Introduction to Tosca Fluid

Tosca 2018
Course objectives
Upon completion of this course, you will be able to:

- Solve fundamental topology optimization problems for internal flow applications
- Postprocess results and perform surface smoothing
- Follow-up and transfer results into the CAE environment

Targeted audience
CFD Analysts

Prerequisites
Basic familiarity with CFD
Day 1

- **Lesson 1:** Methodology

- **Lesson 2:** Overview, Setup and Execution
  - Workshop 1: Back step flow

- **Lesson 3:** Postprocessing and Results Extraction
  - Workshop 2: Flow splitter
  - Workshop 3: Inlet tank (optional)
Appendix 1: Tosca Fluid Tips and Tricks
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

- Multibody Simulation, Simpack
  - System analysis to extract virtual load history of complete working cycle

- CAD Geometry, CATIA
  - Fully parameterized 3D geometry; FEA model generation via associative interface

- Mesh Calibration, Isight *
  - Automated mesh calibration; sufficient mesh quality for accurate results

* Included in extended licensing pool
### SIMULIA's Power of the Portfolio

#### Abaqus
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Fluid, Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization

#### Isight
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments

#### Tosca
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization

#### fe-safe
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics

#### Simpack
- 3D Multibody Dynamics Simulation
- Mechanical or Mechatronic Systems
- Detailed Transient Simulation (Offline and Realtime)

### Modules
- **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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## Revision Status

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Lesson content:

- Introduction
  - Topology optimization
  - Optimality criteria (OC) method
  - “Optimization” versus “Improvement”
- Topology Optimization Approach in Tosca Fluid
  - Optimality criterion and optimization approach
- Optimization Results
  - What is a Tosca Fluid result?
  - Approaches for result extraction
- Optimization Workflow
- Cell Sedimentation and Backflow Tolerance

1 hour
Lesson 1: Methodology
Lesson 2: Overview, Setup and Execution

Lesson content:

- Overview and Preparation
  - Software components
  - Working with Tosca Fluid
  - Preparation of the CFD model

- Defining the Optimization Job
  - Using the GUI
  - Optimization problem definition
  - Parameter file

- Running Tosca Fluid
  - Running an optimization job using the GUI
  - Files and results

1.5 hours
Workshop 1a: Back step flow (ANSYS Fluent)

1. Content
   a. Simple optimization example
   b. Setup and running
   c. Flow behavior after the optimization run

45 minutes
Workshop 1b: Back step flow (STAR-CCM+)

1. Content
   a. Simple optimization example
   b. Setup and running
   c. Flow behavior after the optimization run
Lesson 3: Postprocessing and Results Extraction

Lesson content:

- Result Extraction
  - Introduction
  - Files and results
  - Velocity extraction method
  - Sedimentation-based results
  - Particle Track
- Running Tosca Fluid.smooth using the GUI
  - Smoothing

1.5 hours
1. Content
   a. Complex optimization example
   b. Basic postprocessing steps
   c. Result smoothing
Workshop 2b: Flow splitter (STAR-CCM+)

1. Content
   a. Complex optimization example
   b. Basic postprocessing steps
   c. Result smoothing

1 hour
Workshop 3a: Inlet tank (ANSYS Fluent)

1. Content
   a. Complex optimization example
   b. Basic postprocessing steps
   c. Result smoothing

1 hour
Workshop 3b: Inlet tank (STAR-CCM+)

1. Content
   a. Complex optimization example
   b. Basic postprocessing steps
   c. Result smoothing
Appendix 1: Tosca Fluid Tips & Tricks

Appendix content:
- Objectives
- Physics
- Tosca Fluid Geometry
- Inflow Conditions
- Tosca Fluid Optimization for Multiple Regions
- Reference Streamline
- Design Space
- Porous Zones
- Potential Applications
- Tosca Fluid Installation
- 3DS Knowledge Base
- Linux
- Stability Issues of CFD solver
- Predefined High Viscous Run