

Modeling Fracture and Failure with Abaqus

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Day 1

- **Lecture 1** **Basic Concepts of Fracture Mechanics**
- **Lecture 2** **Modeling Cracks**
- **Lecture 3** **Fracture Analysis**
- **Workshop 1** **Crack in a Three-point Bend Specimen**
- **Workshop 2** **Crack in a Helicopter Airframe Component**

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Day 2

- **Lecture 4** **Material Failure and Wear**
- **Lecture 5** **Element-based Cohesive Behavior**
- **Workshop 3** **Crack Growth in a Three-point Bend Specimen using Cohesive Connections (Part 1)**
- **Workshop 4** **Crack Growth in a Helicopter Airframe Component using Cohesive Elements**
- **Lecture 6** **Surface-based Cohesive Behavior**
- **Workshop 3** **Crack Growth in a Three-point Bend Specimen using Cohesive Connections (Part 2)**



Day 3

- **Lecture 7** **Virtual Crack Closure Technology (VCCT)**
- **Workshop 5** **Crack Growth in a Three-point Bend Specimen using VCCT**
- **Lecture 8** **Low-cycle Fatigue**
- **Lecture 9** **Mesh-independent Fracture Modeling (XFEM)**
- **Workshop 6** **Crack Growth in a Three-point Bend Specimen using XFEM**
- **Workshop 7** **Modeling Crack Propagation in a Pressure Vessel with Abaqus using XFEM**



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Lecture 1	5/11	Updated for 6.11
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Lecture 7	5/11	Updated for 6.11
Lecture 8	5/11	Updated for 6.11
Lecture 9	5/11	Updated for 6.11
Workshop 1	5/11	Updated for 6.11
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Workshop 4	5/11	Updated for 6.11
Workshop 5	5/11	Updated for 6.11
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Workshop 7	5/11	Updated for 6.11



Basic Concepts of Fracture Mechanics

Lecture 1

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L1.2

Overview

- Introduction
- Fracture Mechanisms
- Linear Elastic Fracture Mechanics
- Small Scale Yielding
- Energy Considerations
- The J-integral
- Nonlinear Fracture Mechanics
- Mixed-Mode Fracture
- Interfacial Fracture
- Creep Fracture
- Fatigue

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Modeling Cracks

Lecture 2

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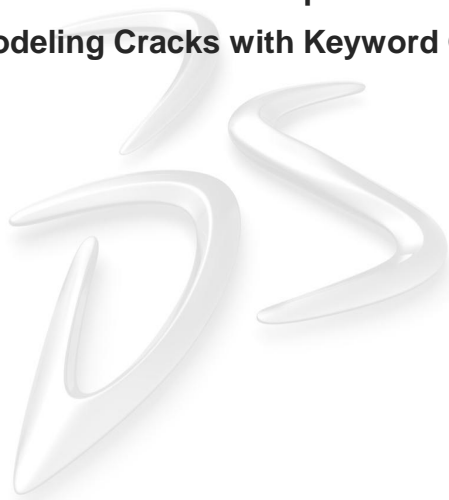


L2.2

Overview

- Crack Modeling Overview
- Modeling Sharp Cracks in Two Dimensions
- Modeling Sharp Cracks in Three Dimensions
- Finite-Strain Analysis of Crack Tips
- Limitations Of 3D Swept Meshing For Fracture
- Modeling Cracks with Keyword Options

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Fracture Analysis

Lecture 3

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L3.2

Overview

- Calculation of Contour Integrals
- Examples
- Nodal Normals in Contour Integral Calculations
- J-Integrals at Multiple Crack Tips
- Through Cracks in Shells
- Mixed-Mode Fracture
- Material Discontinuities
- Numerical Calculations with Elastic-Plastic Materials
- Residual Stresses
- Workshop 1
- Workshop 2

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Material Failure and Wear

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Overview

- Progressive Damage and Failure
- Damage Initiation for Ductile Metals
- Damage Evolution
- Element Removal
- Damage in Fiber-Reinforced Composite Materials
- Failure in Fasteners
- Material Wear and Ablation

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Element-based Cohesive Behavior

Lecture 5

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Overview

- Introduction
- Element Technology
- Constitutive Response
- Viscous Regularization
- Modeling Techniques
- Examples
- Workshop 3 (Part 1)
- Workshop 4

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Surface-based Cohesive Behavior

Lecture 6

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L6.2

Overview

- Surface-based Cohesive Behavior
- Element- vs. Surface-based Cohesive Behavior
- Workshop 3 (Part 2)

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Virtual Crack Closure Technique (VCCT)

Lecture 7

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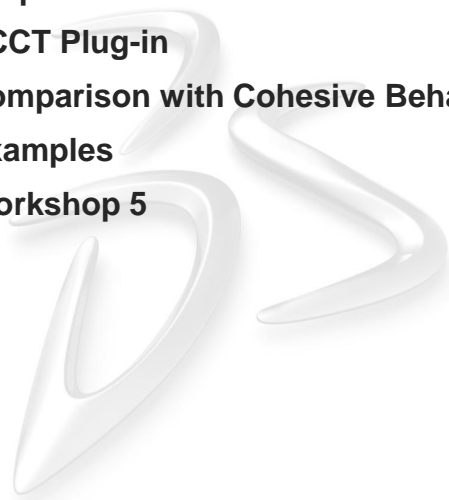
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L7.2

Overview

- Introduction
- VCCT Criterion
- Example using Abaqus/Standard
- Example using Abaqus/Explicit
- Output
- VCCT Plug-in
- Comparison with Cohesive Behavior
- Examples
- Workshop 5

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Low-cycle Fatigue

Lecture 8

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Overview

- Introduction
- Low-cycle Fatigue in Bulk Materials
- Low-cycle Fatigue at Material Interfaces

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Mesh-independent Fracture Modeling (XFEM)

Lecture 9

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L9.2

Overview

- Introduction
- Basic XFEM Concepts
- Damage Modeling
- Creating an XFEM Fracture Model
- Example 1 – Crack Initiation and Propagation using Cohesive Damage
- Example 2 – Crack Initiation and Propagation using LEFM
- Example 3 – Low Cycle Fatigue
- Example 4 – Propagation of an Existing Crack
- Example 5 – Delamination and Through-thickness Crack Propagation
- Example 6 – Contour Integrals
- Modeling Tips
- Current Limitations
- Workshops
- References

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