Introduction to ExSight

V6
R2013X

About this Course

Course objectives

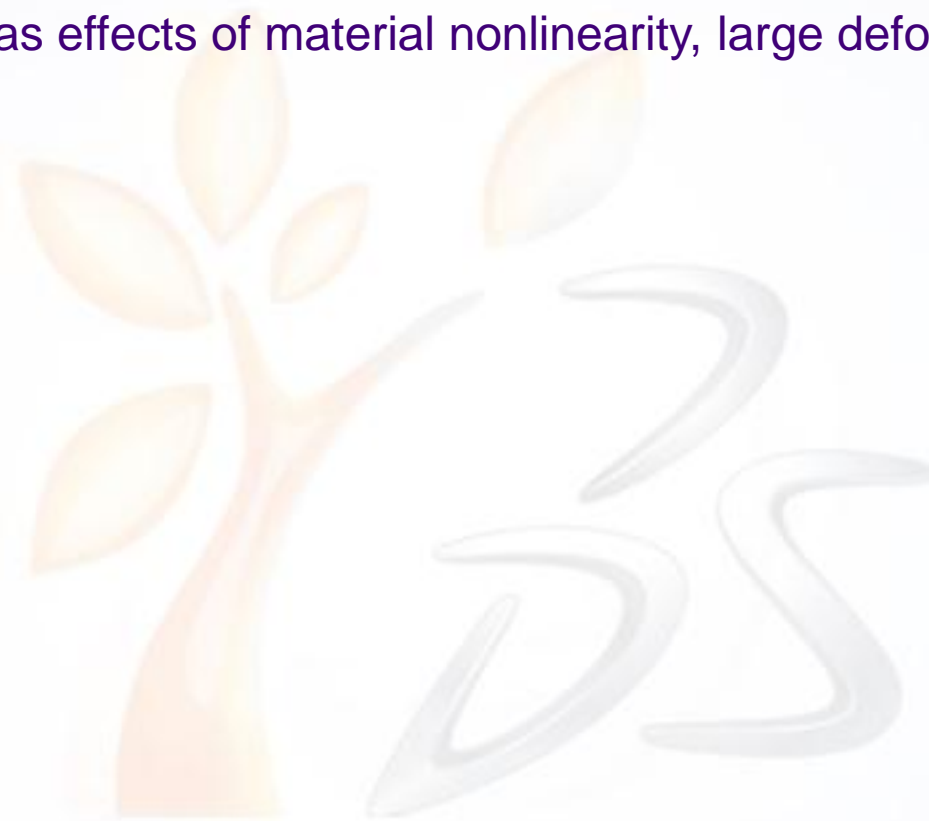Upon completion of this course you will be able to:

- Create complete Finite Element models
- Run and monitor the simulations
- View and evaluate simulation results
- Perform structural simulations (such as effects of material nonlinearity, large deformation, and contact)

Targeted audience

Simulation Analysts

Prerequisites

None

16 hours

Day 1

▷	Lesson 1	V6 Overview
▷	Workshop 1	Navigating V6
▷	Lesson 2	Meshing
▷	Workshop 2a	Intersecting Pipes – Mesh
▷	Workshop 2b	Pump – Mesh
▷	Workshop 2c	Reinforced Panel – Mesh
▷	Lesson 3	Material and Section Properties
▷	Workshop 3a	Intersecting Pipes – Materials and Section Properties
▷	Workshop 3b	Pump – Materials and Section Properties
▷	Workshop 3c	Reinforced Panel – Materials and Section Properties
▷	Lesson 4	Steps and Static Simulations
▷	Workshop 4a	Intersecting Pipes – Step Definition and Loads
▷	Workshop 4b	Intersecting Pipes – Submission and Postprocessing

Day 2

- Lesson 5   Loads, Restraints and Initial Conditions

- Workshop 5a   Pump – Step Definition and Loads
- Workshop 5b   Reinforced Panel – Step Definition and Loads

- Lesson 6   Connections, Interactions and Rigid Bodies

- Workshop 6a   Pump – Connections and Interactions
- Workshop 6b   Reinforced Panel – Connections, Submission and Postprocessing

- Lesson 7   Submitting and Postprocessing

- Workshop 7   Pump – Submission and Postprocessing

- Lesson 8   Dynamic Simulations

- Workshop 8a   Vibrating Cantilevered Plate
- Workshop 8b   Forming of a Channel
- Workshop 8c   Pipe Whip

- Lesson 9   Heat Transfer

- Workshop 9   Pump – Thermal Analysis

Additional Material

Legal Notices

Revision Status

Lesson 1	**12/12**	**Updated for R2013x**		**Workshop 1**	**12/12**	**Updated for R2013x**
Lesson 2	**12/12**	**Updated for R2013x**		**Workshop 2a**	**12/12**	**Updated for R2013x**
Lesson 3	**12/12**	**Updated for R2013x**		**Workshop 2b**	**12/12**	**Updated for R2013x**
Lesson 4	**12/12**	**Updated for R2013x**		**Workshop 2c**	**12/12**	**Updated for R2013x**
Lesson 5	**12/12**	**Updated for R2013x**		**Workshop 3a**	**12/12**	**Updated for R2013x**
Lesson 6	**12/12**	**Updated for R2013x**		**Workshop 3b**	**12/12**	**Updated for R2013x**
Lesson 7	**12/12**	**Updated for R2013x**		**Workshop 4a**	**12/12**	**Updated for R2013x**
Lesson 8	**12/12**	**Updated for R2013x**		**Workshop 4b**	**12/12**	**Updated for R2013x**
Lesson 9	**12/12**	**New for R2013x**		**Workshop 4c**	**12/12**	**Updated for R2013x**
Appendix 1	**12/12**	**Updated for R2013x**		**Workshop 5a**	**12/12**	**Updated for R2013x**
				Workshop 5b	**12/12**	**Updated for R2013x**
				Workshop 5c	**12/12**	**Updated for R2013x**
				Workshop 6a	**12/12**	**Updated for R2013x**
				Workshop 6b	**12/12**	**Updated for R2013x**
				Workshop 7a	**12/12**	**Updated for R2013x**
				Workshop 7b	**12/12**	**Updated for R2013x**
				Workshop 8a	**12/12**	**Updated for R2013x**
				Workshop 8b	**12/12**	**Updated for R2013x**
				Workshop 8c	**12/12**	**New for R2013x**
				Workshop 9	**12/12**	**New for R2013x**

Lesson 1: V6 Overview

Lesson content:

▷   What is PLM?

▷   What is V6?

▷   Working with the V6 Database

▷   Connecting to V6

▷   Selecting the Security Context and Roles

▷   Understanding the V6 User Interface

▷   Using the Navigation Tools

▷   Exploring the V6 Objects

▷   Authoring the Objects

▷   Importing and Exporting Data

▷   Saving Data

▷   Understanding Simulation Workbenches in V6

▷   Working with the ExSight Workbenches

▷   Understanding the Simulation Capabilities in ExSight

▷   Understanding Conventions in ExSight

▷   Workshop 1

1 hour
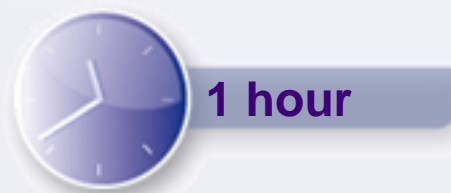
Workshop 1: Navigating through V6

In this workshop you will learn to navigate through the V6 platform. After completion of this exercise, you will be able to:

    a. Connect to a V6 database

    b. Use basic V6 navigation tools
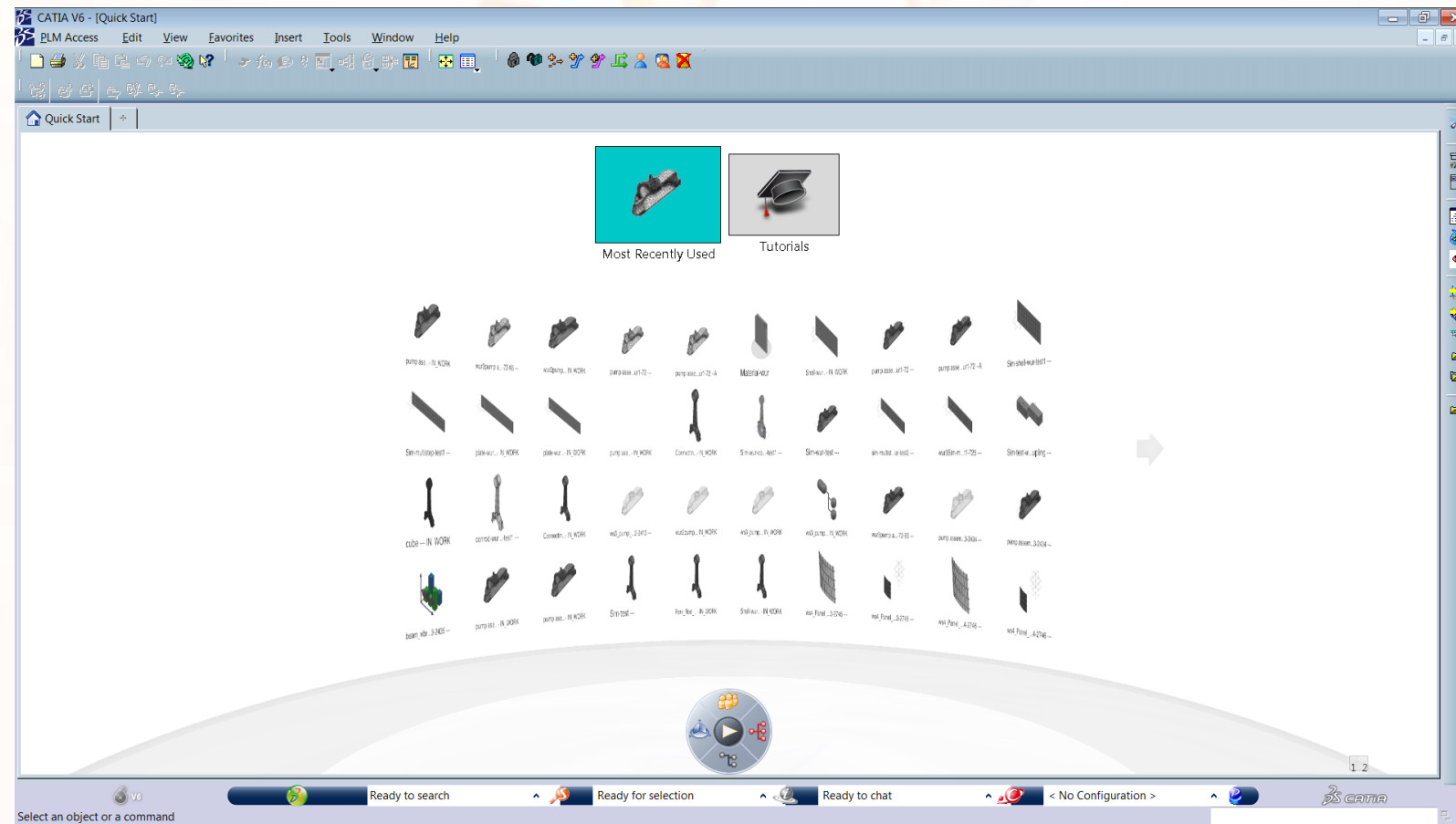
30 minutes

Lesson 2: Meshing (1/2)

Lesson content:

▷ Introduction to Meshing in V6

▷ Workflow Overview

▷ Creating a New Finite Element Model Representation

▷ The Advanced Meshing Workbench Layout

▷ Generating Meshes in ExSight

▷ The Octree Meshers

▷ Creating Octree Tetrahedron Meshes

▷ Creating Octree Triangle Meshes

▷ Creating Surface Meshes

▷ Working with the Surface Mesher

▷ Using the Surface Rules Mesher

▷ More on Creating 3D Solid Meshes

▷ Generating Sweep 3D Meshes

▷ Creating Tetrahedron Filler Meshes

1 hour

Workshop 2a: Intersecting Pipes – Mesh

In this workshop, you will create a good quality tetrahedral mesh on the three-dimensional intersecting pipe model.

After completion of this exercise, you will be able to:

    a. Open the ExSight workbench and create a Finite Element Model Representation

   b. Create a good quality tetrahedral mesh on a solid geometry
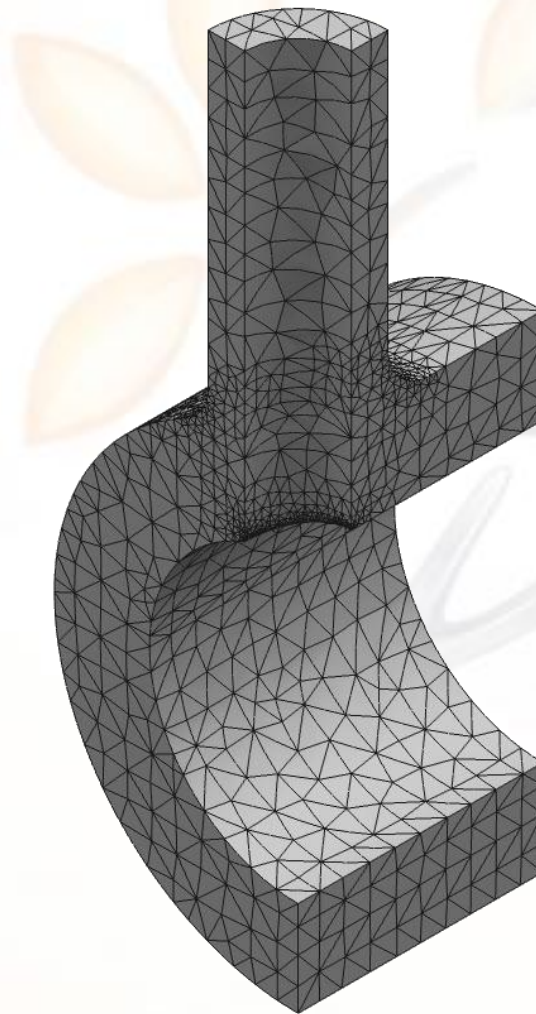
20 minutes

Workshop 2b: Pump – Mesh

In this workshop you will create a Finite Element Mesh Representation for the pump assembly. You will mesh each part with tetrahedral elements.

After completion of this exercise, you will be able to:

    a. Create an ExSight simulation for a CATIA Product
    b. Create a Finite Element Mesh Representation
    c. Mesh the different parts of an assembly with tetrahedral elements
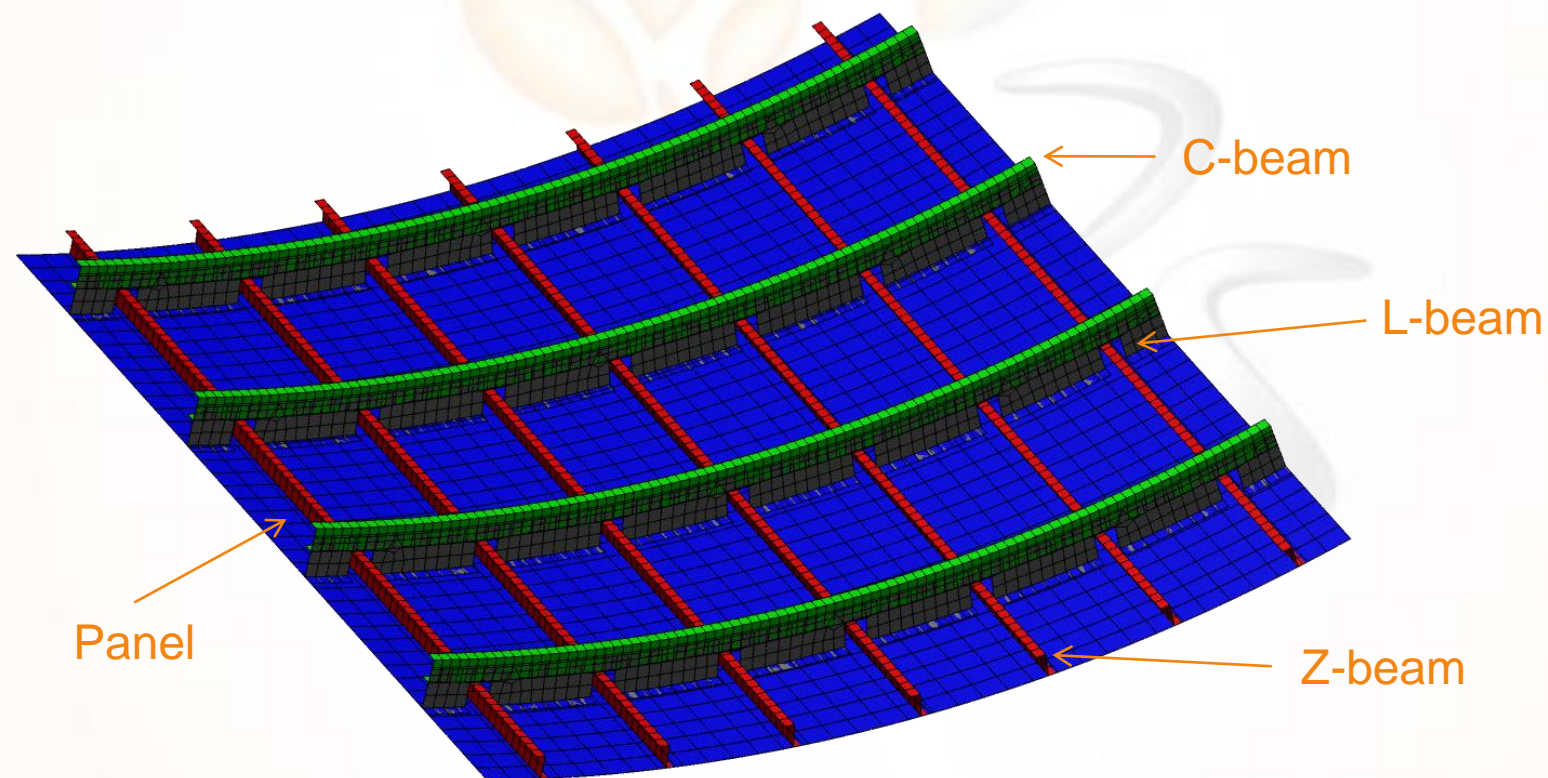

Pump housing

Gasket

Pump cover

Bolts
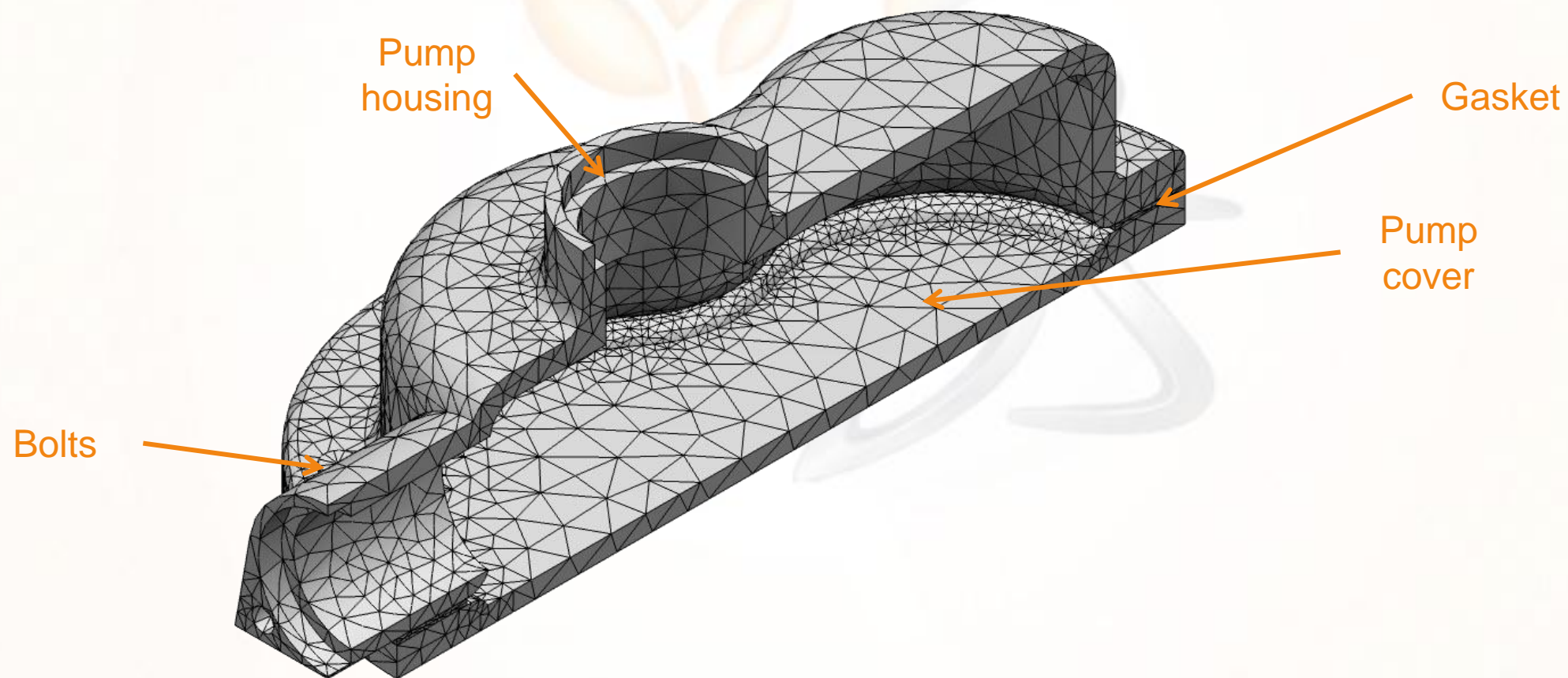
30 minutes

Workshop 2c: Reinforced Panel – Mesh

In this workshop, you will create surface meshes on all components of the panel.

After completion of this exercise, you will be able to:

    a. Create a Finite Element Model Representation

    b. Apply surface meshes to different components of an assembly

C-beam

L-beam

Panel

Z-beam

45 minutes

Lesson 3: Materials and Section Properties

Lesson content:

▷ Understanding Materials

▷ Core and Covering Materials

▷ Material Definition in V6

▷ Creating a Material

▷ Adding New Domains

▷ Editing a Material Domain

▷ Understanding Simulation Domains

▷ Material Models

▷ Working with Materials

▷ Applying a Material

▷ Understanding Section Properties

▷ Creating Solid Section Properties

▷ Creating Shell Section Properties

▷ Specifying Orientations

▷ Creating Beam Section Properties
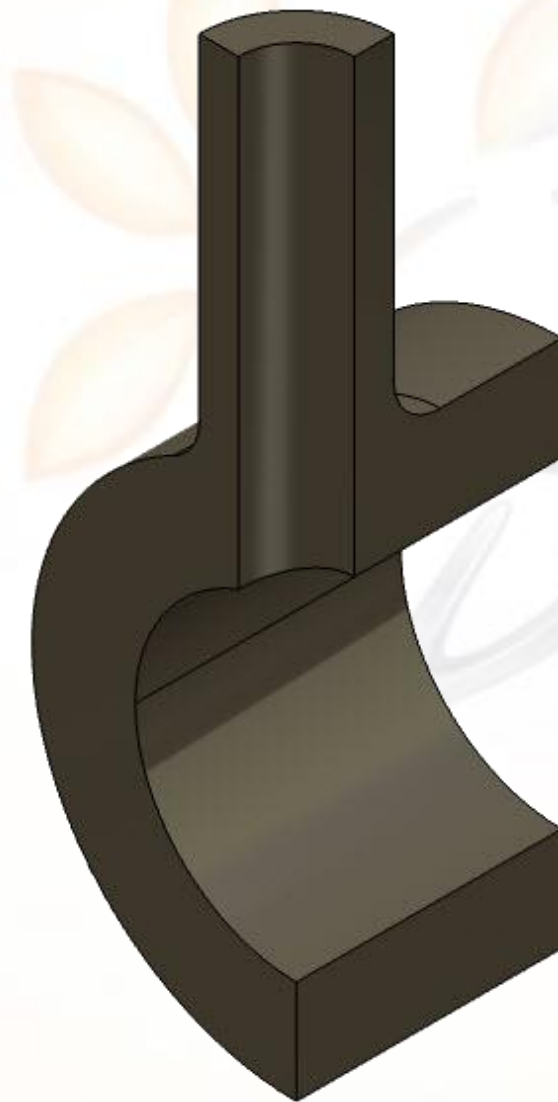
▷ Workshop 3a

▷ Workshop 3b

▷ Workshop 3c

1 hour

Workshop 3a: Intersecting Pipes – Materials and Section Properties

In this workshop, you will create an elastic material and apply it to the intersecting pipe geometry.

After completion of this exercise, you will be able to:

    a. Open the Material Editor workbench and create an elastic material

    b. Apply materials and create section properties
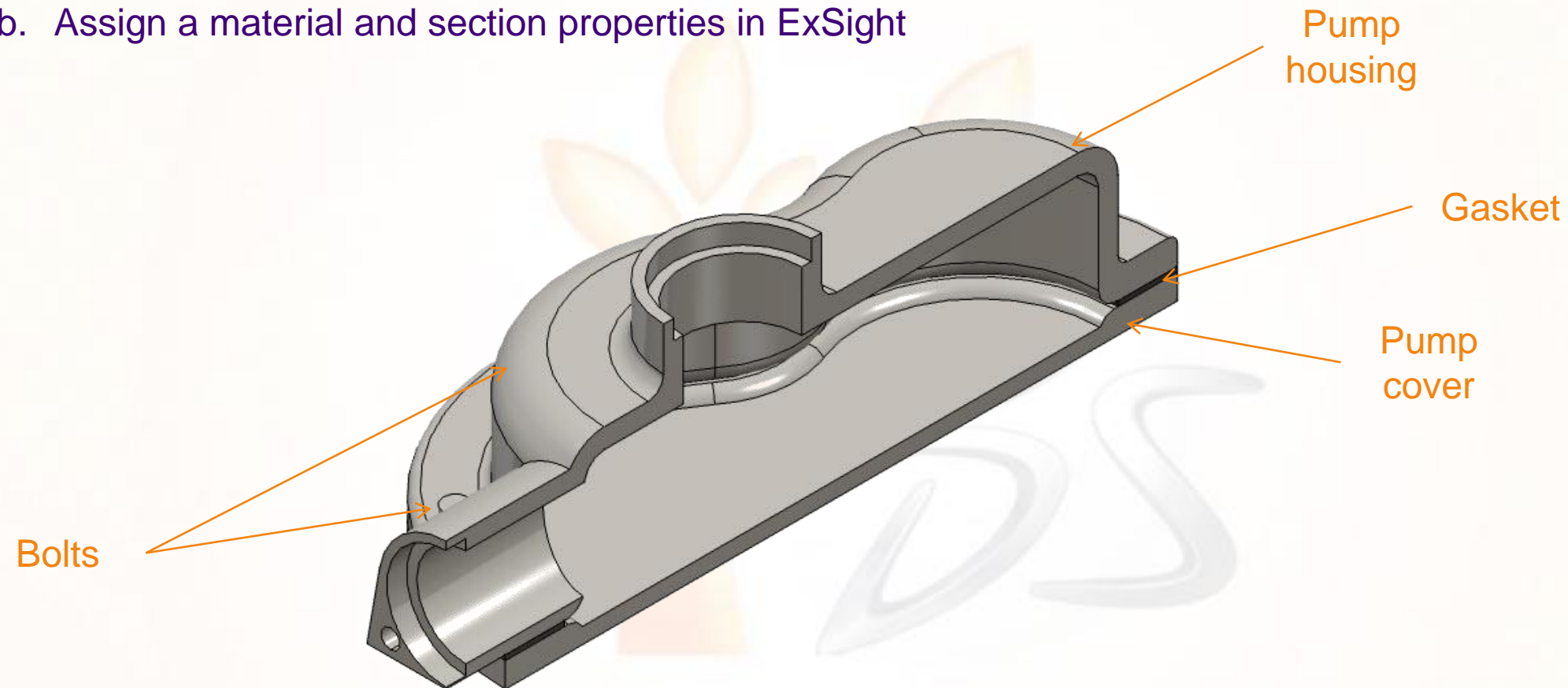

20 minutes

Workshop 3b: Pump – Materials and Section Properties

In this workshop you will create and assign the material and section properties for the parts in the pump assembly.

After completion of this exercise, you will be able to:

     a. Import and create materials in V6

   b. Assign a material and section properties in ExSight

Pump housing

Gasket

Pump cover

Bolts

45 minutes

Workshop 3c: Reinforced Panel – Materials and Section Properties

In this workshop, you will create an elastic material and apply it to all the components of the panel.

After completion of this exercise, you will be able to:

    a. Create an elastic material

    b. Apply a material to all the components of an assembly

    c. Create shell sections and assign it to the different components of the panel
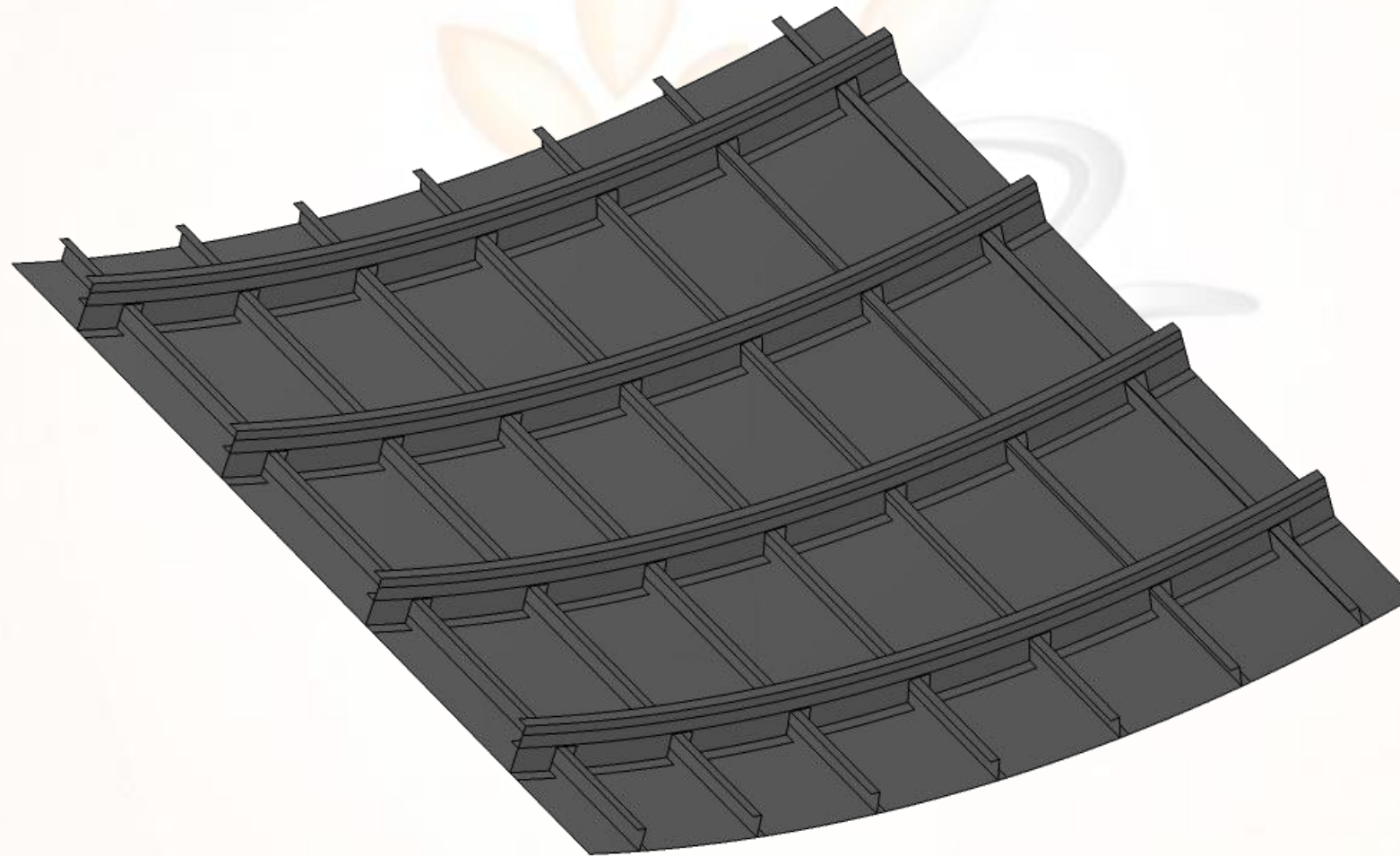
45 minutes

Lesson 4: Steps and Static Simulations

Lesson content:

▷ Simulation Steps and Procedures

▷ Overview of Nonlinear Problems

▷ Overview of Static Simulation

▷ Understanding Nonlinear Static Simulation

▷ Understanding Implicit Methods

▷ Creating Static Steps

▷ Options for Static Steps

▷ Understanding Perturbation Procedures

▷ Creating Static Perturbation Steps

▷ Understanding Multistep Simulations
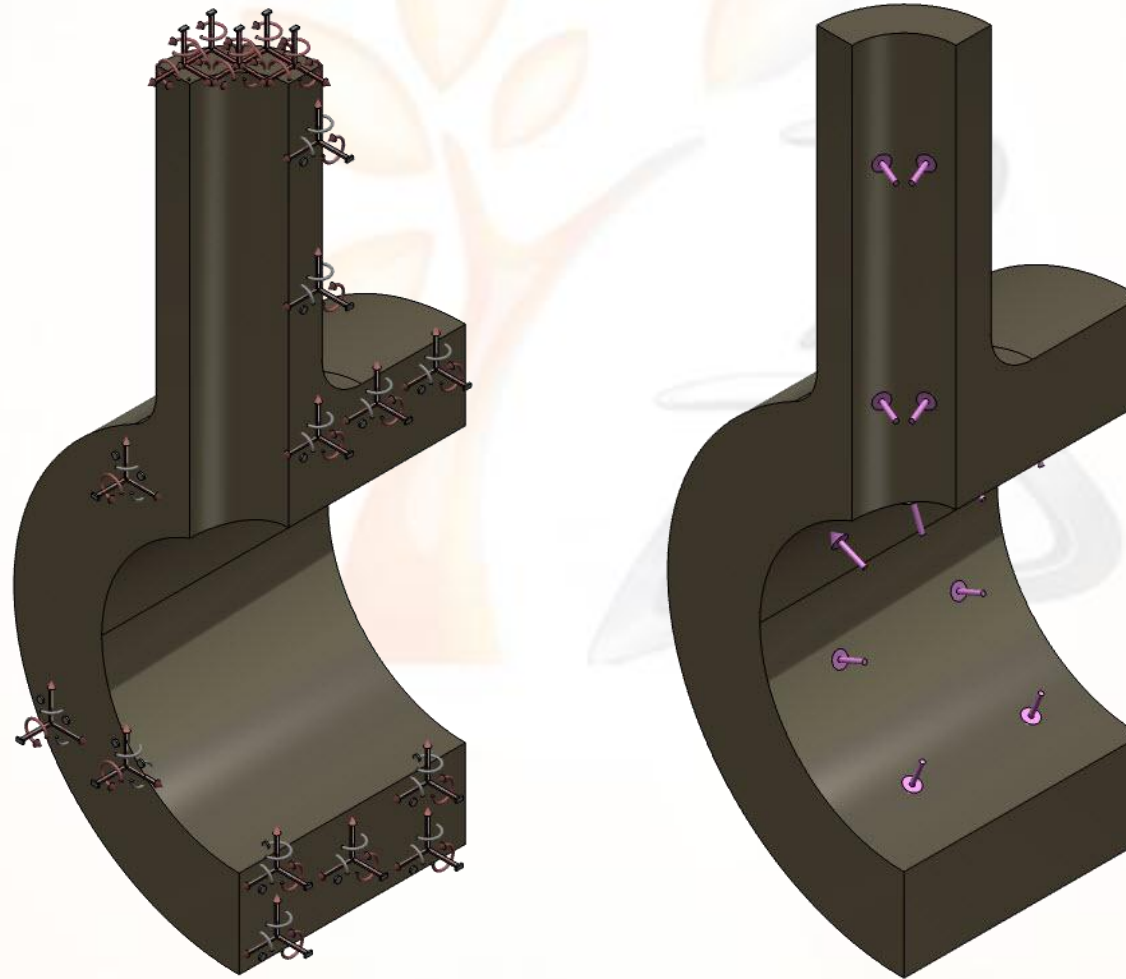
▷ Workshop 4a

▷ Workshop 4b

45 minutes

Workshop 4a: Intersecting Pipes – Step Definition and Loads

In this workshop, you will define a static simulation step and apply loads and restraints to the model.

After completion of this exercise, you will be able to:

    a. Define the static simulation steps

    b. Create the pressure loads

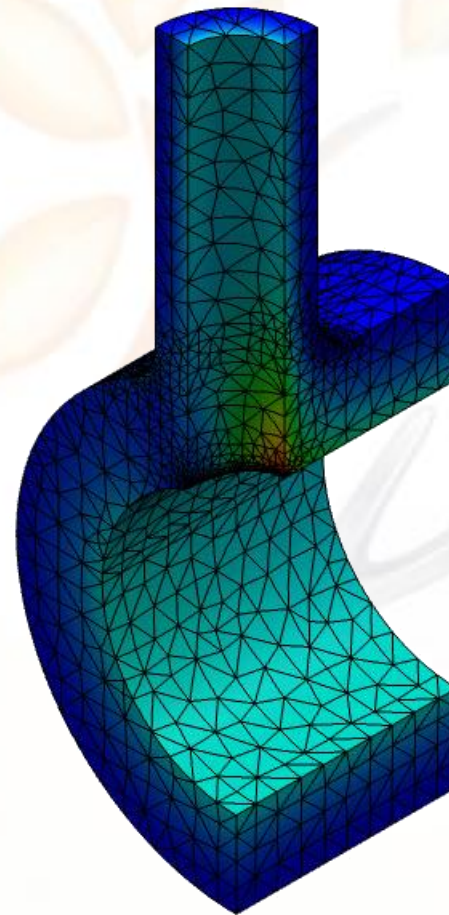   c. Apply the displacement restraints

30 minutes

Workshop 4b: Intersecting Pipes – Submission and Post-processing

In this workshop, you will execute the ExSight simulation and visualize the results.

After completion of this exercise, you will be able to:

    a. Execute an ExSight simulation

    b. Post-process the results using different techniques

30 minutes

Lesson 5: Loads, Restraints and Initial Conditions

Lesson content:

▷ Defining Loads and Restraints

▷ Understanding Amplitudes

▷ Working with Local Coordinate Systems

▷ Defining Initial Conditions
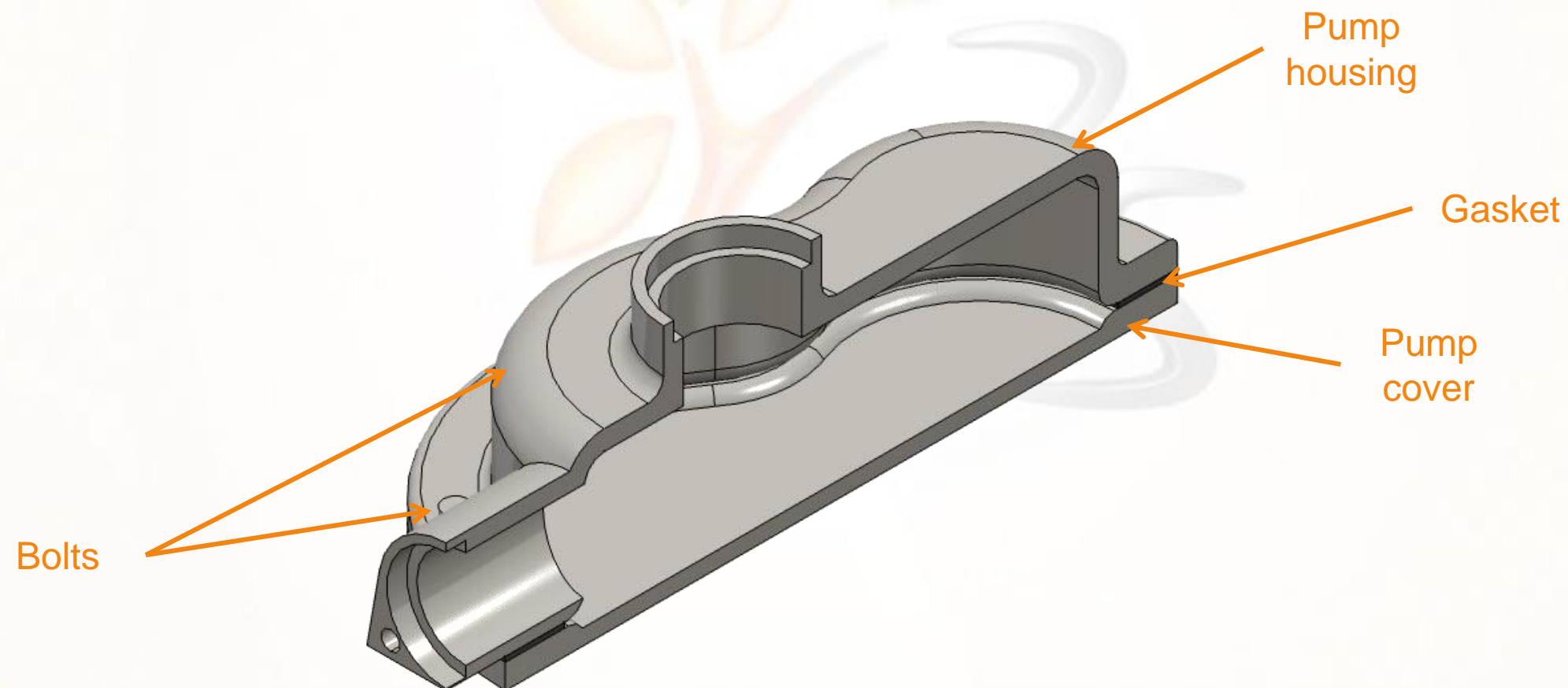
▷ Workshop 5a

▷ Workshop 5b

30 minutes

Workshop 5a: Pump – Step Definition and Loads

In this workshop you will create two static steps. In the first static step, you will introduce a state of pre-tension in the bolts by applying bolt loads. In the second static step, the bolts will be fixed and a pressure load will be applied to the interior faces of the assembly. Since interactions, loads, and boundary conditions can be step dependent, simulation steps must be defined before loads and boundary conditions.

After completion of this exercise, you will be able to:

    a. Create simulation steps in ExSight
    b. Apply different types of loads and boundary conditions to a model in an ExSight simulation

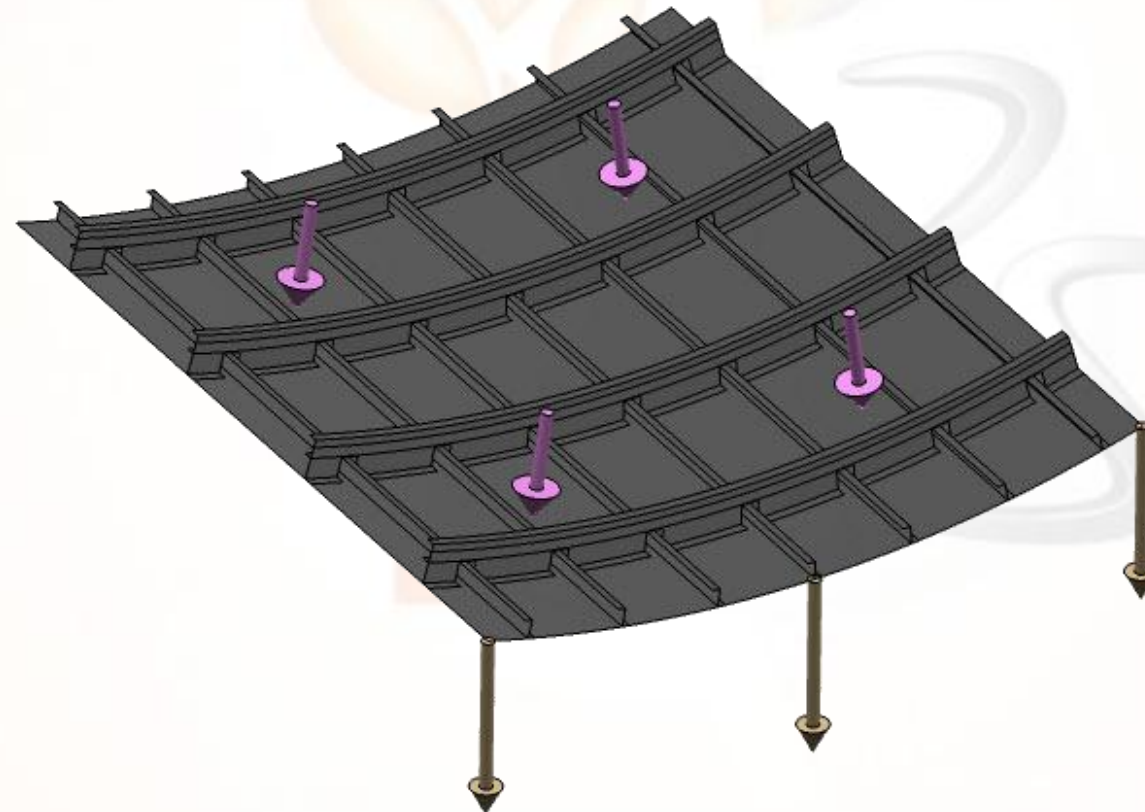Pump housing

Gasket

Pump cover

Bolts

45 minutes

Workshop 5b: Reinforced Panel – Step Definition and Loads

In this workshop, you will define a static step and define the loads and restraints.

After completion of this exercise, you will be able to:

    a. Define static simulation steps

    b. Create pressure loads

    c. Apply translational loads and displacement restraints

45 minutes

Lesson 6: Connections, Interactions and Rigid Bodies

Lesson content:

▷ Overview of Connections, Interactions and Rigid Bodies

▷ Understanding Connections

▷ Understanding Connection Types

▷ Applying Loads and Restraints to Connections

▷ Understanding Rigid Bodies

▷ Defining Rigid Bodies and Analytical Rigid Surfaces

▷ Applying Loads and Restraints to Rigid Bodies

▷ Understanding Interactions

▷ Approaches to Modeling Contact

▷ Defining Interactions

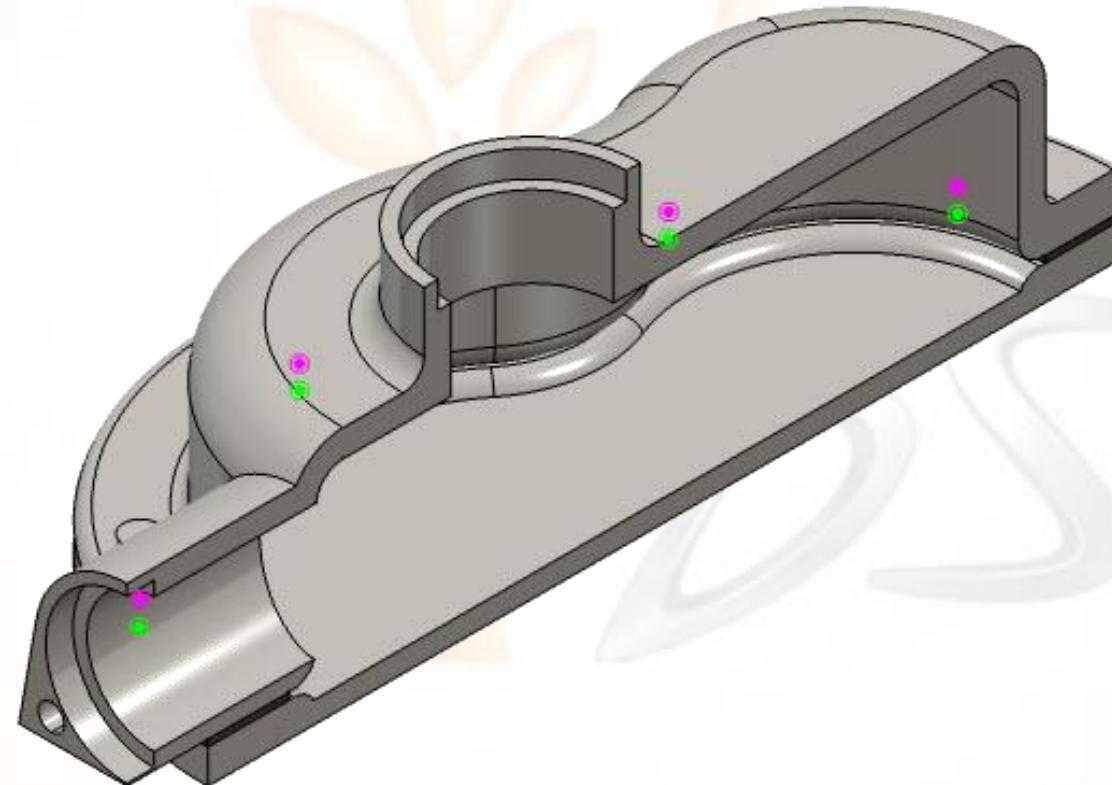▷ Workshop 6a

▷ Workshop 6b

45 minutes

Workshop 6a: Pump – Connections and Interactions

In this workshop, you will define contact between the various parts of the assembly. In addition, you will also define tie connections between the bolt shanks and the pump cover.

After completion of this exercise, you will be able to:

    a. Define contact between the different parts of the assembly

   b. Create tie connections using free engineering connections

25 minutes

Workshop 6b: Reinforced Panel – Connections, Submission and Postprocessing

In this workshop, you will define tied contact between the different parts of the panel assembly. In addition, you will execute the simulation, visualize and postprocess the results.

After completion of this exercise, you will be able to:

a. Define tied contact using the contact detection tool
b. Execute a simulation
c. Perform basic postprocessing
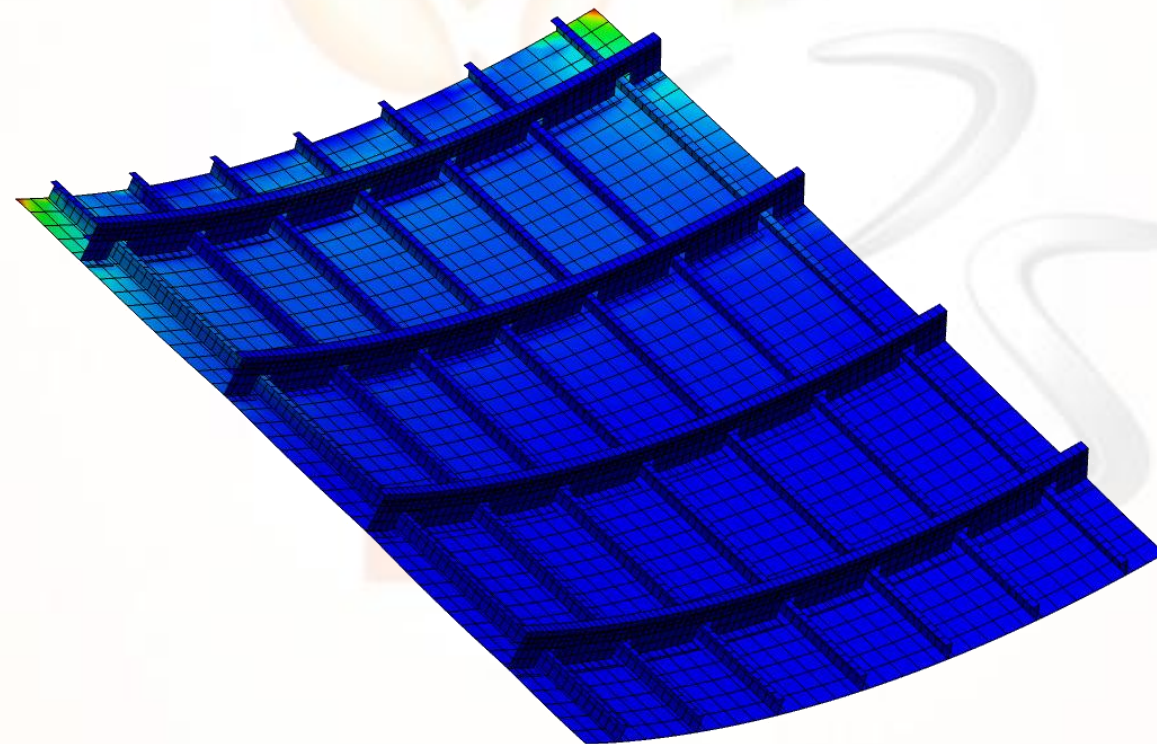
45 minutes

Lesson 7: Running Simulations and Postprocessing

Lesson content:

▷ Completing the Simulation Model

▷ Running Simulations

▷ Evaluating Results

▷ Workshop 7

45 minutes

Workshop 7: Pump – Submission and Postprocessing

In this workshop, you will execute the previously saved ExSight simulation and will apply different postprocessing techniques to visualize the results.

After completion of this exercise, you will be able to:

    a. Execute an ExSight simulation

    b. Postprocess the results using different techniques
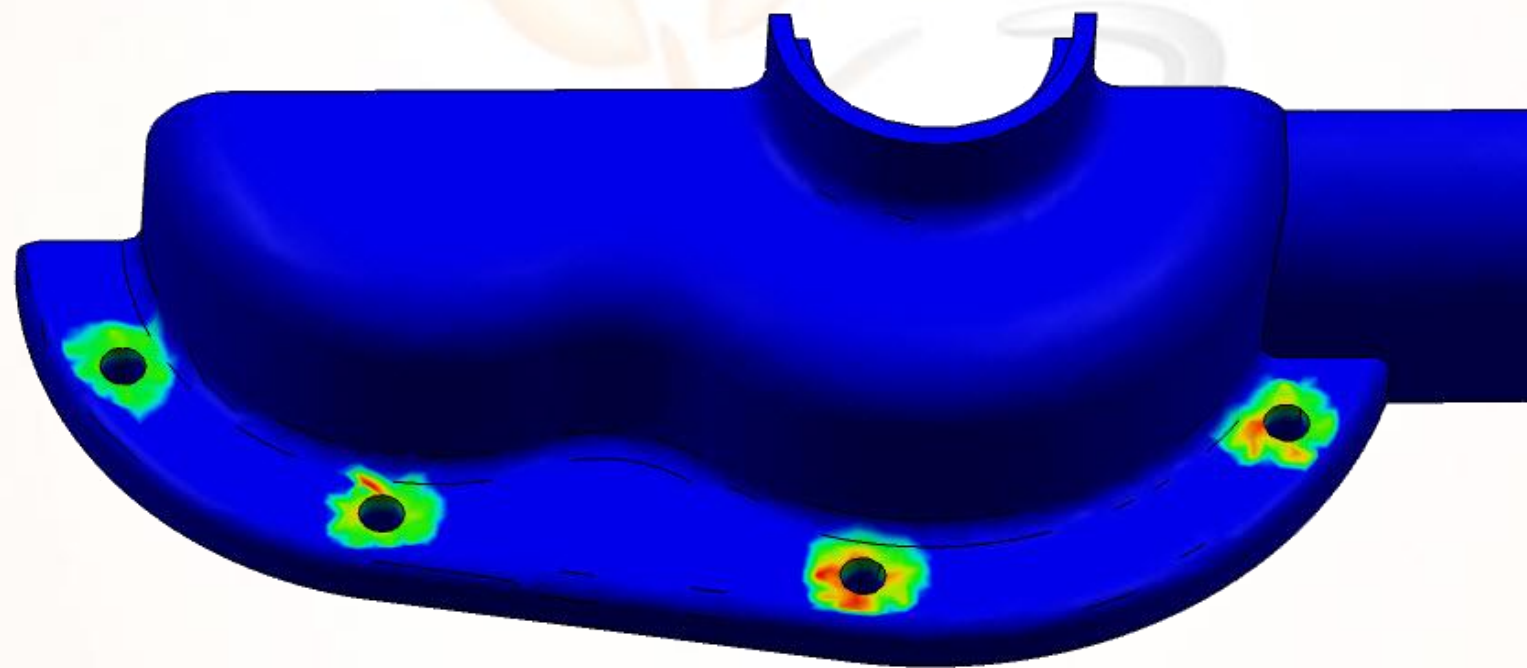
45 minutes

Lesson 8: Dynamic Simulation

Lesson content:

45 minutes

Workshop 8a: Vibrating Cantilevered Plate

In this workshop, you will analyze the dynamic response of a cantilevered plate using frequency extraction and implicit dynamics.

After completion of this exercise, you will be able to:

a. Conduct an eigenvalue extraction simulation in order to evaluate the different natural frequency modes of a structure

b. Set up a simple implicit dynamic simulation
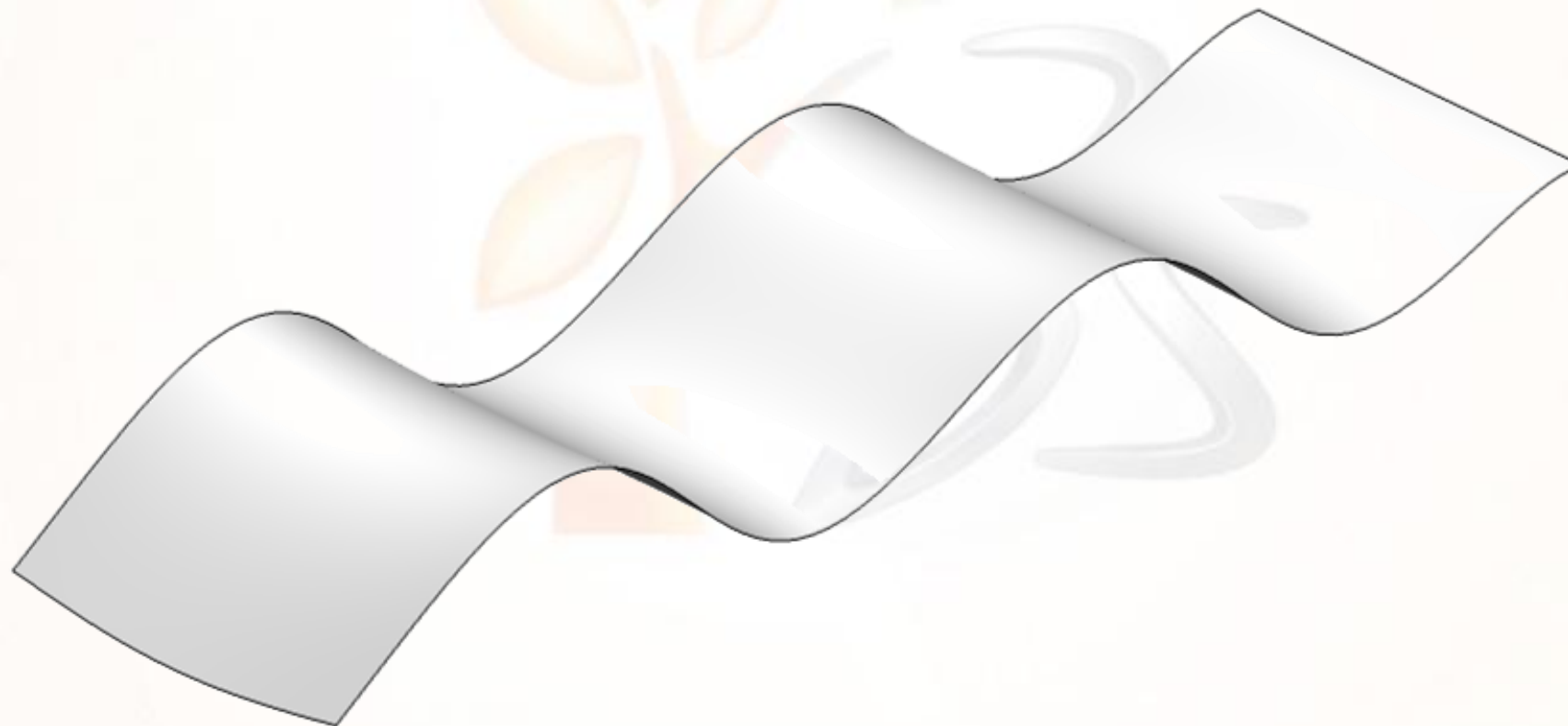
60 minutes

Workshop 8b: Forming a Channel

In this workshop, you will simulate the process of forming a channel from a piece of sheet metal using a multiple-step explicit dynamic simulation.

After completion of this exercise, you will be able to:

a. Conduct a multiple-step simulation within ExSight
b. Set up a model using general contact
c. Prescribe loads and displacements using amplitude curves
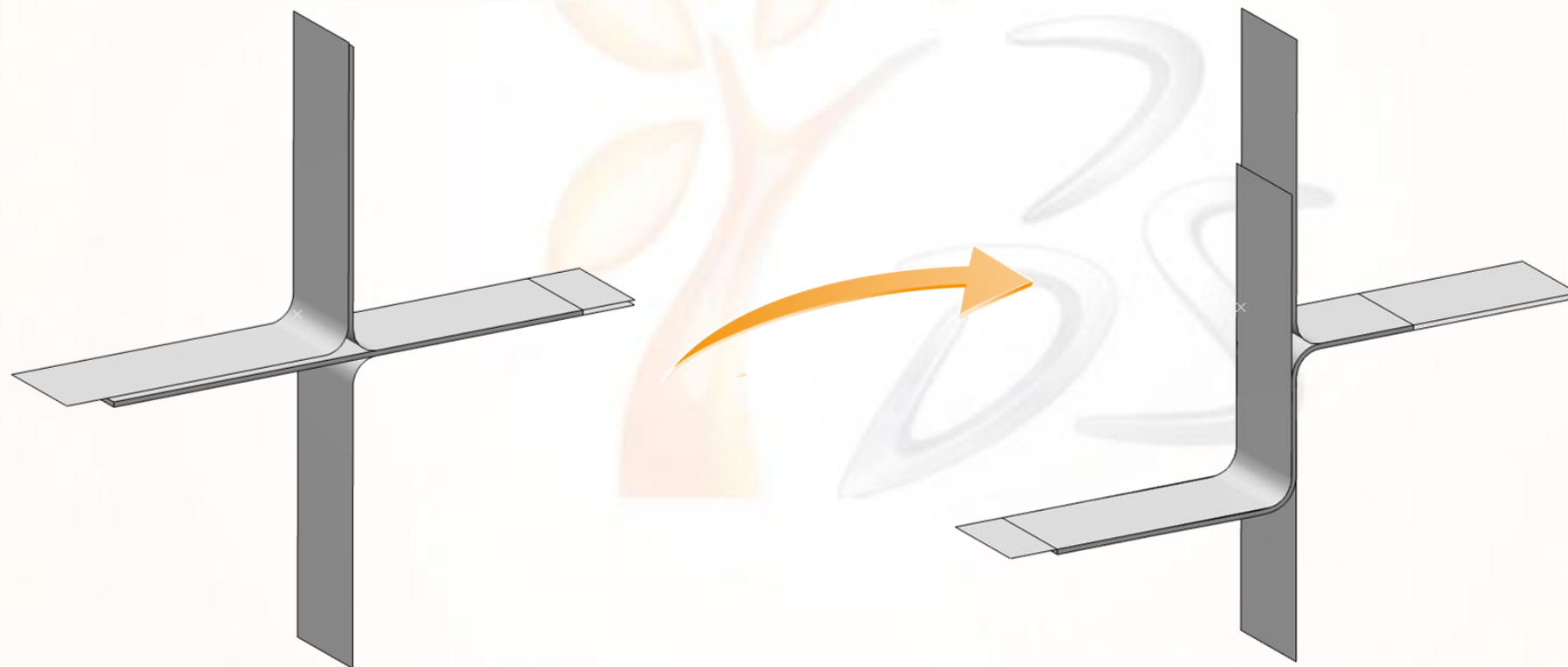
60 minutes

Workshop 8c: Pipe Whip Simulation

In this workshop, we will simulate a pipe-on-pipe impact resulting from the rupture of a high-pressure line in a power plant. It is assumed that a sudden release of fluid could cause one segment of the pipe to rotate about its support and strike a neighboring pipe.

After completion of this exercise, you will be able to:

    a. Conduct an explicit dynamic simulation within ExSight

    b. Set up a model using general contact

    c. Prescribe an initial rotating velocity condition
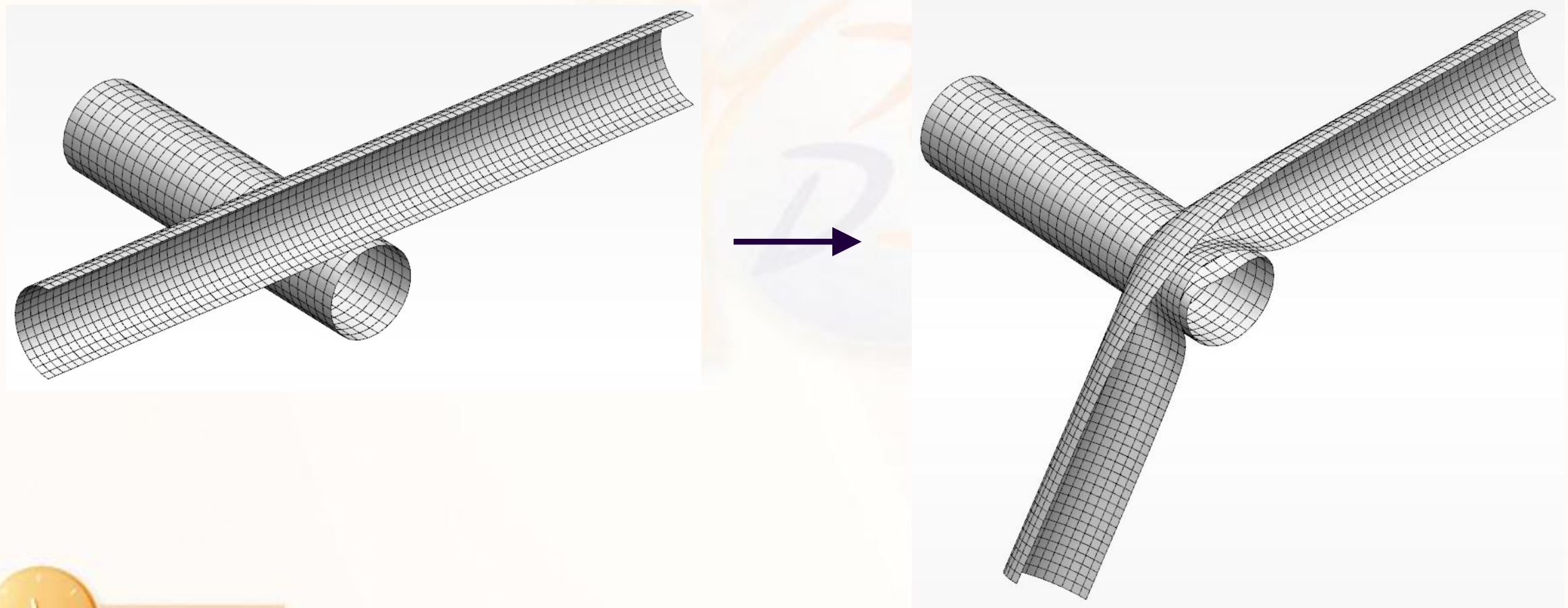
30 minutes

Lesson 9: Heat Transfer Simulation

Lesson content:

▷ Introduction

▷ Thermal and Initial Conditions in ExSight

▷ Thermal Material Properties

▷ Creating Heat Transfer Steps

▷ Thermal Interactions in ExSight

▷ Steady-State Heat Transfer Example

▷ Workshop 9: Thermal Analysis of a Pump Housing
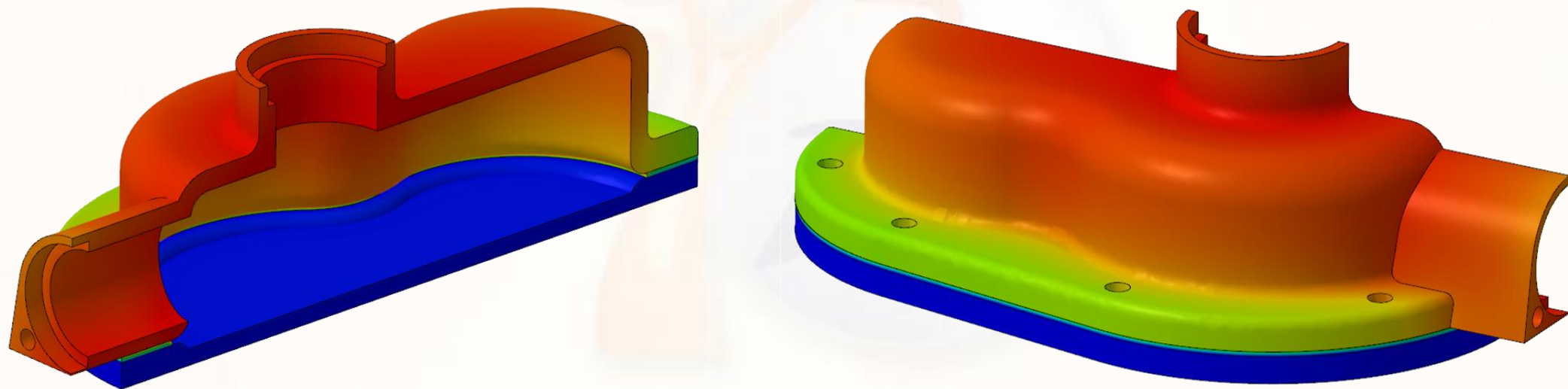
45 minutes

Workshop 9: Thermal Simulation of a Pump Housing

In this workshop, we will perform a steady-state heat transfer analysis of a pump housing containing a hot fluid.

After completion of this exercise, you will be able to:

    a. Conduct a steady-state heat transfer analysis within ExSight

    b. Set up thermal interactions between bodies in contact

    c. Prescribe a number of different thermal boundary conditions

60 minutes

Appendix 1: Element Selection Criteria

Lesson content:

▷ Elements in ExSight

▷ Structural (Shells) vs. Continuum Elements

▷ Modeling Bending Using Continuum Elements

▷ Stress Concentrations

▷ Contact

▷ Incompressible Materials

▷ Mesh Generation

▷ Solid Element Selection Summary

1 hour