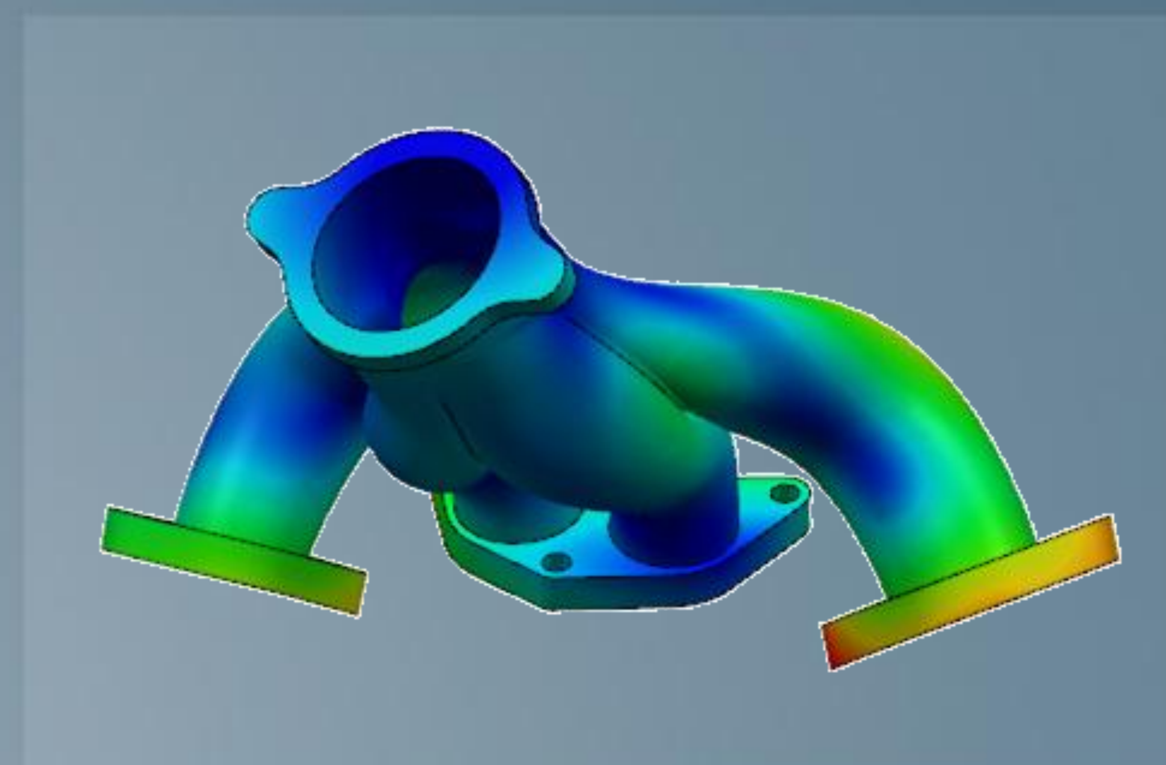
Dynamics Simulation Essentials

R2014x



3DEXPERIENCE

About this Course

Course objectives

Upon completion of this course you will be able to:

- Create complete Finite Element models for dynamic simulations
- Run and monitor the simulations
- View and evaluate simulation results
- Perform structural dynamics simulations (linear and nonlinear)

Targeted audience

Simulation Analysts

Prerequisites

Structural Mechanics Simulation Essentials

1 day

Day 1

- Lesson 1 Dynamic Simulations
- Workshop 1 Vibrating Cantilevered Plate
- Lesson 2 Linear Dynamics
- Workshop 2a Frequency Analysis of an Exhaust Manifold
- Workshop 2b Harmonic Response Analysis of a Control Arm
- Workshop 2c: Cargo Crane under Dynamic Loading
- Lesson 3 Nonlinear Dynamics
- Workshop 3 Pipe Whip Simulation
- Lesson 4 Quasi-static Simulations
- Workshop 4a Channel Forming
- Workshop 4b Bending of a Thin Tube

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Revision Status

Lesson 1	4/14	New for R2014x
Lesson 2	4/14	New for R2014x
Lesson 3	4/14	New for R2014x
Lesson 4	4/14	New for R2014x
Workshop 1	4/14	New for R2014x
Workshop 2a	4/14	New for R2014x
Workshop 2b	4/14	New for R2014x
Workshop 2c	4/14	New for R2014x
Workshop 3	4/14	New for R2014x
Workshop 4a	4/14	New for R2014x
Workshop 4b	4/14	New for R2014x

Lesson 1: Dynamic Simulations

Lesson content:

- Physics Modeling Apps
- Simulation Steps and Procedures
- What Makes a Problem Dynamic?
- Equations for Dynamic Problems
- Selected Applications
- Workshop Preliminaries

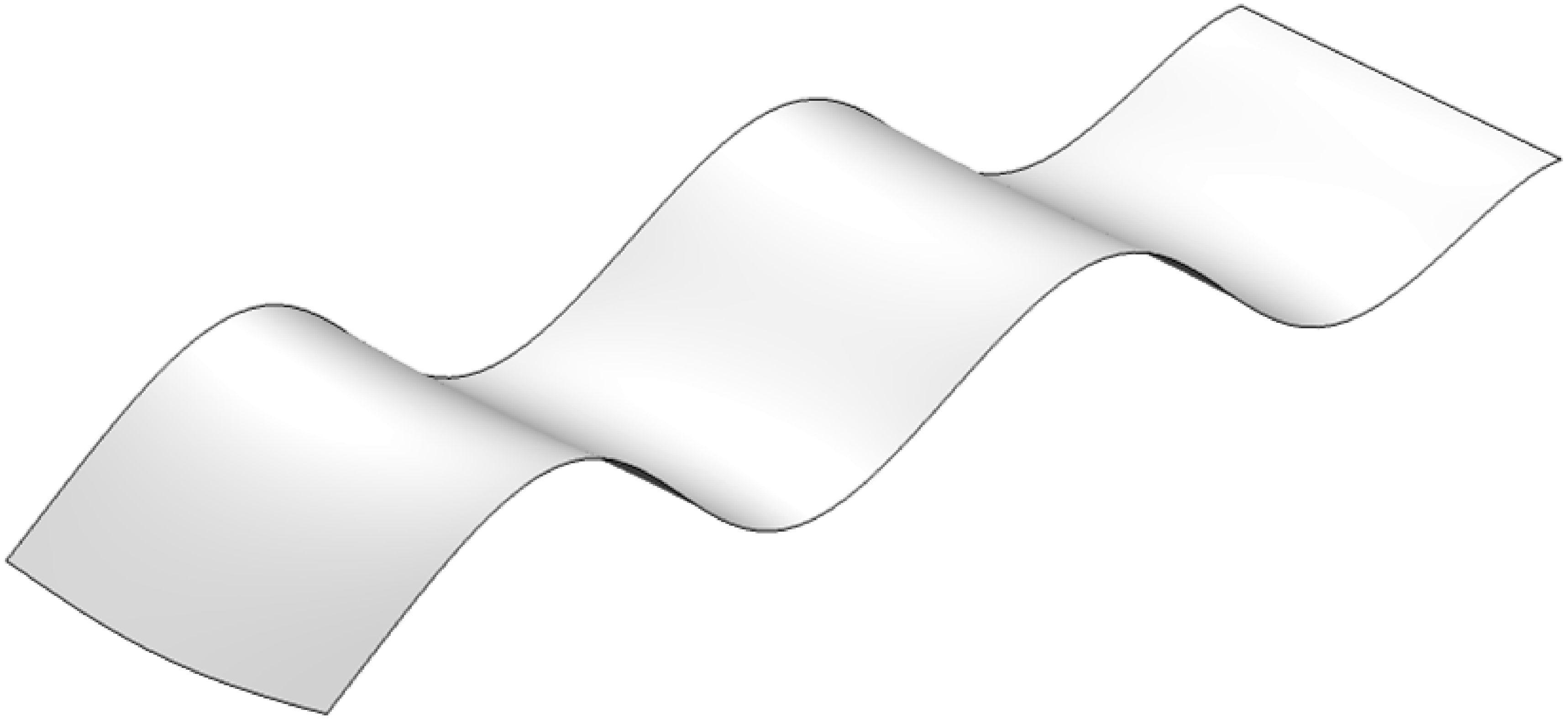
30 minutes

Workshop 1: 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

Lesson 2: Linear Dynamics

Lesson content:

- Overview
- Natural Frequency Extraction
- Modal Superposition
- Steady State Dynamics
- Modal Dynamics

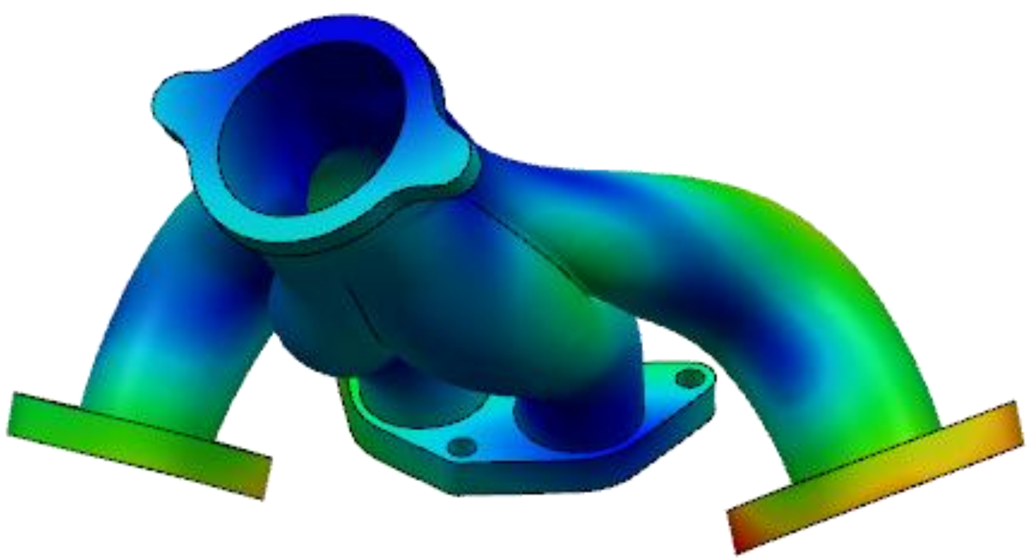
30 minutes

Workshop 2a: Frequency Analysis of an Exhaust Manifold

In this exercise, the natural frequencies of an unrestrained exhaust manifold are examined. The mesh is imported from an Abaqus input file. The structure is modeled with parabolic tetrahedral elements and linear elastic response is assumed.

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

a. Perform a frequency extraction analysis



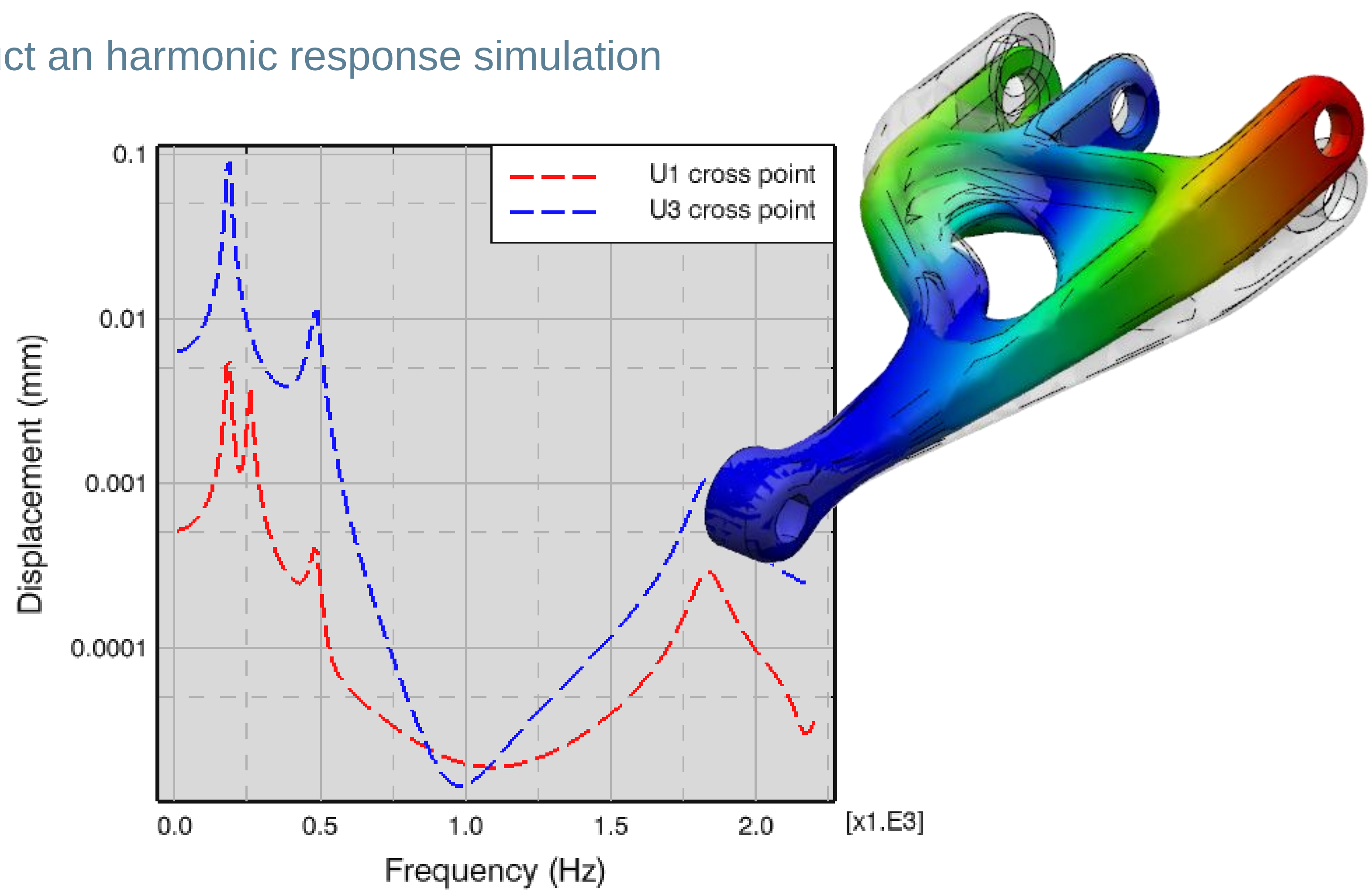
30 minutes

Workshop 2b: Harmonic Response Analysis of a Control Arm

In this workshop we will perform a steady-state dynamic analysis of the lower control arm of an automotive wishbone suspension. We will obtain the mechanical response of this component in the frequency domain to a harmonic excitation. The frequency range of interest for the harmonic analysis is 2200 Hz.

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

a. Conduct an harmonic response simulation



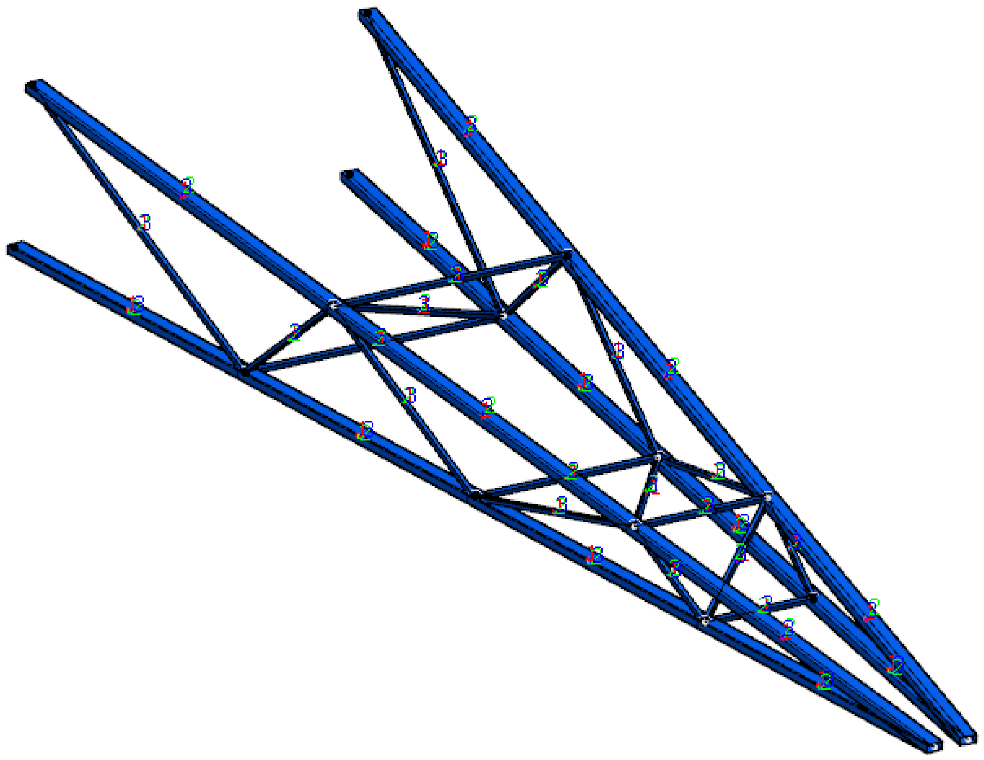
45 minutes

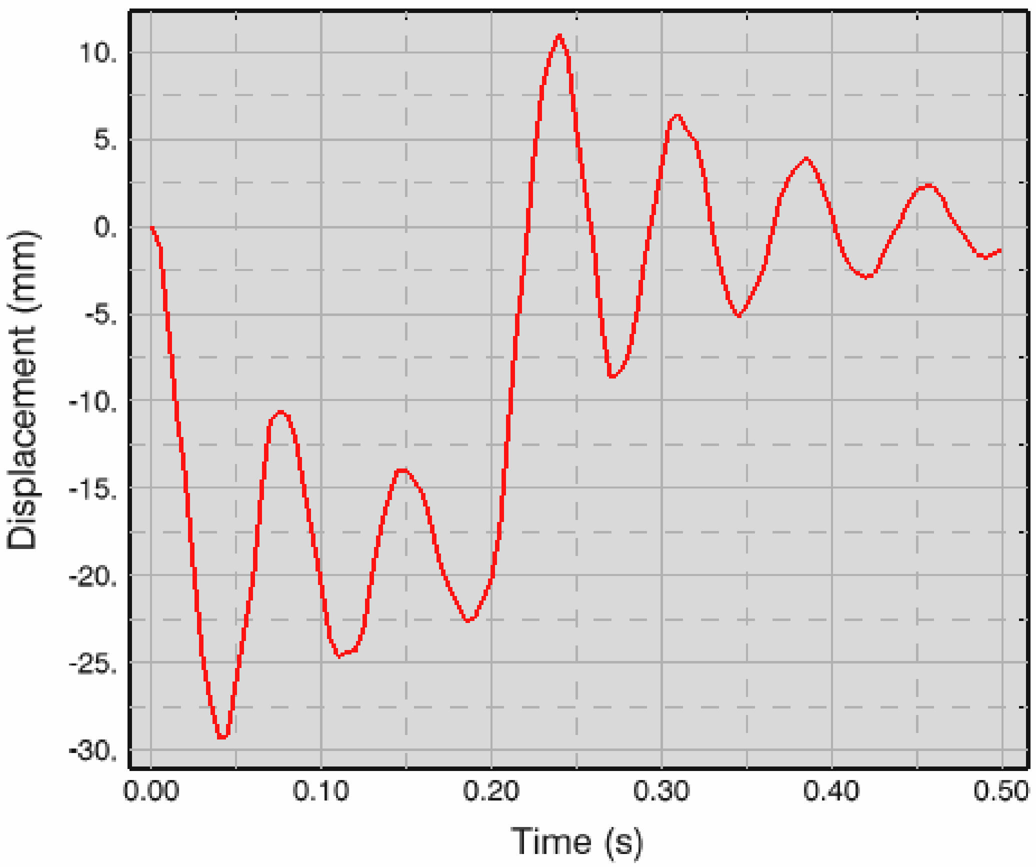
Workshop 2c: Cargo Crane under Dynamic Loading

A light-service, cargo crane is shown below. You have now been asked to investigate what happens when a load of 10 kN is dropped onto the lifting hook for 0.2 seconds. The connections can only withstand a maximum pull-out force of 100 kN. You have to decide whether or not any of these connections will break. The short duration of the loading means that inertia effects are likely to be important, making dynamic analysis essential.

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

a. Conduct a modal dynamic simulation





30 minutes

Lesson 3: Nonlinear Dynamics

Lesson content:

- Overview
- Time Integration of the Equations of Motion
- Implicit vs. Explicit Time Integration
- Automatic Time Incrementation in Implicit Dynamics
- Automatic Time Incrementation in Explicit Dynamics
- Comparing Implicit and Explicit Dynamics

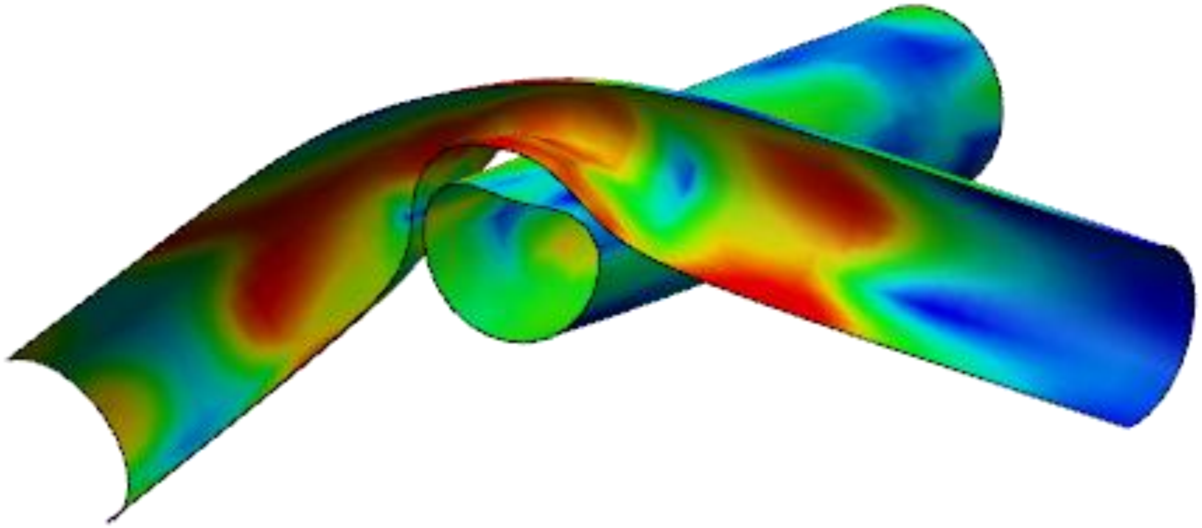
45 minutes

Workshop 3: 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.
b. Set up a model using general contact
c. Prescribe an initial rotating velocity condition



30 minutes

Lesson 4: Quasi-static Simulations

Lesson content:

- Solution Strategies
- Quasi-Static Simulations Using Explicit Dynamics
- Quasi-Static Simulations Using Implicit Dynamics

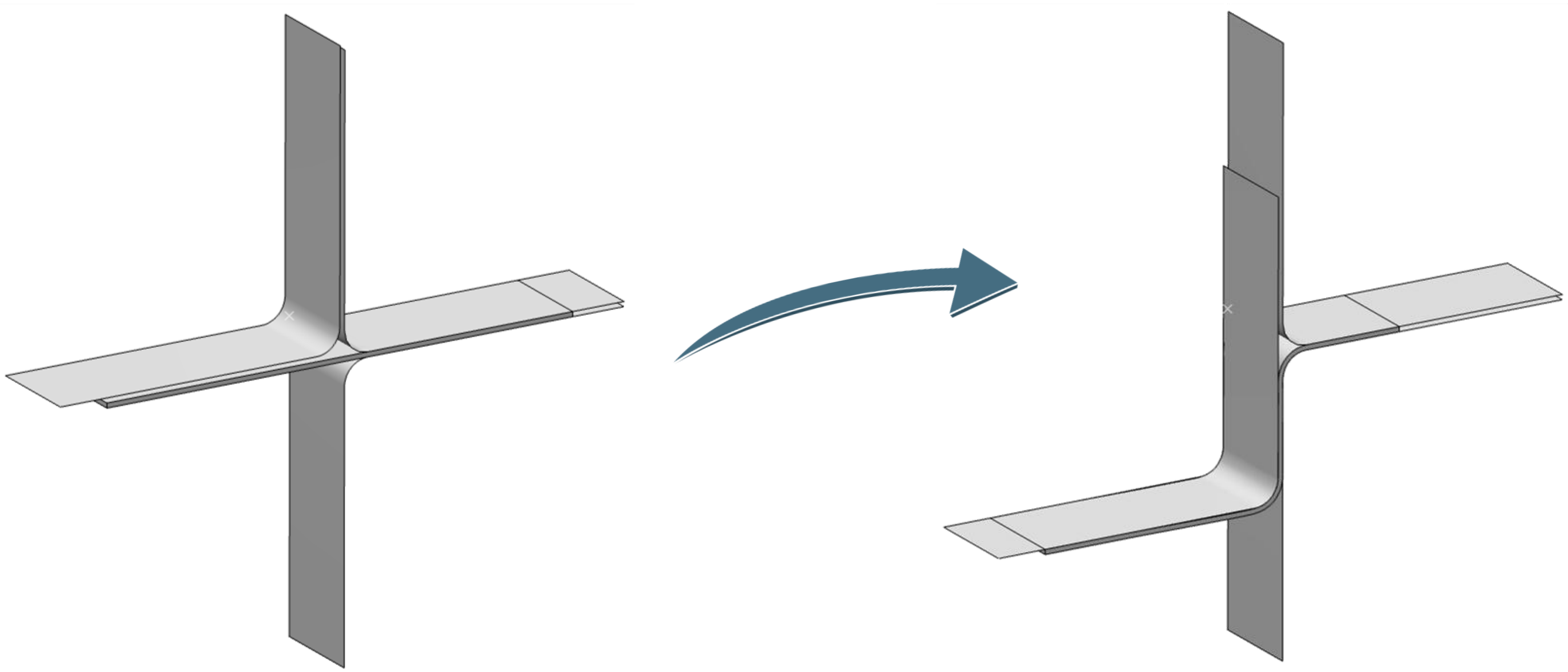
45 minutes

Workshop 4a: Channel Forming

In this workshop, you will simulate a channel forming process 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.
b. Set up a model using general contact
c. Prescribe loads and displacements using amplitude curves



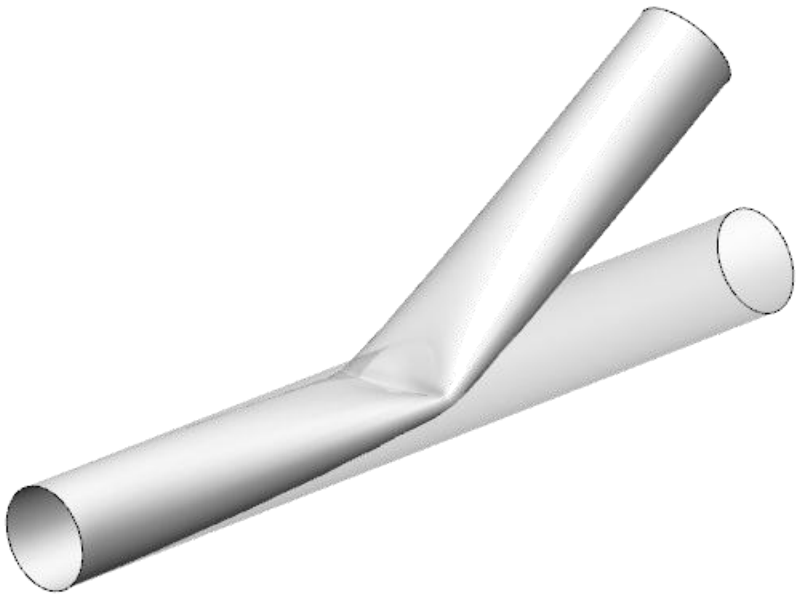
45 minutes

Workshop 4b: Bending of a Thin Tube

This workshop considers the bending of a thin tube. The material model is elastic-plastic. Rigid end caps are attached to the nodes at each end of the tube. A rotation is applied to one end of the tube; the other end is pinned. Local buckling of tube walls occurs when the bending is severe.

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

a. Conduct an implicit dynamic simulation to solve a quasi-static problem



30 minutes