of HTC
6. Effects on Coarser Meshes
7. Lab: Heat Transfer Coefficients
8. Assessment: Heat Transfer Coefficients

6 Thermal Radiation 12 Topics

1. Chapter Contents: Thermal Radiation
2. Radiation Overview
3. Surface-to-Surface (S2S) Model
4. Discrete Ordinate Method (DOM)
5. Radiative Boundary Conditions
6. Practice: Thermal Radiation
7. Practice: Boundary Conditions
8. Practice: Radiation Patches
9. Practice: Solver, Reports, Scenes
10. Practice: Analysis
11. Lab: Thermal Radiation
12. Assessment: Thermal Radiation

Eulerian multiphase modeling in Simcenter STAR-CCM+ 6 Chapters

Identify the physics and phase interaction models in Simcenter STAR-CCM+ that are required to setup the specified multiphase flow simulation.

1 Learning Experience Overview 1 Topic

1. Introduction to the Learning Path

2 Modeling droplets with different particle sizes 13 Topics

1. How do we start with complex models
2. Mixing mono-dispersed bubbles
3. Monitoring convergence when mixing mono-dispersed bubbles
4. Lab: Starting a mono-dispersed Eulerian multiphase simulation
5. Introducing population balance models
6. Breakup and coalescence processes
7. Details of the method of moments approach
8. Setting up the S-Gamma model
9. Lab: Allowing particles to breakup

10. Details of the method of classes approach
11. Lab: Using the A-MuSIG model
12. Lab answer: Using the A-MuSIG model
13. Knowledge check: Modeling droplets with different particle size distributions

3 Modeling multiple flow regimes 10 Topics

1. Recognizing stratified flows
2. Details of the Multiple Flow Regime model
3. Selecting physics models and Phase Interaction
4. Detecting large scale interfaces
5. Solving the multiple flow regime model
6. Lab: Setting up the LSI physics
7. Meshing for free surfaces
8. Lab: Completing the mesh setup and data analysis
9. Lab Answer: Completing the mesh setup and data analysis
10. Knowledge check: Modeling multiple flow regimes

4 Modeling dissolution mass transfer 9 Topics

1. What is mass transfer?
2. Introducing dissolution mass transfer
3. Activating mass transfer in a multiphase interaction
4. Lab: Transferring mass in an oxidation ditch
5. Specifying dissolution mass transfer parameters
6. Selecting multi-component fluids
7. Lab: Transferring mass in the aerated mixing vessel
8. Lab Answer: Transferring mass in the aerated mixing vessel
9. Knowledge check: Modeling dissolution mass transfer

5 Modeling wall and bulk boiling 10 Topics

1. Introduction to Boiling
2. Vaporization in the bulk
3. Boiling at the wall
4. Evaporative and quenching heat transfer
5. Boiling parameters in Simcenter STAR-CCM+
6. Setting up boiling
7. Boiling convergence
8. Lab: Transferring heat between phases
9. Knowledge check: Modeling wall and bulk boiling
10. Leaving the Learning Path

6 Assessment: Eulerian multiphase modeling in Simcenter STAR-CCM+ 1 Topic

1. Assessment: Eulerian multiphase modeling in Simcenter STAR-CCM+

Data Analysis in Simcenter STAR-CCM+ 5 Chapters

Create basic and advanced Data Analysis to analyze the solution and highlight flow structures.

1 Creating Reports, Plots and Scenes 7 Topics

1. Simcenter STAR-CCM+ Reports
2. Discussing Effective Data Analysis
3. Refining Display In Scenes
4. Visualizing Boundary Heat Flux
5. Lab: Setting Up Basic Data Analysis
6. Lab Answer: Setting Up Basic Data Analysis
7. Knowledge Check: Creating Reports, Plots and Scenes

2 Color and Light Effects in Scenes 7 Topics

1. Creating a Color Bar
2. Color Theory
3. Adding Light Effects in Scenes
4. Using different Views in Scenes

5. Lab: Creating a Color Map for Color Blind People
6. Lab Answer: Creating a Color Map for Color Blind People
7. Knowledge Check: Color and Light Effects in Scenes

3 Activating volume rendering in scenes 16 Topics

1. Creating a Resampled Volume
2. Using Color Maps for Rendered Volumes
3. Lab: Dealing with colormaps and resampled volumes
4. Improving Displayer Settings for Rendered Volumes
5. Lab: Light your scene up
6. Lab: Improving a Scene with Volume Rendering
7. Lab Answer: Improving a Scene with Volume Rendering
8. Knowledge Check: Volume rendering
9. What is advanced rendering?
10. Enhancing Volume Rendering
11. Casting shadows
12. Knowledge Check: Advanced rendering
13. Adding Rendering Materials
14. Emitting light locally from a displayer
15. Lab: Rendering the scene expertly
16. Knowledge Check: Activating volume rendering in scenes

4 Accessing solution data 14 Topics

1. Overview of derived parts
2. What are warp derived parts?
3. Effective communication using derived parts
4. Effective communication using plots
5. What is solution history?
6. Creating solution history
7. Analyzing solution history data
8. Lab: Creating solution history
9. Lab: Analyzing solution history
10. Lab answer: Analyzing solution history
11. How does data focus work?
12. Creating data focus in plots for scenes
13. Lab: Applying data focus
14. Knowledge Check: Accessing solution data

5 Playing screens 11 Topics

1. What is screenplay?
2. Creating a single action playing on screen
3. Lab: Playing a single action on screen
4. Creating multiple actions playing on screen
5. Lab: Adding multiple actions to a screenplay
6. Lab answer: Adding multiple actions to a screenplay
7. Discovering advanced actions
8. Creating advanced actions playing on screen
9. Lab: Setting up advanced screenplay actions
10. Lab answer: Setting up advanced screenplay actions
11. Knowledge check: Discovering screenplay visualization

Efficient Workflows in Simcenter STAR-CCM+ 6 Chapters

The overall goal is to establish an efficient meshing workflow to support simulations containing geometries with hundreds to thousands of individual parts.

1 Preparing the Geometry 7 Topics

1. Geometry Import
2. Organize and Imprint Geometry
3. Divide Surfaces
4. Bounded Shape
5. Extract Volume

6. Lab: Geometry Preparation
7. Knowledge Check: Geometry Preparation

2 Meshing Setup 7 Topics

1. Chapter Introduction and Tags
2. Regions and Interfaces
3. Mesh Operations
4. Mesh Pipeline and Interface Initialization
5. Comparison Views
6. Lab: Meshing Setup
7. Knowledge Check: Meshing Setup

3 Physics Model and Value Definitions 7 Topics

1. Chapter Introduction and Physics Continua
2. Solid Materials
3. Values Using Part Subgroups
4. Values Using Surface Subgroups
5. Custom Trees
6. Lab: Physics Model and Value Definitions
7. Knowledge Check: Physics Model and Value Definitions

4 Simulation Setup, Data Analysis and Reporting 12 Topics

1. Introduction
2. CFL Number and Simulation Comments
3. Reports and Monitors
4. Stopping Criteria
5. Scenes
6. Window Layouts, Serial to Parallel, Run Solver, and Monitoring the Solution
7. LED Heating Power Reports
8. Data Analysis on Sub Surfaces
9. Summary Reports
10. Custom Summary Reports
11. Lab: Simulation Setup, Data Analysis, and Reporting
12. Knowledge Check: Simulation Setup, Data Analysis, and Reporting

5 Converting a simulation file into a template file 11 Topics

1. Dynamic queries in the meshing pipeline
2. Dynamic Queries for Regions, Boundaries, and Interfaces
3. Lab: Setting up the first queries
4. Lab: Dynamic queries for solid material
5. Lab Answer: Dynamic queries for solid material
6. Reports with Dynamic Queries
7. Lab: Adjusting part surface selection in reports
8. Selecting Objects in Scene Displayers using Dynamic Queries
9. Lab: Completing and testing the template
10. Lab Answer: Completing and testing the template
11. Assessment: Converting a Simulation File into a Template File

6 Using Simulation Operations 11 Topics

1. Discovering Simulation Operations
2. Demonstrating the setup of Simulation Operations
3. Lab: Mesh and run using Simulation Operations
4. Lab answer: Mesh and run using Simulation Operations
5. Introducing the multi-time scale approach
6. Understanding the simulation setup
7. Automating the alternating solution of two physics
8. Setting up the Simulation Operation
9. Lab: Using Simulation Operations in a CHT simulation
10. Lab answer: Using Simulation Operations in a CHT simulation
11. Knowledge Check: Using Simulation Operations

Fundamentals of multiphase modeling 6 Chapters

Multiphase can be modeled in various ways. Here you will learn which models are implemented in Simcenter STAR-CCM+ and gain insight in their background.

1 Learning Experience Overview 2 Topics

1. Welcome: Navigation Overview
2. Fundamentals of multiphase modeling intro

2 Classifying multiphase flows 7 Topics

1. Multiphase and multicomponent
2. Modeling approaches
3. Modeling multiphase in Simcenter STAR-CCM+ Part I
4. Modeling multiphase in Simcenter STAR-CCM+ Part II
5. Modeling multiphase in Simcenter STAR-CCM+ Part III
6. Efficient multiphase modeling of real world problems
7. Knowledge check: Classifying multiphase flows

3 Eulerian multiphase fundamentals 7 Topics

1. Conservation equations
2. Forces acting on particles
3. Drag force acting on particles
4. Introducing bubbly flows
5. Setting up Eulerian phases
6. Lab: Simulating terminal velocity
7. Knowledge check: Eulerian multiphase fundamentals

4 Lagrangian multiphase fundamentals 7 Topics

1. What is Lagrangian multiphase?
2. Lagrangian multiphase basic equations
3. Describing components and models of the Lagrangian model
4. Setting up Lagrangian phases
5. Boundary interaction modes and injecting particles
6. Lab: Following solid particles
7. Knowledge check: Lagrangian multiphase fundamentals

5 Volume of Fluid fundamentals 12 Topics

1. Thinking about the Volume of Fluid method
2. Considering numerical requirements
3. VOF meshing considerations
4. Introducing adaptive mesh refinement
5. Discussing solver parameters
6. Discussing VOF parameters
7. Activating VOF
8. Boundary conditions and turbulence
9. Lab: Simulating a free surface in a tank
10. Lab answer: Simulating a free surface in a tank
11. Knowledge check: Volume of Fluid fundamentals
12. Leaving the Learning Path

6 Assessment: Fundamentals of multiphase modeling 1 Topic

1. Assessment: Fundamentals of multiphase modeling

Lagrangian multiphase modeling in Simcenter STAR-CCM+ 6 Chapters

The aim of this course is to teach the techniques needed to conduct accurate and efficient particle or droplet simulations using computational fluid dynamics.

1 Learning Experience Overview 2 Topics

1. Welcome: Navigation Overview
2. Introduction to the Learning Path

2 Keeping track of particles 12 Topics

1. What are track data?
2. Knowledge check: Parcels and particles
3. Comparing parcel and particle counts in histogram plots
4. Injectors: Hollow Cone Injector
5. Lab: Analyzing boundary sampling data tracks
6. Knowledge check: Plotting data
7. Loading and filtering track files
8. What can we do with particle track data?
9. Visualizing track data using derived parts
10. Injectors: Part Injector with direction field function
11. Lab: Analyzing track file data
12. Knowledge check: Keeping track of particles

3 Visualizing particles stuck in a hydraulic filter 11 Topics

1. Injectors: Part Injector with flow field distribution
2. Lab: Preparing a hydraulic filter simulation
3. Lab answer: Preparing a hydraulic filter simulation
4. How can different interaction modes be applied to a boundary?
5. Lab: Adding composite boundary condition modes to a hydraulic filter simulation
6. Summarizing Lagrangian solver settings
7. Displaying tracks in scenes
8. Knowledge check: Solving particles
9. Lab: Experimenting with the visualization of transmitted and stuck particles
10. Lab answer: Experimenting with the visualization of transmitted and stuck particles
11. Knowledge check: Visualizing particles stuck in a hydraulic filter

4 Lagrangian droplets evaporating and condensing in a spray dryer 7 Topics

1. Preparing mesh and physics for humid air
2. Lab: Preparing mesh and physics for humid air
3. Lab: Injecting and evaporating droplets
4. Lab answer: Injecting and evaporating droplets
5. Monitoring the condensation process
6. Lab: Monitoring the condensation process
7. Knowledge check: Lagrangian droplets evaporating and condensing in a spray dryer

5 Modeling fluid film in Simcenter STAR-CCM+ 10 Topics

1. Introducing fluid film
2. Creating a shell region
3. Knowledge check: Regions with fluid film
4. Lab: Preparing the fluid film setup
5. Lab: Injecting droplets that build a fluid film
6. Lab answer: Injecting droplets that build a fluid film
7. Fluid film evaporation and condensation
8. Pure vapor and dry walls
9. Knowledge check: Modeling fluid film in Simcenter STAR-CCM+
10. Leaving the Learning Path

6 Assessment: Lagrangian multiphase modeling in Simcenter STAR-CCM+ 1 Topic

1. Assessment: Lagrangian multiphase modeling in Simcenter STAR-CCM+

Feature highlights of Simcenter STAR-CCM+ 8 Chapters

This learning path highlights selected features in the current release of Simcenter STAR-CCM+.

1 Learning Experience Overview 1 Topic

1. Introduction to the Learning Path

2 Lagrangian phase injectors 11 Topics

1. Feature highlight: Lagrangian phase injectors
2. Injectors: Part Injector with flow field distribution
3. Lab: Injecting particles into a filter
4. Lab answer: Injecting particles into a filter
5. Injectors: Part Injector with direction field function
6. Lab: Injecting water into a shower
7. Injectors: Part injector using an arbitrary section
8. Injectors: Hollow Cone Injector with particle size distribution
9. Injectors: Solid Cone Injector
10. Injectors: Film stripping injector
11. Knowledge check: Lagrangian phase injectors

3 Refining the mesh adaptively 7 Topics

1. Introducing adaptive mesh refinement
2. Activating VOF and AMR
3. Lab: Activating the adaptive mesh solver
4. Examples for AMR use
5. Lab: Inserting the AMR solver
6. Lab answer: Inserting the AMR solver
7. Knowledge check: Refining the mesh adaptively

4 Playing screens 11 Topics

1. What is screenplay?
2. Creating a single action playing on screen
3. Lab: Playing a single action on screen
4. Creating multiple actions playing on screen
5. Lab: Adding multiple actions to a screenplay
6. Lab answer: Adding multiple actions to a screenplay
7. Discovering advanced actions
8. Creating advanced actions playing on screen
9. Lab: Setting up advanced screenplay actions
10. Lab answer: Setting up advanced screenplay actions
11. Knowledge check: Discovering screenplay visualization

5 Using Simulation Operations 11 Topics

1. Discovering Simulation Operations
2. Demonstrating the setup of Simulation Operations
3. Lab: Mesh and run using Simulation Operations
4. Lab answer: Mesh and run using Simulation Operations
5. Introducing the multi-time scale approach
6. Understanding the simulation setup
7. Automating the alternating solution of two physics
8. Setting up the Simulation Operation
9. Lab: Using Simulation Operations in a CHT simulation
10. Lab answer: Using Simulation Operations in a CHT simulation
11. Knowledge Check: Using Simulation Operations

6 Using tags and filters in queries 5 Topics

1. Explaining the tags in the mixing vessel sim file
2. How to use tags in dynamic queries
3. Lab: Using tags to reduce the geometry
4. Using filters to find information in reports
5. Knowledge check: Queries

7 Preparing geometry by wrapping 18 Topics

1. How should surfaces be treated?
2. Why do we wrap the bike?
3. What can diagnostics tell me about the surface?
4. Creating the surface wrapper operation
5. Lab: Creating a first wrapped surface on a bike
6. Knowledge check: Wrapper surfaces
7. How does the surface wrapper work?
8. Controlling the wrapped surface quality

9. How to identify the volume I’m interested in wrapping?
10. Creating contact preventions
11. Lab: Creating contact preventions for the bike
12. Lab: Improving the wrapped surface
13. Lab answer: Improving the wrapped surface
14. Fine tuning the wrapped surface quality
15. Partial and local surface wrapping
16. Deep Dive - How does the surface wrapper work?
17. Knowledge check: Wrapper properties
18. Leaving the Learning Path

8 Assessment: Feature highlights in Simcenter STAR-CCM+ 1 Topic

1. Assessment: Feature highlights in Simcenter STAR-CCM+

Turbulence and turbulence modeling 8 Chapters

Turbulence is mainly modeled in CFD simulations. This course describes the background of many models and a bit about their history. Contains no labs.

1 Learning Experience Overview 1 Topic

1. Introduction to the Learning Path

2 Fundamental equations and concepts 9 Topics

1. Governing equations
2. Classifying flows
3. Comparing laminar and turbulent flows
4. Knowledge Check: Fundamental concepts
5. When and why does a flow become turbulent?
6. Characterizing turbulent flow
7. Velocity profiles in turbulent flow
8. Knowledge check: Pipe flow
9. References: Fundamental equations and concepts

3 Theoretical concepts in turbulent flows 6 Topics

1. Changing the flow with time
2. What is the energy cascading process
3. Characterizing turbulent scales
4. Inconsistencies leading to turbulence
5. Knowledge Check: Theoretical concepts
6. References: Theoretical concepts in turbulent flows

4 Fundamental concepts of turbulence modeling 6 Topics

1. Approaches to solving turbulence
2. When to use DNS or an averaging approach
3. Explaining the Reynolds decomposition
4. Explaining the RANS equations and turbulence models
5. Knowledge Check: Modeling concepts
6. References: Fundamental concepts of turbulence modeling

5 Modeling turbulence in simulation 8 Topics

1. What do we know about turbulence modeling?
2. Deriving and modeling the Reynolds stresses
3. Reynolds Stress Transport model
4. Introducing the eddy viscosity models
5. Knowledge Check: Simulate turbulence
6. Modeling Reynolds stresses using the Spalart-Allmaras model
7. Knowledge check: Spalart-Allmaras
8. References: Modeling turbulence in simulation

6 Modeling turbulence using two-equation models 11 Topics

1. Modeling Reynolds stresses using the Standard k-Epsilon model
2. Modeling Reynolds stresses using the Realizable k-Epsilon model
3. Modeling Reynolds stresses using the k-Omega model

4. Knowledge Check: Two-Equations
5. Limits of the eddy viscosity models
6. How to account for near wall turbulence effects?
7. The elliptic relaxation idea
8. Blending the elliptic relaxation model
9. Summary of RANS turbulence models in Simcenter STAR-CCM+
10. Knowledge Check: Eddy viscosity
11. References: Modeling turbulence using two-equation models

7 Scale resolving simulations and transition modeling 9 Topics

1. Accepting the challenge: Applied LES
2. Explaining the subgrid scale models
3. DES: Mixing RANS and LES
4. Knowledge Check: Scale resolving
5. Transition modeling
6. Transition models in Simcenter STAR-CCM+
7. Knowledge check: Transition
8. References: Explaining large eddy simulations
9. Leaving the Learning Path

8 Assessment: Turbulence and turbulence modeling 1 Topic

1. Assessment: Turbulence and turbulence modeling

Introduction to HEEDS MDO 9 Chapters

Introduction to the HEEDS MDO, Design Space Exploration with a focus on Optimization, use of the software as well as the modeling and simulation approach.

1 HEEDS Overview 3 Topics

1. Application Example: Static Air Mixer
2. Simulation Tool Overview: Golf Shot Challenge
3. Simulation Tool Demo: SwingGui

2 The Automated Design Space Exploration Process 8 Topics

1. Lab - Manual Optimization
2. Manual Optimization Observations
3. Post-processing in HEEDS POST
4. Introduction to Design Space Exploration
5. Automating the Manual Design Process
6. Application Example: Rubber Bushing Mount
7. Summary Automated Design Space Exploration Process
8. Knowledge Check - Design Space exploration

3 Process Automation 5 Topics

1. Batch Execution
2. SwingGui Batch Execution
3. Summary Batch Execution and Extension Learning
4. Lab - Process Automation
5. Knowledge Check - Batch Execution

4 Efficient Search 8 Topics

1. Optimization Problem Statement in Standard Form
2. Main ingredients for optimization
3. Closed form Solutions vs Implicit Functions
4. Optimization Algorithms and Introduction to SHERPA
5. Global vs Local Search & Impact of Constraints
6. Application Example: Stiffened Panel
7. Summary Optimization Problem Statement and Efficient Search
8. Knowledge Check - Efficient Search

5 Insight & Discovery 11 Topics

1. Introduction to Insight & Discovery

2. Runtime monitoring
3. HEEDS POST
4. Lab - Automated Optimization Exercise
5. HEEDS Execution and Directory Structure
6. Data Storage and Control of Data
7. Study Review, Messaging, and Troubleshooting
8. Message Files
9. Summary on Insight & Discovery & Extension Learning
10. Lab - Study Review, Messaging, & Troubleshooting
11. Knowledge Check - Insight Discovery

6 Tagging, Analysis Portals, and Variables 8 Topics

1. Tagging Methods Overview
2. Analysis Portals
3. Continuous, Discrete, and Dependent Variables
4. Constant and Text Parameters
5. Defining Variables
6. Summary on Tagging, Variables & Extension Learning
7. Lab - Dependent & Discrete Variables Exercise
8. Knowledge Check - Tagging Variables

7 Hybrid-Adaptive Search 10 Topics

1. Objectives and their impact on Performance
2. Constraints
3. Active Constraints
4. Error Designs
5. Lab - Constrained Optimization Exercise
6. A more detailed look at SHERPA
7. Optimization Search Path Comparatives
8. How Many Evaluations & Restart
9. Summary on Hybrid-Adaptive Search
10. Knowledge Check - Hybrid Adaptive Search

8 Multi-Objective & Multi-Analysis Design Space Exploration 6 Topics

1. Weighted Sum vs Pareto Optimization
2. Pareto Optimization
3. Using Multiple Analyses
4. Summary on Multi-Objective and Multi-Analyses
5. Lab - Multi-Objective & Multi-Analysis
6. Knowledge Check - MultiObjective and Multi-Analysis

9 Assessment: Introduction to HEEDS MDO 1 Topic

1. Assessment: Introduction to HEEDS MDO

Eulerian multiphase modeling in Simcenter STAR-CCM+ - 2020.2 6 Chapters

Identify the physics and phase interaction models in Simcenter STAR-CCM+ that are required to setup the specified multiphase flow simulation.

1 Learning Experience Overview 1 Topic

1. Introduction to the Learning Path

2 Modeling droplets with different particle sizes - 2020.2 13 Topics

1. How do we start with complex models
2. Mixing mono-dispersed bubbles
3. Monitoring convergence when mixing mono-dispersed bubbles
4. Lab: Starting a mono-dispersed Eulerian multiphase simulation
5. Introducing population balance models
6. Breakup and coalescence processes
7. Details of the method of moments approach
8. Setting up the S-Gamma model
9. Lab: Allowing particles to breakup
10. Details of the method of classes approach

11. Lab: Using the A-MuSIG model
12. Lab answer: Using the A-MuSIG model
13. Knowledge check: Modeling droplets with different particle size distributions

3 Modeling multiple flow regimes - 2020.2 10 Topics

1. Recognizing stratified flows
2. Details of the Multiple Flow Regime model
3. Selecting physics models and Phase Interaction
4. Detecting large scale interfaces
5. Solving the multiple flow regime model
6. Lab: Setting up the LSI physics
7. Meshing for free surfaces
8. Lab: Completing the mesh setup and data analysis
9. Lab Answer: Completing the mesh setup and data analysis
10. Knowledge check: Modeling multiple flow regimes

4 Modeling dissolution mass transfer - 2020.2 9 Topics

1. What is mass transfer?
2. Introducing dissolution mass transfer
3. Activating mass transfer in a multiphase interaction
4. Lab: Transferring mass in an oxidation ditch
5. Specifying dissolution mass transfer parameters
6. Selecting multi-component fluids
7. Lab: Transferring mass in the aerated mixing vessel
8. Lab Answer: Transferring mass in the aerated mixing vessel
9. Knowledge check: Modeling dissolution mass transfer

5 Modeling wall and bulk boiling - 2020.2 10 Topics

1. Introduction to Boiling
2. Vaporization in the bulk
3. Boiling at the wall
4. Evaporative and quenching heat transfer
5. Boiling parameters in Simcenter STAR-CCM+
6. Setting up boiling
7. Boiling convergence
8. Lab: Transferring heat between phases
9. Knowledge check: Modeling wall and bulk boiling
10. Leaving the Learning Path

6 Assessment: Eulerian multiphase modeling in Simcenter STAR-CCM+ - 2020.2 1 Topic

1. Assessment: Eulerian multiphase modeling in Simcenter STAR-CCM+