

Buckling, Postbuckling, and Collapse Analysis with Abaqus

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Day 1

- **Lecture 1** **Basic Concepts and Overview**
- **Workshop 1** **Buckling and Postbuckling Analyses
of a Crane Structure**
- **Lecture 2** **Finite Element Formulation**
- **Lecture 3** **Finite Element Implementation in Abaqus**
- **Lecture 4** **Eigenvalue Buckling Analysis**
- **Workshop 2** **Eigenvalue Buckling of a Ring
Subjected to External Pressure**
- **Workshop 3** **Elastic Buckling of Ring-Supported Cylindrical Shell
under Hydrostatic Pressure**

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Day 2

- **Lecture 5** **Regular and Damped Static Solution Procedures for Postbuckling Analyses**
- **Workshop 4** **Nonlinear Buckling of Ring-Supported Cylindrical Shell under Hydrostatic Pressure**
- **Workshop 5** **Static Buckling Analysis of a Circular Arch**
- **Lecture 6** **Modified Riks Static Solution Procedure for Postbuckling Analyses**
- **Workshop 5** **Static Buckling Analysis of a Circular Arch (continued)**
- **Lecture 7** **Dynamic Analysis Solution Procedures for Postbuckling Analyses**
- **Workshop 5** **Static Buckling Analysis of a Circular Arch (continued)**
- **Workshop 6** **Tube Crush Dynamic Analysis**
- **Lecture 8** **Putting It All Together...**
- **Workshop 7** **Capstone Workshop: Lee's Frame Buckling Problem**
- **Workshop 8** **Buckling and Postbuckling Analyses of a Stiffened Panel**



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Lecture 1	5/11	Updated for 6.11
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Lecture 4	5/11	Updated for 6.11
Lecture 5	5/11	Updated for 6.11
Lecture 6	5/11	Updated for 6.11
Lecture 7	5/11	Updated for 6.11
Lecture 8	5/11	Updated for 6.11
Workshop 1	5/11	Updated for 6.11
Workshop 2	5/11	Updated for 6.11
Workshop 3	5/11	Updated for 6.11
Workshop 4	5/11	Updated for 6.11
Workshop 5	5/11	Updated for 6.11
Workshop 6	5/11	Updated for 6.11
Workshop 7	5/11	Updated for 6.11
Workshop 8	5/11	Updated for 6.11

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Basic Concepts and Overview

Lecture 1

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L1.2

Overview

- Introduction
- Solution Techniques
- Analysis Selection Guide
- Example: Lee's Frame Buckling Problem
- Summary
- Workshop

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Finite Element Formulation

Lecture 2

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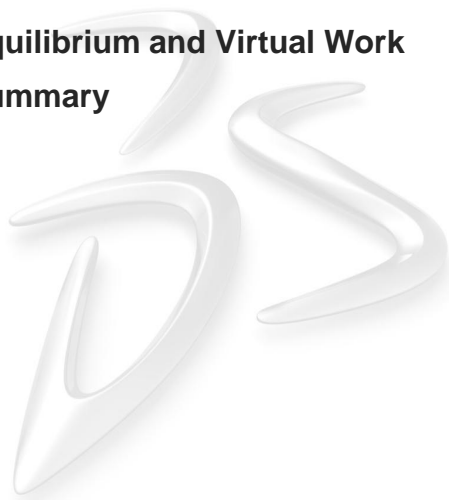
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L2.2

Introduction

- **Basic Equations in Finite Element Analysis**
- **Linearization**
- **Nonlinear Problems in Mechanics**
- **Geometrically Nonlinear Analysis**
- **Stress and Strain Measures**
- **Equilibrium and Virtual Work**
- **Summary**

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FE Implementation in Abaqus

Lecture 3

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L3.2

Outline

- Abaqus Definitions
- General and Perturbation Procedures
- Including Nonlinear Effects in an Abaqus Simulation
- General Procedure Solution Techniques
- Nonlinear Analysis Using Implicit Methods
- Solution Control
- Diagnostics
- Riks Method
- Automatic Time Incrementation
- General Procedure Implicit Equation Solvers
- Nonlinear Analysis Using Explicit Methods
- Perturbation Procedure Solution Techniques
- Introducing Imperfections for Postbuckling Simulations
- Summary

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Eigenvalue Buckling Analysis

Lecture 4

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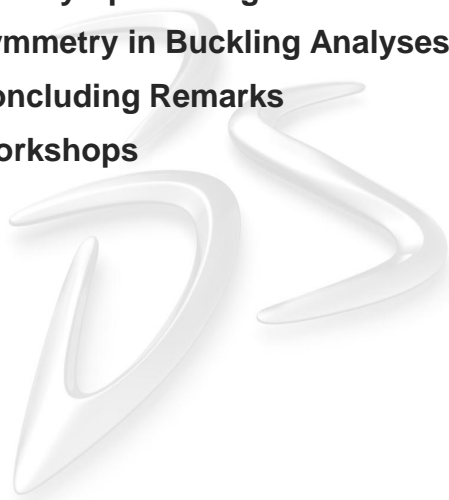
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L4.2

Overview

- Introduction
- Eigenvalue Problem Formulation
- Abaqus Usage
- Example: Buckling of a Thin Cylindrical Shell
- Closely Spaced Eigenvalues
- Symmetry in Buckling Analyses
- Concluding Remarks
- Workshops

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Regular and Damped Static Solution Procedures for Postbuckling Analyses

Lecture 5

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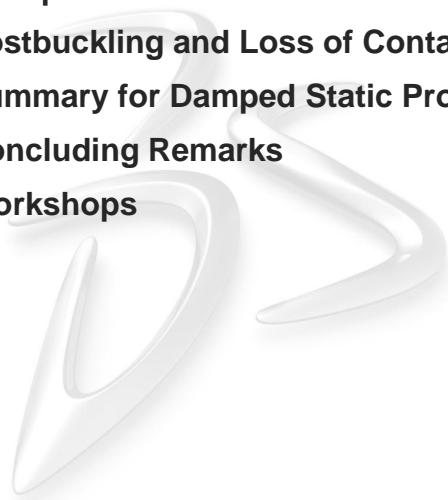
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L5.2

Overview

- Motivation
- Regular Static Procedure
- Motivation for Damped Static Procedures
- Automatic Stabilization
- Dashpots
- Postbuckling and Loss of Contact
- Summary for Damped Static Procedures
- Concluding Remarks
- Workshops

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Modified Riks Static Solution Procedure for Postbuckling Analyses

Lecture 6

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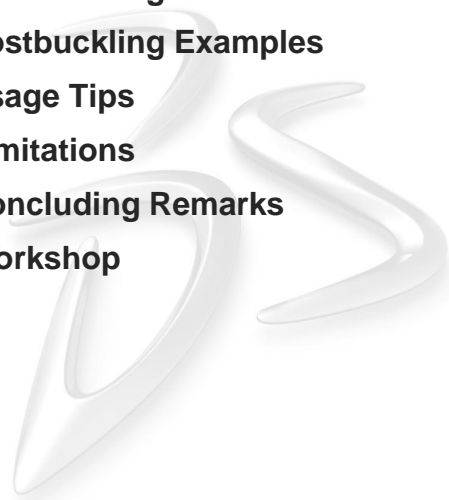
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L6.2

Overview

- Introduction
- Abaqus Implementation
- Abaqus Usage
- Snap-Through Problems
- Postbuckling Problems
- Postbuckling Examples
- Usage Tips
- Limitations
- Concluding Remarks
- Workshop

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Dynamic Analysis Solution Procedures for Postbuckling Analyses

Lecture 7

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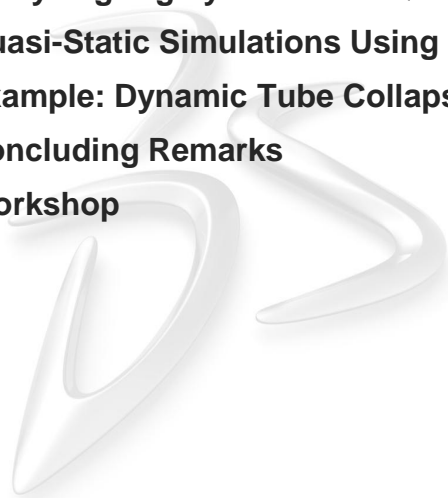
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L7.2

Overview

- What Makes a Problem Dynamic?
- Equations for Dynamic Problems
- Nonlinear Dynamics
- Workshop
- Analyzing Highly Nonlinear Quasi-Static Problems
- Quasi-Static Simulations Using Explicit Dynamics
- Example: Dynamic Tube Collapse
- Concluding Remarks
- Workshop

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Putting It All Together...

Lecture 8

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L8.2

Overview

- Buckling Analysis Selection Guide Revisited
- Weatherseal Example
- References for Further Study
- Workshops

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