

Crashworthiness Analysis with Abaqus

© DASSAULT SYSTEMES



Day 1

- **Lecture 1** Introduction and Motivation
- **Lecture 2** Setting up an Abaqus Model
- **Lecture 3** Explicit Dynamics in Abaqus
- **Lecture 4** Contact Modeling
 - **Workshop 1** Impact of a Dodge Caravan Bumper against a Rigid Barrier
- **Lecture 5** Element Technology

© DASSAULT SYSTEMES



Day 2

- **Lecture 6** **Constraints and Connections**
 - **Workshop 2** **Crash Analysis of a Rail**
 - **Workshop 3** **Door Pole-Intrusion Test**
 - **Workshop 4** **Iltis All-Terrain Vehicle Curb Strike**
- **Lecture 7** **Material Modeling**
- **Lecture 8** **Progressive Damage and Failure**

Important note: Submit the global model for Workshop 7 prior to completing work on this day.

Day 3

- **Lecture 9** **Occupant Safety**
 - **Workshop 5** **Deployment of a Single Chamber Airbag**
 - **Workshop 6** **Seatbelt Safety System**
- **Lecture 10** **Advanced Analysis Techniques**
 - **Workshop 7** **Side Impact Analysis of a Pickup Truck using Submodeling Technique**
- **Lecture 11** **Output and Postprocessing**
 - **Workshop 8** **Curved Beam Analysis**
- **Lecture 12** **Translators**

Additional Material

- **Appendix 1 Output Filtering***

- * This appendix includes a detailed discussion of output filtering for general applications; however, the information is relevant for crash analysis.

- **Appendix 2 Abaqus/Standard to Abaqus/Explicit Co-simulation**

- **Workshop 9 Beam Impact Co-simulation**

© DASSAULT SYSTEMES

Crashworthiness Analysis with Abaqus



Legal Notices

The Abaqus Software described in this documentation is available only under license from Dassault Systèmes and its subsidiary and may be used or reproduced only in accordance with the terms of such license.

This documentation and the software described in this documentation are subject to change without prior notice.

Dassault Systèmes and its subsidiaries shall not be responsible for the consequences of any errors or omissions that may appear in this documentation.

No part of this documentation may be reproduced or distributed in any form without prior written permission of Dassault Systèmes or its subsidiary.

© Dassault Systèmes, 2009.

Printed in the United States of America

Abaqus, the 3DS logo, SIMULIA and CATIA are trademarks or registered trademarks of Dassault Systèmes or its subsidiaries in the US and/or other countries.

Other company, product, and service names may be trademarks or service marks of their respective owners. For additional information concerning trademarks, copyrights, and licenses, see the Legal Notices in the Abaqus 6.9-EF Release Notes and the notices at: http://www.simulia.com/products/products_legal.html.

© DASSAULT SYSTEMES

Crashworthiness Analysis with Abaqus



Revision Status

Lecture 1	11/09	Updated for 6.9-EF
Lecture 2	11/09	Updated for 6.9-EF
Lecture 3	11/09	Updated for 6.9-EF
Lecture 4	11/09	Updated for 6.9-EF
Lecture 5	11/09	Updated for 6.9-EF
Lecture 6	11/09	Updated for 6.9-EF
Lecture 7	11/09	Updated for 6.9-EF
Lecture 8	11/09	Updated for 6.9-EF
Lecture 9	11/09	Updated for 6.9-EF
Lecture 10	11/09	Updated for 6.9-EF
Lecture 11	11/09	Updated for 6.9-EF
Lecture 12	11/09	Updated for 6.9-EF

Workshop 1	11/09	Updated for 6.9-EF
Workshop 2	11/09	Updated for 6.9-EF
Workshop 3	11/09	Updated for 6.9-EF
Workshop 4	11/09	Updated for 6.9-EF
Workshop 5	11/09	Updated for 6.9-EF
Workshop 7	11/09	Updated for 6.9-EF
Workshop 8	11/09	Updated for 6.9-EF
Workshop 9	11/09	Updated for 6.9-EF
Appendix 1	11/09	Updated for 6.9-EF
Appendix 2	11/09	Updated for 6.9-EF

Introduction and Motivation

Lecture 1

© DASSAULT SYSTEMES



L1.2

Overview

- Background
- Selected Crashworthiness Applications
- Abaqus Crashworthiness Functionality

© DASSAULT SYSTEMES



Setting up an Abaqus analysis

Lecture 2

© DASSAULT SYSTEMES



L2.2

Overview

- Components of an Abaqus Model
- Details of an Abaqus Input File
- Encrypting Abaqus Input Data
- Abaqus Input Conventions
- Abaqus Output
- Loads and Boundary Conditions
- Initial Conditions
- Example: Tube Crush Model
- Documentation
- Parallel Execution

© DASSAULT SYSTEMES



Explicit Dynamics in Abaqus

Lecture 3

© DASSAULT SYSTEMES



L3.2

Overview

- What is Explicit Dynamics?
- Overview of Abaqus/Explicit
- Stable Time Increment
- Mass Scaling
- Selective Subcycling

© DASSAULT SYSTEMES



Contact Modeling

Lecture 4

© DASSAULT SYSTEMES

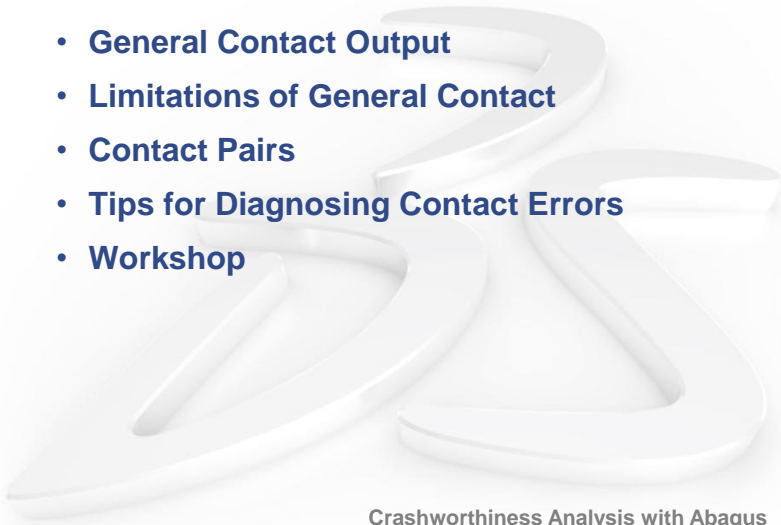


L4.2

Overview

- Contact in Abaqus/Explicit
- Overview of General Contact
- Basic Features of General Contact
- Keyword Interface
- Additional Features of General Contact
- General Contact Output
- Limitations of General Contact
- Contact Pairs
- Tips for Diagnosing Contact Errors
- Workshop

© DASSAULT SYSTEMES



Element Technology

Lecture 5

© DASSAULT SYSTEMES

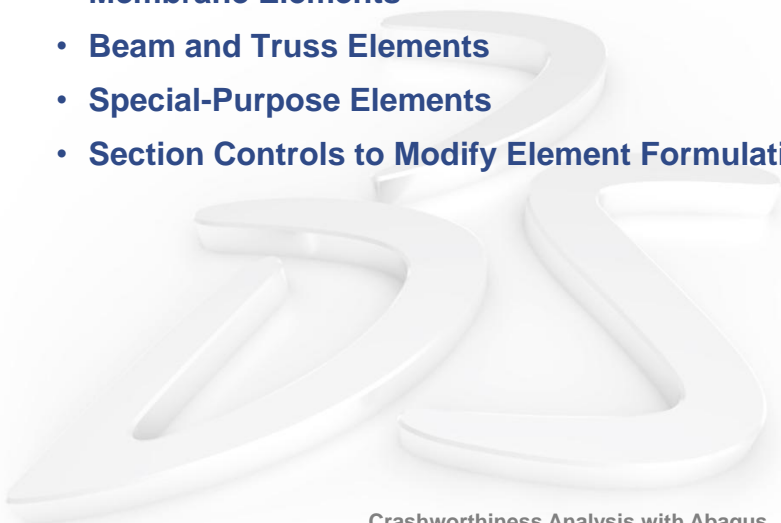


L5.2

Overview

- Introduction
- Designing the Crash Mesh
- Solid Elements
- Shell Elements
- Membrane Elements
- Beam and Truss Elements
- Special-Purpose Elements
- Section Controls to Modify Element Formulation

© DASSAULT SYSTEMES



Constraints and Connections

Lecture 6

© DASSAULT SYSTEMES



L6.2

Overview

- Introduction
- Multi-Point Constraints
- Rigid Bodies
- Surface-Based Coupling Constraints
- Connector Elements
- Surface-Based Ties
- Mesh-Independent Fasteners
- Cohesive Connections
- Tips for Diagnosing Constraint and Connection Errors
- Workshops

© DASSAULT SYSTEMES



Material Modeling

Lecture 7

© DASSAULT SYSTEMES



L7.2

Overview

- Introduction
- Material Data Definition
- Metal Plasticity
- Hyperelastic Solid Rubbers
- Time-Domain Viscoelasticity
- Hyperfoam
- Crushable Foams
- Low-Density Foams
- Honeycomb Material
- Fabric Modeling
- Other Material Properties and Models

© DASSAULT SYSTEMES



Progressive Damage and Failure

Lecture 8

© DASSAULT SYSTEMES



L8.2

Overview

- Progressive Damage and Failure

© DASSAULT SYSTEMES



Occupant Safety

Lecture 9

© DASSAULT SYSTEMES



L9.2

Overview

- Headforms
- Dummies
- Airbags
- Seatbelts
- Workshops

© DASSAULT SYSTEMES



Advanced Analysis Techniques

Lecture 10

© DASSAULT SYSTEMES



L10.2

Overview

- Static Initialization and Import
- Submodeling
- Incorporating Manufacturing Effects
- Quasi-Static Analysis
- Tire Modeling and Analysis
- Restart
- Workshop

© DASSAULT SYSTEMES



Output and Postprocessing

Lecture 11

© DASSAULT SYSTEMES



L11.2

Overview

- Output
- Results Visualization
- Workshop

© DASSAULT SYSTEMES



Translators

Lecture 12

© DASSAULT SYSTEMES



L12.2

Overview

- Translator from PAM-CRASH to Abaqus
- Translator from RADIOSS to Abaqus

© DASSAULT SYSTEMES



Output Filtering

Appendix 1

© DASSAULT SYSTEMES



A1.2

Overview

- What is aliasing?
- Preventing aliasing
- Abaqus/Viewer postprocessing filters
- Filter options
- Filter distortions
- References

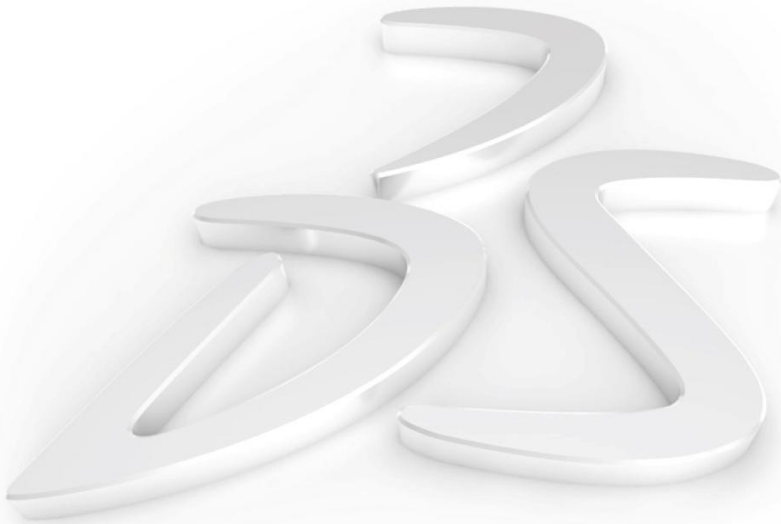
© DASSAULT SYSTEMES



Abaqus/Standard to Abaqus/Explicit Co-simulation

Appendix 2

© DASSAULT SYSTEMES



A2.2

Overview

- Introduction
- Examples
- Co-simulation modeling
- Postprocessing
- Substructuring
- Technology notes

© DASSAULT SYSTEMES

