

Automotive Powertrain Assembly Analysis with Abaqus

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Seminar Overview

- **Lecture 1** Introduction and Motivation
- **Lecture 2** Contact
- **Lecture 3** Gaskets and Bolt Loading
- **Lecture 4** Thermal Stress Analysis
- **Lecture 5** Dynamics—NVH Effects
- **Lecture 6** Manufacturing Process

- **Appendix 1** Maximizing Success with Contact in Abaqus/Standard
- **Appendix 2** Large Model Management
- **Appendix 3** Materials for Powertrain

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Revision Status

Lecture 1	5/11	Updated for 6.11
Lecture 2	5/11	Updated for 6.11
Lecture 3	5/11	Updated for 6.11
Lecture 4	5/11	Updated for 6.11
Lecture 5	5/11	Updated for 6.11
Lecture 6	5/11	Updated for 6.11
Appendix 1	5/11	Updated for 6.11
Appendix 2	5/11	Updated for 6.11
Appendix 3	5/11	Updated for 6.11



Introduction and Motivation

Lecture 1

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L1.2

Overview

- Background
- Powertrain Applications (not comprehensive)
- Summary of Relevant Abaqus Features for Powertrain

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Contact

Lecture 2

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L2.2

Overview

- **Contact Analysis in Powertrain**
- **How to Approach Contact Analyses**
- **Example: Coolant Manifold Cover Assembly**
 - *TIE
 - Adjusting surfaces
- **Example: 3-D Rubber Seal**
 - *CONTROLS
 - Contact output
- **Application: Press Fit Analysis of Valve Seats**
 - Submodeling
 - Interference fit problems
- **Bolted Joints with Threads**

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Gaskets and Bolt Loading

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L3.2

Overview

- Introduction
- Gasket Element Formulations
- Gasket Element Library
- Defining Gasket Element Geometry
- Gasket Element Behavior
- Using Gasket Elements in a Model
- Application: Coolant Manifold Cover Gasket
- Application: Transmission Pan Gasket
- Application: Engine Bore Distortion
- Gasket Element Output Variables
- Practical Tips for Gasket Usage

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Thermal Stress Analysis

Lecture 4

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L4.2

Overview

- Thermal-Stress Procedures in Abaqus
- Sequentially Coupled Thermal-Stress Analysis
- Temperature Application
- Thermal Stress Example: Exhaust Manifold
- Using CFD Results with Abaqus

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Dynamics—NVH

Lecture 5

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L5.2

Overview

- Introduction
- Natural Frequency Extraction
- Forced Harmonic Excitation
- Dynamic Gaskets
- Structural Acoustics

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Manufacturing Processing Effects

Lecture 6

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L6.2

Overview

- **Introduction**
- **Example: Machining of a Coolant Manifold Assembly**
 - Transferring results between Abaqus/Standard analyses
- **Example: Oil Pan Vibration**
 - Manufacturing process effects on steady-state vibration and fatigue life

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Maximizing Success with Contact in Abaqus/Standard

Appendix 1

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A1.2

Overview

- Understanding Abaqus Solution Algorithms
- Overview of Contact in Abaqus/Standard
- Contact Discretization
- Relative Sliding Between Bodies
- The Contact Algorithm in Abaqus
- Understanding the Message File
- Contact Diagnostics (Visual)
- Systematic Modeling Practices
- Troubleshooting Contact Analyses

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Large Model Management

Appendix 2

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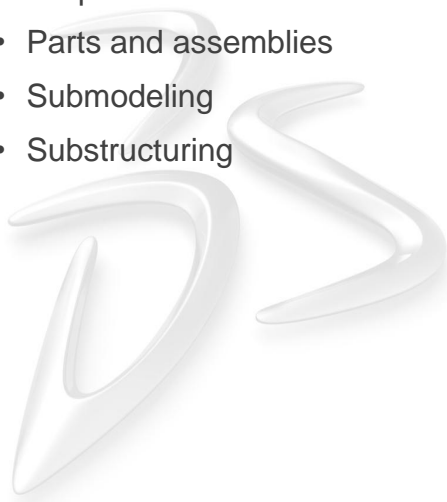
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A2.2

Overview

- **What is a Large Model?**
- **Managing Computer Resources for Large Models**
- **Analysis Techniques to Manage Large Models**
 - Restart
 - Output control
 - Parts and assemblies
 - Submodeling
 - Substructuring

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Materials for Powertrain

Appendix 3

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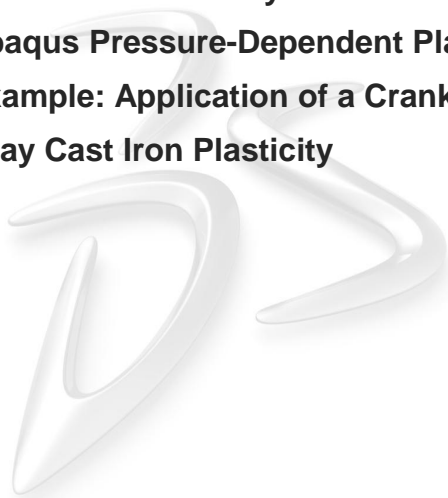
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A3.2

Overview

- Introduction
- Linear Elasticity (Hooke's Law)
- Abaqus Rubber Material Models
- Example: Curve Fitting Rubber Test Data
- Solid Metal Plasticity
- Abaqus Pressure-Dependent Plasticity Models
- Example: Application of a Crankshaft Seal
- Gray Cast Iron Plasticity

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