Course objectives
Upon completion of this course you will be able to:
- Set up a finite element-based flexible rail track in Simpack
- Prepare FE models for import
- Perform Craig-Bampton reduction
- Import reduced FE models into Simpack
- Select the appropriate FE modeling method
- Model nonlinear rail pads and ballast defects

Target Audience
Simpack Rail users interested in advanced train/track interaction
Engineers involved in dynamic behavior of tracks, bridges, switches and crossings

Prerequisites
Introduction to Simpack training course successfully completed
Simpack Rail training course successfully completed
Optional: Simpack Flexible Bodies training course

About this Course
1 day
Day 1

- Lesson 1: Simpack FlexTrack Overview
- Lesson 2: Preparing the FE Model
  - Workshop 1: Linear Flexible Rail
- Lesson 3: Flexible Track Setup in Simpack
  - Workshop 2: Your First FlexTrack Model
  - Workshop 3: FlexTrack with Track Irregularities (Optional)
- Lesson 4: Advanced Track Elements
  - Workshop 4: Advanced Track Elements

Optional Content:

- Lesson 5: FlexTrack Workflow Variants
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# Revision Status

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Lesson content:

- What is Simpack FlexTrack?
- Simpack FlexTrack Applications
- Possibilities and Limitations
- Building Blocks
- Modeling Variant 1 – FE Beam Model Assemblies
- Modeling Variant 2 – Generic FE Model Assemblies
- Modeling Variant 3 – Complete FE Model
Lesson content:

- Basics of Craig-Bampton Substructuring/Reduction
- Substructuring/Reduction with Abaqus
- Substructuring/Reduction with ANSYS
- Coupling Elements
- A Typical Sleeper FE Model
- A Typical Rail FE Model
- Reduction of the Sleeper and Rail with Abaqus
- Reduction of the Sleeper and Rail with ANSYS
- Typical FE Substructuring Issues
- Workshop 1: Linear Flexible Rail
Workshop 1: Linear Flexible Rail

Aims:

1. Familiarize yourself with a basic FE rail model
2. Create a .fbi file and load it in Simpack as a Simpack Linear Flexible body
3. Create Markers at retained nodes
4. Visualize the eigenmodes
Lesson content:

- The Nonlinear Flextrack Body Type
- The Nonlinear Flextrack Configuration (.ftr) File
- Must-Haves in the .ftr File
- Making the .ftr File Available to a Simpack Model
- Setup of the Nonlinear Flextrack Body and Joint
- Connecting a Nonlinear Flextrack Body to the Rail-Wheel Modeling Elements
- Workshop 2: Nonlinear Flextrack
- Workshop 3: Nonlinear Flextrack with Track Irregularities

60 minutes
Aims:

1. Set up a FlexTrack database
2. Create an .ftr file
3. Set up a Nonlinear Flextrack Body
4. Understand the Flextrack debug information
5. Connect the flexible track to a wheelset
6. Verify the track eigenmodes
7. Postprocess Flextrack results
Aims:

1. Create and apply track irregularities from a measured signal
2. Modify the .ftr file to reduce model loading time
Lesson content:

- Nonlinear Force Elements in the Nonlinear Flextrack Body Definition
- Limitations
- Usage in the .ftr file
- Example of Nonlinear Force Elements in the .ftr File
- Workshop 4: Advanced FlexTrack Elements
Aims:

1. Create a model using a flexible track section with nonlinear spring and damper elements
2. Define nonlinear spring and damper elements
3. Model clearances between the substructures of a Nonlinear Flextrack Body
4. Integrate hyper elastic material definitions into a Nonlinear Flextrack Body
5. Verify the nonlinear track behavior in the Simpack postprocessor
Lesson 5: FlexTrack Workflow Variants

Lesson content:

- Modeling Variants of FlexTrack
  - Variant 1 and 2 of flexible Rail Track Modeling
  - Variant 3 for complex rail track structure

This lesson is optional