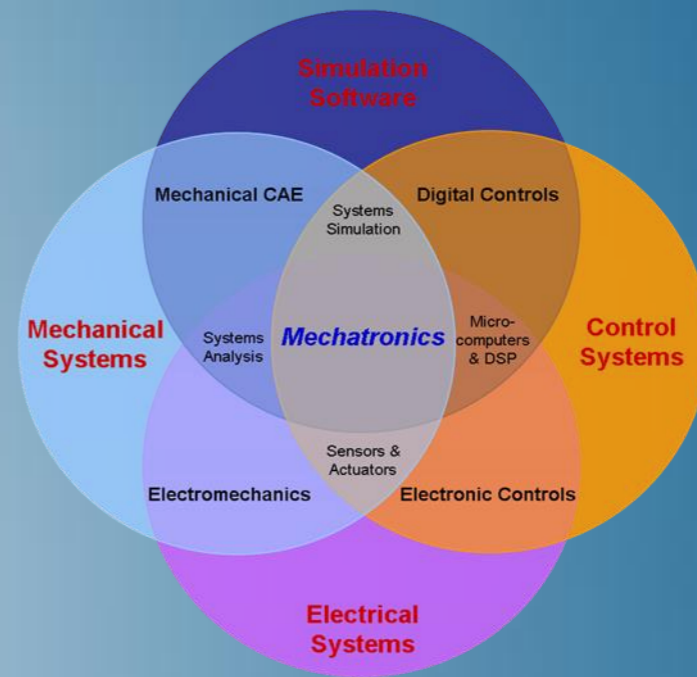


Co-simulation with Abaqus and Dymola

Abaqus 2018



3DEXPERIENCE[®]



About this Course

Course objectives

Upon completion of this course you will be able to:

- ▶ Set up an Abaqus model for Abaqus-Dymola co-simulation
- ▶ Create a simple control system in Dymola
- ▶ Run a co-simulation

Targeted audience

Simulation Analysts

Prerequisites

None



4 hours

Day 1

- ▶ Lecture 1 Abaqus-Dymola co-simulation
 - Workshop 1 Machining tool cooling system

- ▶ Lecture 2 Introduction to Dymola
 - Workshop 2 Dymola control system

- ▶ Lecture 3 Co-simulation features in Abaqus and execution
 - Workshop 3 Abaqus model for co-simulation

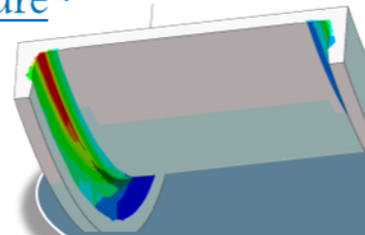
- ▶ Lecture 4 Interpretation of results
 - Workshop 4 Running jobs and interpreting results

SIMULIA

- ▶ SIMULIA is the Dassault Systèmes brand for Realistic Simulation solutions
- ▶ Portfolio of established, best-in-class products
 - Abaqus, Isight, Tosca, fe-safe, Simpack

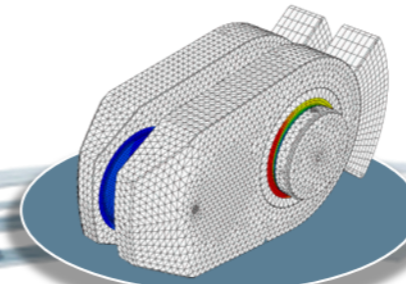
Design Optimization: Tosca Structure *

Simulation-driven design refinement to improve performance



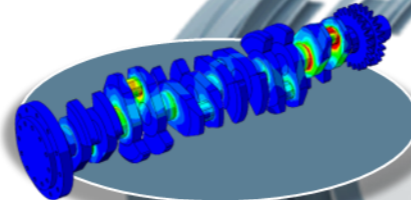
Durability Assessment: fe-safe *

Accurate life estimation to achieve certification



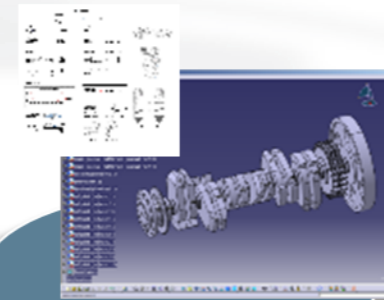
FEA Stress Analysis: Abaqus *

Detailed stress analysis using extracted load history from MBS



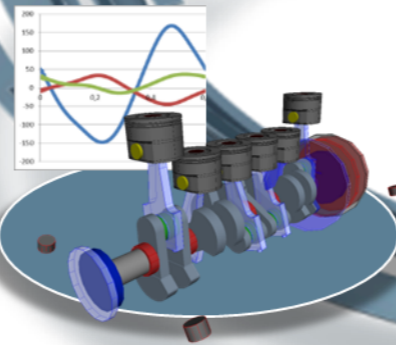
CAD Geometry: CATIA

Fully parameterized 3D geometry; FEA model generation via associative interface



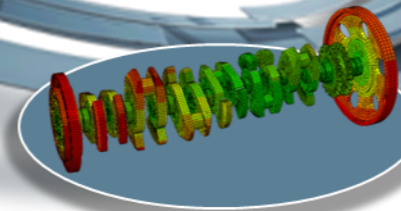
Multibody Simulation: Simpack

System analysis to extract virtual load history of complete working cycle



Mesh Calibration: Isight *

Automated mesh calibration; sufficient mesh quality for accurate results

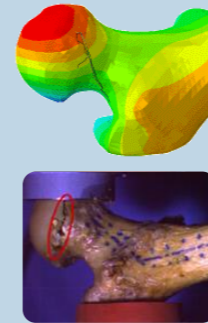


* Included in extended licensing pool

SIMULIA's Power of the Portfolio

Abaqus

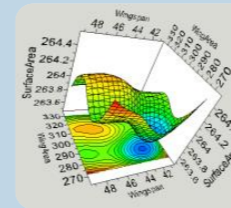
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization



Realistic Human Simulation
High Speed Crash & Impact
Noise & Vibration

Isight

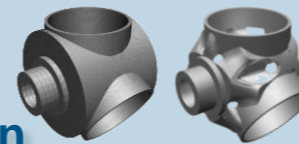
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments



Material Calibration
Workflow Automation
Design Exploration

Tosca

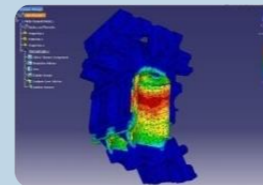
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization



Conceptual/Detailed Design
Weight, Stiffness, Stress
Pressure Loss Reduction

fe-safe

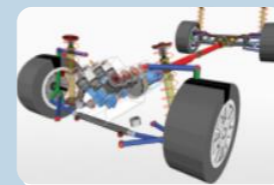
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics



Safety Factors
Creep-Fatigue Interaction
Weld Fatigue

Simpack

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



Complete System Analyses
(Quasi-)Static, Dynamics, NVH
Flex Bodies, Advanced
Contact

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Revision Status

Lecture 1	11/17	Updated for Abaqus 2018 / Dymola 2018
Lecture 2	11/17	Updated for Abaqus 2018 / Dymola 2018
Lecture 3	11/17	Updated for Abaqus 2018 / Dymola 2018
Lecture 4	11/17	Updated for Abaqus 2018 / Dymola 2018
Workshop 1	11/17	Updated for Abaqus 2018 / Dymola 2018
Workshop 2	11/17	Updated for Abaqus 2018 / Dymola 2018
Workshop 3	11/17	Updated for Abaqus 2018 / Dymola 2018
Workshop 4	11/17	Updated for Abaqus 2018 / Dymola 2018

Lesson 1: Abaqus-Dymola co-simulation

Lesson content:

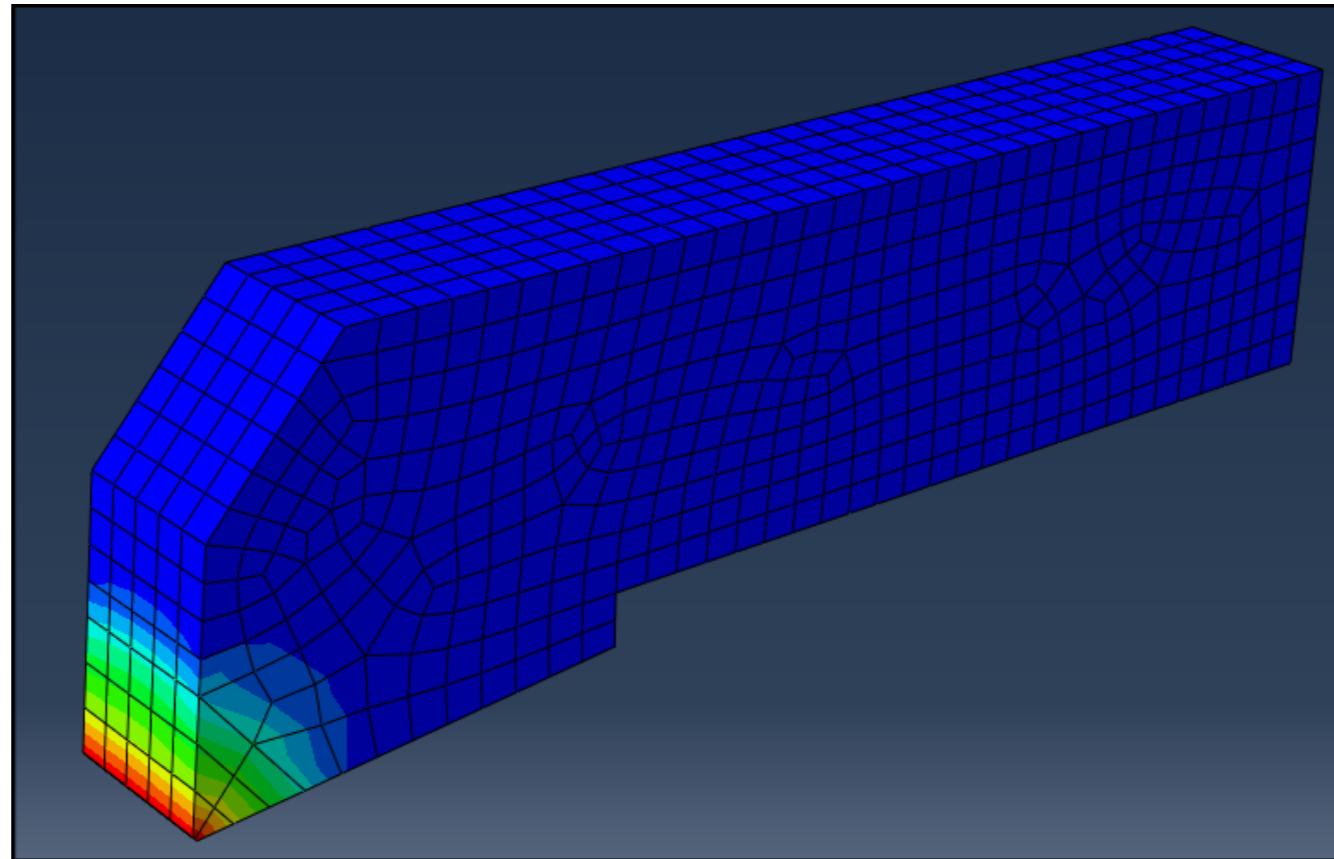
- ▶ Logical modeling
- ▶ Abaqus-Dymola co-simulation
- ▶ Illustration – Backhoe digging automation
- ▶ Workflow for Abaqus-Dymola co-simulation
- ▶ Workshop Preliminaries



30 minutes

Workshop 1: Machining tool cooling system

In this workshop, you will create a three-dimensional model of a lathe tool, simulate the heat produced by the friction, and control the flux of water cooling down the tool in order to maintain a target temperature at the tip.



Objectives

When you complete this workshop you will be able to:

- i. Set up an Abaqus model for Abaqus-Dymola co-simulation.
- ii. Create a simple control system in Dymola.
- iii. Run a co-simulation.



20 minutes

Lesson 2: Introduction to Dymola

Lesson content:

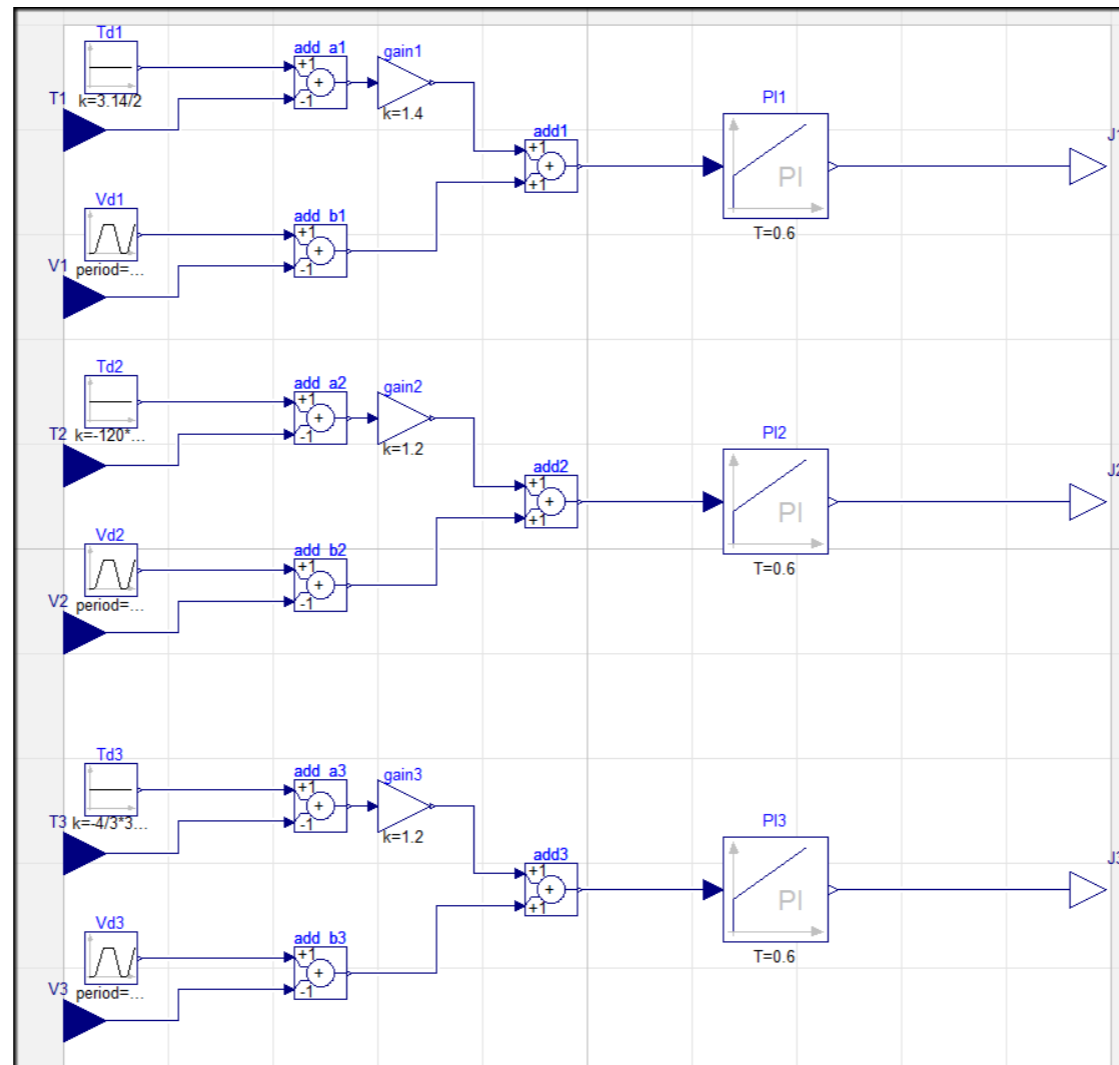
- ▶ Introduction to Dymola
- ▶ GUI Editor
- ▶ Modelica Language
- ▶ Requirements for Co-simulation
- ▶ What is FMI and FMU?
- ▶ Example – Cantilever Beam
- ▶ Summary



45 minutes

Workshop 2: Dymola control system

In this workshop, you will create a Dymola model of the control system of a robot with three degrees of freedom.



Objectives

When you complete this workshop you will be able to:

- Create a Dymola model oriented for co-simulation.



30 minutes

Lesson 3: Co-simulation features in Abaqus and execution

Lesson content:

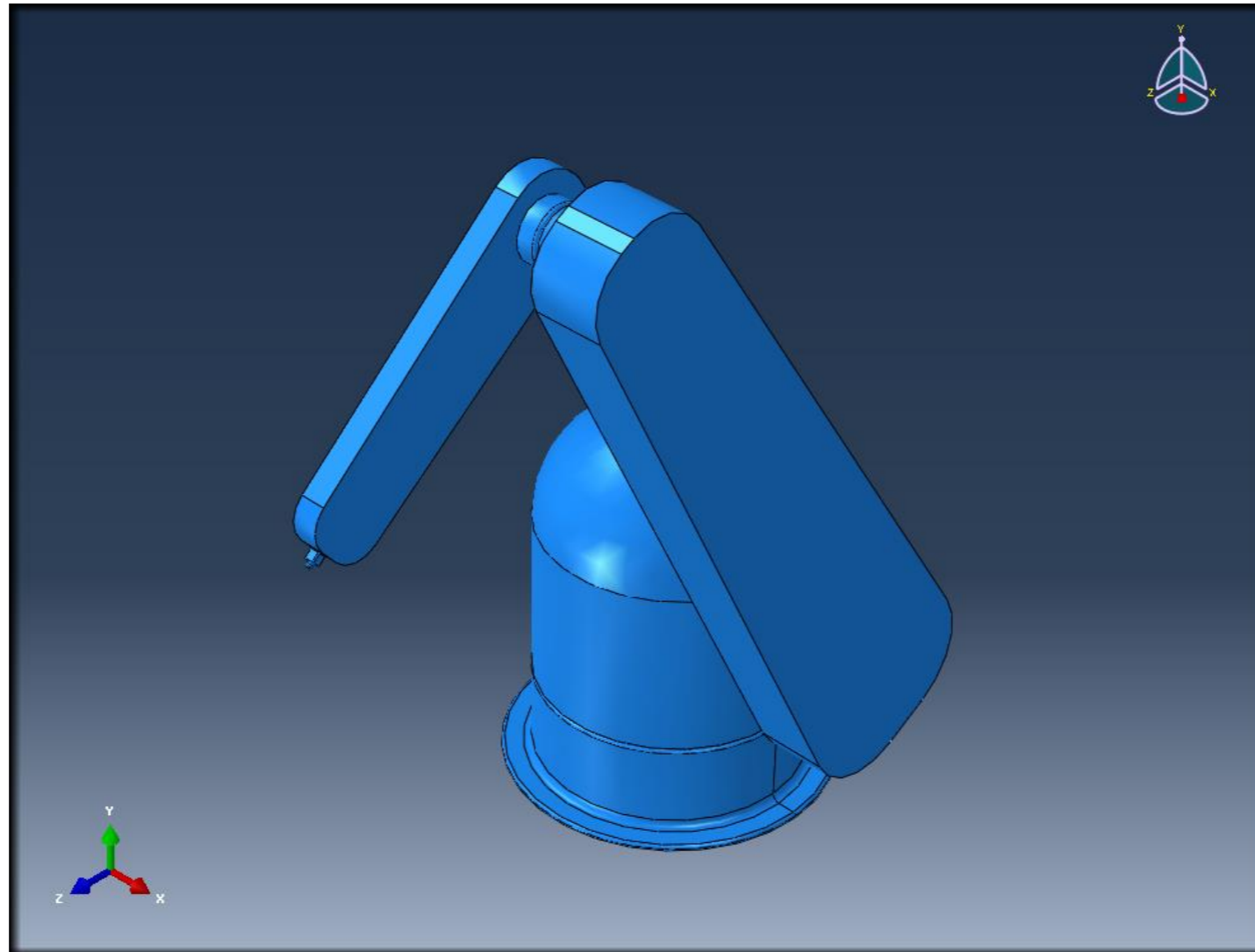
- ▶ Abaqus-Dymola co-simulation model preparation workflow
- ▶ Identifying the Abaqus analysis step for co-simulation
- ▶ Defining sensors and actuators
- ▶ SIMULIA co-simulation engine
- ▶ Configuration file
- ▶ Example – Cantilever Beam
- ▶ Summary



2 hours

Workshop 3: Robot Abaqus model for co-simulation

In this workshop, you will modify the robot model in order to prepare it to be controlled by Dymola.



Objectives

When you complete this workshop you will be able to:

- i. Set up an Abaqus model for Abaqus-Dymola co-simulation.



15 minutes

Lesson 4: Interpretation of results

Lesson content:

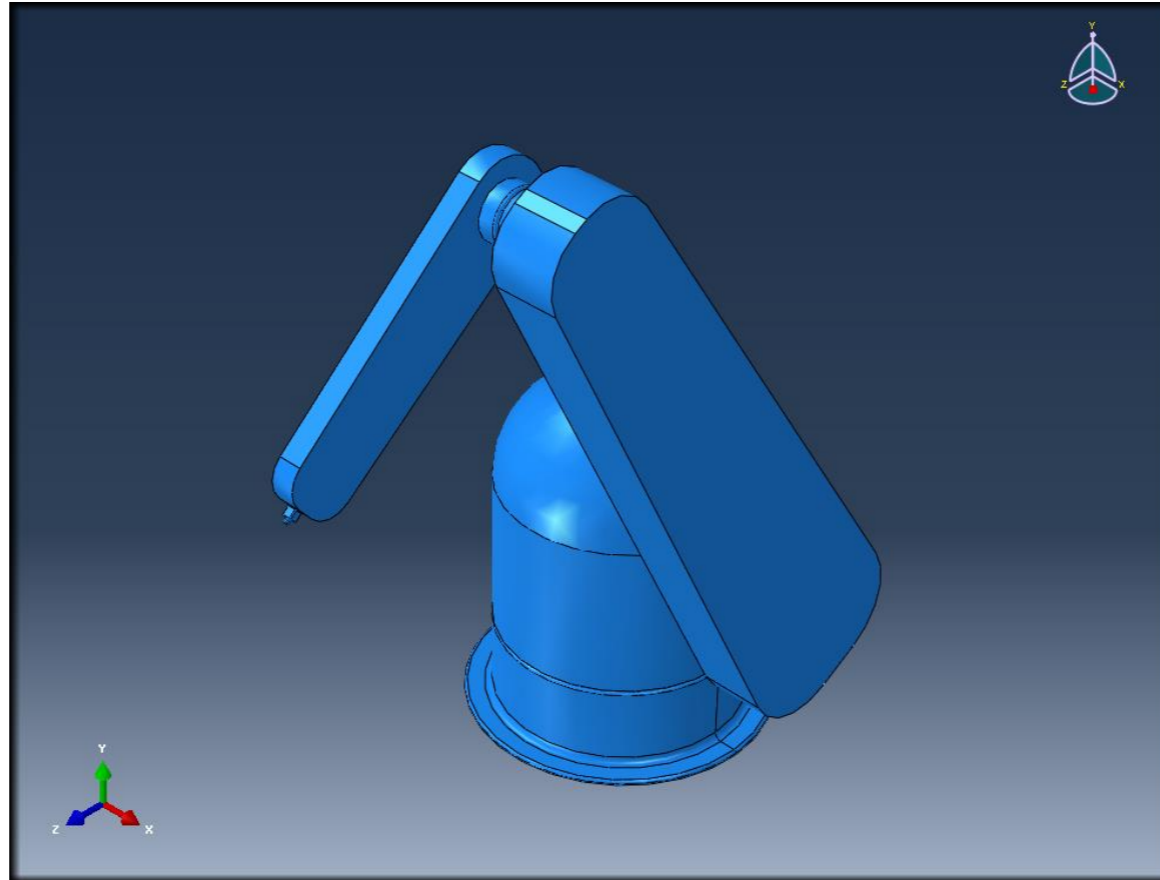
- ▶ Running the co-simulation
- ▶ Example – Cantilever Beam
- ▶ Analyzing the results in Abaqus
- ▶ Analyzing the results in Dymola



30 minutes

Workshop 4: Running jobs and interpreting results

In this workshop, you will set the parameters for the co-simulation, run the co-simulation jobs and examine the results in both Abaqus and Dymola.



Objectives

When you complete this workshop you will be able to:

- i. Set up and run an Abaqus-Dymola co-simulation
- ii. Evaluate the results in Abaqus
- iii. Evaluate the results in Dymola



30 minutes