

Obtaining a Converged Solution with Abaqus

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Day 1

- **Lecture 1** Introduction to Nonlinear FEA
- **Workshop 1** Nonlinear Spring
- **Lecture 2** Nonlinear FEA with Abaqus/Standard
- **Lecture 3** Solution of Unstable Problems
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Day 2

- **Lecture 6** **Convergence Problems: Element Behavior**
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Lecture 8	5/11	Updated for 6.11
Workshop 1	5/11	Updated for 6.11
Workshop 2	5/11	Updated for 6.11
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Workshop 5	5/11	Updated for 6.11
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Workshop Answers 8	5/11	Updated for 6.11



Introduction to Nonlinear FEA

Lecture 1

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L1.2

Overview

- Why Use FEA to Solve Mechanics Problems?
- What is Convergence?
- When is a Problem Nonlinear?
- Properties of Linear Problems in Mechanics
- Properties of Nonlinear Problems in Mechanics
- Numerical Techniques for Solving Nonlinear Problems

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Nonlinear FEA with Abaqus/Standard

Lecture 2

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L2.2

Overview

- Equilibrium Revisited
- Nonlinear Solution Methods
- Abaqus/Standard Convergence Criteria: An Overview
- Automatic Time Incrementation
- Contact Convergence

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Obtaining a Converged Solution with Abaqus

Solution of Unstable Problems

Lecture 3

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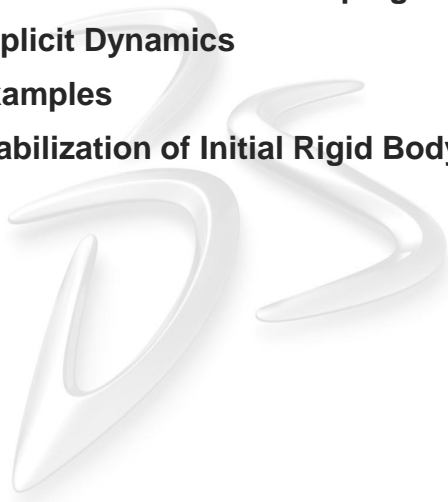
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L3.2

Overview

- Unstable Quasi-Static Problems
- Globally Unstable Problems
- Stabilization of Local Instabilities
- Symptoms of Local Instability
- Automated Viscous Damping
- Implicit Dynamics
- Examples
- Stabilization of Initial Rigid Body Motion

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Why Abaqus Fails to Find a Converged Solution

Lecture 4

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Overview

- The Basic Problems
- Understanding the Warning Messages
- Helping Abaqus Find a Converged Solution

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Convergence Problems: Contact Simulations

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L5.2

Overview

- Unstable Separation of Contacting Surfaces
- Chattering Between Contact Surfaces
- Contact with Quadratic Elements
- Poorly Defined Master Surfaces
- Friction

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Convergence Problems: Element Behavior

Lecture 6

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Overview

- Hourglassing in Reduced-Integration Elements
- Checkerboarding
- Ill-Conditioning

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Convergence Problems: Constraints and Loading

Lecture 7

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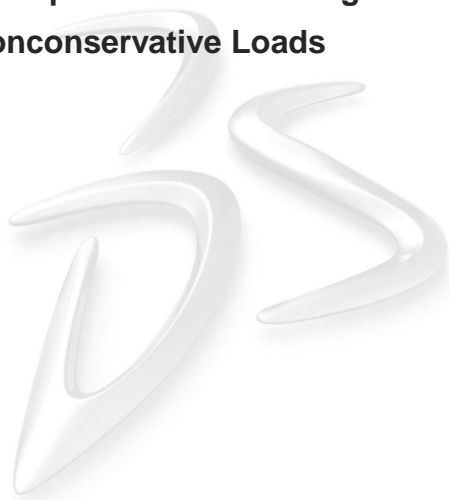
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L7.2

Overview

- General Remarks
- Overconstraints Detected during Model Processing
- Overconstraints Detected during Analysis Execution
- Controlling the Overconstraint Checks
- Example: Four-bar Linkage
- Nonconservative Loads

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Convergence Problems: Materials

Lecture 8

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L8.2

Overview

- Large Strains and Linear Elasticity
- Unstable Material Behavior
- Example: Plate with a Hole
- Unsymmetric Material Stiffness
- Example: Concrete Slump Test

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