

Appendix B

Appendix A

Examples

Theory

Theories

What is CAD/CAM/CAE?

Abaqus window introduction

Introduction to different modules in Abaqus

Units in Abaqus



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**Workshop  
Tips**

One simple simulation from A-Z step by step

How to define isotropic elastic material

How to use Truss element and related tips

Using SI units

How to apply concentrated Force

How to define static analysis and time concept in this step

Visualize the primary variables like stress, strain and etc.

Get report for stress, strain, reaction forces and deflections

How to scale results

How to see node and Element numbers

How to see undeformed and deformed results together

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Theories

What is FEM?

Familiarity with Discretization Concept

Analytical solutions vs FEM

How a FEM analysis is done?

How to discretize the domain?

How to calculate nodal solution?

Where FEM is used

General Usage of FEM

An example of structural analysis

Degree of freedom

Convergence Study(Validation)

Plane stress and plane strain conditions



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Tips**

Tips to start all simulations

Create points and models in 3D space

What is model tree and how to use it?

How to use Probe value option to watch some results?

How to simulate with plane stress element and usage conditions?

What are simplify conditions to model one part of model ?

How to apply uniform tension?

Using remeshing rule option to check convergency?

How to get result in specific path?



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Theories

Introduction to ABAQUS Element Library

Characterizing elements

Introduction to different Types of Elements

Different Types of degree of freedoms

Element and node numbering

Element formulation

Integration Points

Beam Element and usage conditions

Types of Beams: Euler-Bernoulli

Types of Beams: Timoshenko

Beam element library of Abaqus



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Simulation with beam Element

How to specify beam orientation to watch some results

How create profile for beam section

How to see parts in different colors

How to plot moment and force with in beam model

Settings for plot(Font/Color/multiple plot/Legend ant etc.)

How to model beam with 3D element

How to define Dynamic Analysis

How to get html report from simulation steps

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**Theories**

Monitor difference in Implicit and Explicit

Points to Choose between Explicit & Implicit

Element library/Analysis procedures/Material models/  
Contact formulation/Solution technique/  
Disk space & memory in Two Solvers

Quasi static vs static vs dynamic

Story for Quasi static, static ,and dynamic

Mesh refinement for two solvers

How Abaqus solve truss problem step by step with  
implicit solver

How Abaqus solve truss problem step by step with  
explicit solver

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Appendix B

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How to model explosion via pressure method

How to define tabular amplitude

Monitor primary variable during time

How to define pressure

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Where Explicit Analysis is used

Stability definition for Explicit Method

stability limit calculation

Example for stability limit calculation

Speeding up a Quasi static Explicit Analysis

Load Rate Scaling

Smooth Amplitude Curves

Mass Scaling

Mass VS. Load Rate Scaling

Energy Balance

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Using load rate scaling to increase time of computation

Using Mass scaling to increase time of computation

Checking proper load rate scaling/mass scaling to get right result

How to define shell element

How to use offset in shell elements

How to use spline to create geometry

How to see parts in different colors

How to defined combined hardening for plasticity behavior

How to render shell thickness in viewport

How to define smooth amplitude

What is the meaning of S4R?

What is the meaning of increment, CPU time and etc. in monitor?

How to plot internal energy(ALLIE), and total energy (ETOTAL)

How to show and compare of different contours simultaneously?


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Theories

Procedures Types in ABAQUS

General and Linear Procedures

Linear Perturbation

Frequency Analysis

Natural Frequencies and Mode Shapes

Simple Example for Natural Frequencies :Mass-spring system

Natural Freq. in Real Structures

Eigenvalue Extraction Methods(Natural Frequencies)

Buckling Analysis

Stiff Structures

Buckling of Euler column

How FEM software solve Eigenvalue buckling problem

Eigenvalue Extraction Method(Buckling)

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Finding optimum time period for quasi static problem with natural frequency problem

Viewing frequency mode shapes and natural frequency calculation

Viewing buckling mode shapes and critical load

Frequency analysis on a preloaded structure.

Moment of inertia calculation

Different ways to take a picture from viewport

How to see node and element numbers is different modulus

How to see thickness direction in shell model



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How to define traction-separation elastic behavior for cohesive elements

What is the procedure to model cohesive via element based method

How to define damage initiation based on QUADS damage

How to apply initial thickness settings

How to assemble cohesive parts and other parts

How to define outputs for cohesive elements

Settings in different module for cohesive behavior definition

Cohesive element settings in mesh module

How to see the result of damage initiation for cohesive materials

Plot damage initiation criterion vs time for critical element

Plot damage parameter vs time for critical element

Plot stress vs strain for critical element

**Workshop  
Tips**

Settings to solve convergency problem in implicit solver

Settings to remove element in visualization module

Suitable method to simulate cohesive behavior between bricks and masonry wall

How to define Concrete damage plasticity behavior(CDP)

Using mass scale to increase simulation speed

Output settings for cohesive surface behavior

Settings to define cohesive behavior via surface-based method in explicit solver

How to apply pressure when equivalent force is known

Settings to define cohesive behavior via surface-based method in implicit solver

Plot force vs displacement in debonding of DCB(double cantilever beam)



**Theories**

Where can we use cohesive behavior?

Different methods to simulate cohesive behavior.

Limitations to simulate cohesive behavior in different methods

Traction-separation formula for cohesive behavior

Damage initiation criteria for cohesive in traction-separation law

Criteria of progressive damage behavior in cohesive materials

Usage Limitation of element-based cohesive modeling

Element based method for cohesive material in continuum element

Element based method for cohesive material in traction-separation law

Settings for initial thickness of cohesive with traction-separation law

Different types of cohesive elements

Outputs for cohesive element

Viscous regulation for cohesive element

Usage limitation of surface-based method for cohesive modeling

**Element-based method vs surface-based method**



Theories

Ductile damage initiation for metals

Ductile damage evolution for metals

Introduction to Hashin damage initiation for composites

Progressive damage for Composites

Concrete damage plasticity in tension and how to apply it

Concrete damage plasticity in compression and how to apply it

Required outputs for CDP



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Tips**

How to define composite materials in lamina type

How to define Hashin damage initiation for composites

How to define Hashin damage evolution for composites

How to define isotropic hardening plasticity for metals

How to define damage

How to create section profile for beam

How to define customized coordinate system

How to pattern in assembly module

What is the settings for outputs of different material types (Concretes, metals, composites)

How to embed beam in concrete box

How to view result of concrete damage /ductile damage/Hashin damage

Plot Force vs displacement in FRP



**Theories**

What is the definition of damage and its applications?

What is the difference between microscopic and macroscopic damage in composite materials?

What are the various theories to simulate initiation damage in composite material structures?

What is the available theory to simulate progressive damage of composite material structures?

What are the elements' limitations to simulate progressive damage of composite material structures?

What is Fully coupled thermal-stress analysis and how to use it?

Which ways are available to add criterion to simulate composite damage?

How to use composite damage results as an initiation condition of other simulation?



**Workshop  
Tips**

Defining Elastic property by engineering constant selection

Defining failure criterion parameters for HASHIN

Setting in field output to get required results

View results in layers for fiber and matrix separately

Recommended package to learn Composite damage simulation deeply

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**Theories**

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Theories

- What is yield surface?
- What is von mises yield surface?
- What is work hardening?
- What is isotropic hardening?
- What is linear kinematic hardening?
- What is Johnson-cook hardening?
- What is nonlinear-isotropic/kinematic (combined) hardening?
- What is Baushinger effect?
- What is cyclic hardening with plastic shakedown?
- What is ratcheting?
- What is relaxation of the mean stress?
- How to plot hysteresis curve?

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**Workshop  
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How to create complete models including different parts?

How to assemble parts of complex models?

How to define kinematic hardening in Abaqus?

How to solve convergency problem in implicit solver via settings in step module?

Required outputs to get hysteresis curve

How to apply earthquake load history?

How to plot hysteresis curve?

How to extract result of Abaqus to excel?

How to define combined hardening in Abaqus?

How to use dynamic implicit solver and its settings

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