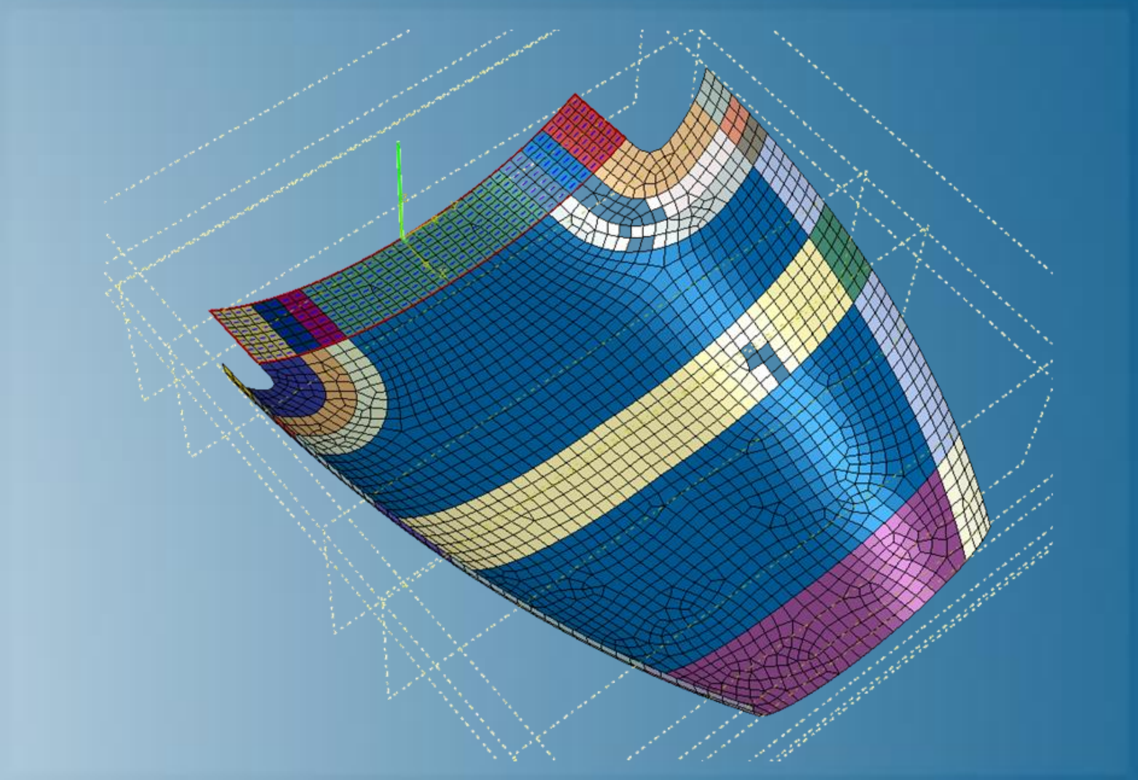
DASSAULT SYSTEMES

Composites Modeler for Abaqus/CAE

Abaqus 2018



3DEXPERIENCE®

About this Course

Course objectives

In this course you will learn about:

- Composites Modeler for Abaqus/CAE, an add-on product to Abaqus/CAE
- How to use Composites Modeler for Abaqus/CAE to account for accurate fiber angles and ply thicknesses in Abaqus simulations to achieve unprecedented accuracy
- How to review and quickly modify your composites models to iteratively improve your designs
- How to use your composites model to generate manufacturing data thereby ensuring that the analyzed model closely corresponds to the real structure

Targeted audience

This is an advanced seminar for users who are already familiar with the native Abaqus/CAE composites modeling functionality.

Prerequisites

The Analysis of Composite Materials with Abaqus seminar is recommended as a prerequisite. At the very least, attendees should be familiar with the Abaqus/CAE composite layup functionality. Attendees should also be comfortable post-processing the results of composites simulations using Abaqus/CAE. An understanding of how composites are manufactured is also helpful.

2 days

Day 1

- Lecture 1 Ply Modeling
- Lecture 2 Draping Simulation (Part 1)
  - Workshop 1 Hemisphere
- Lecture 3 Draping Simulation (Part 2)
  - Workshop 2 Space Structure Component
  - Workshop 3 Curved Frame
- Lecture 4 Property Generation and Mapping
  - Workshop 4 Cooper Hood
  - Workshop 5 Cooper Hood Remeshing

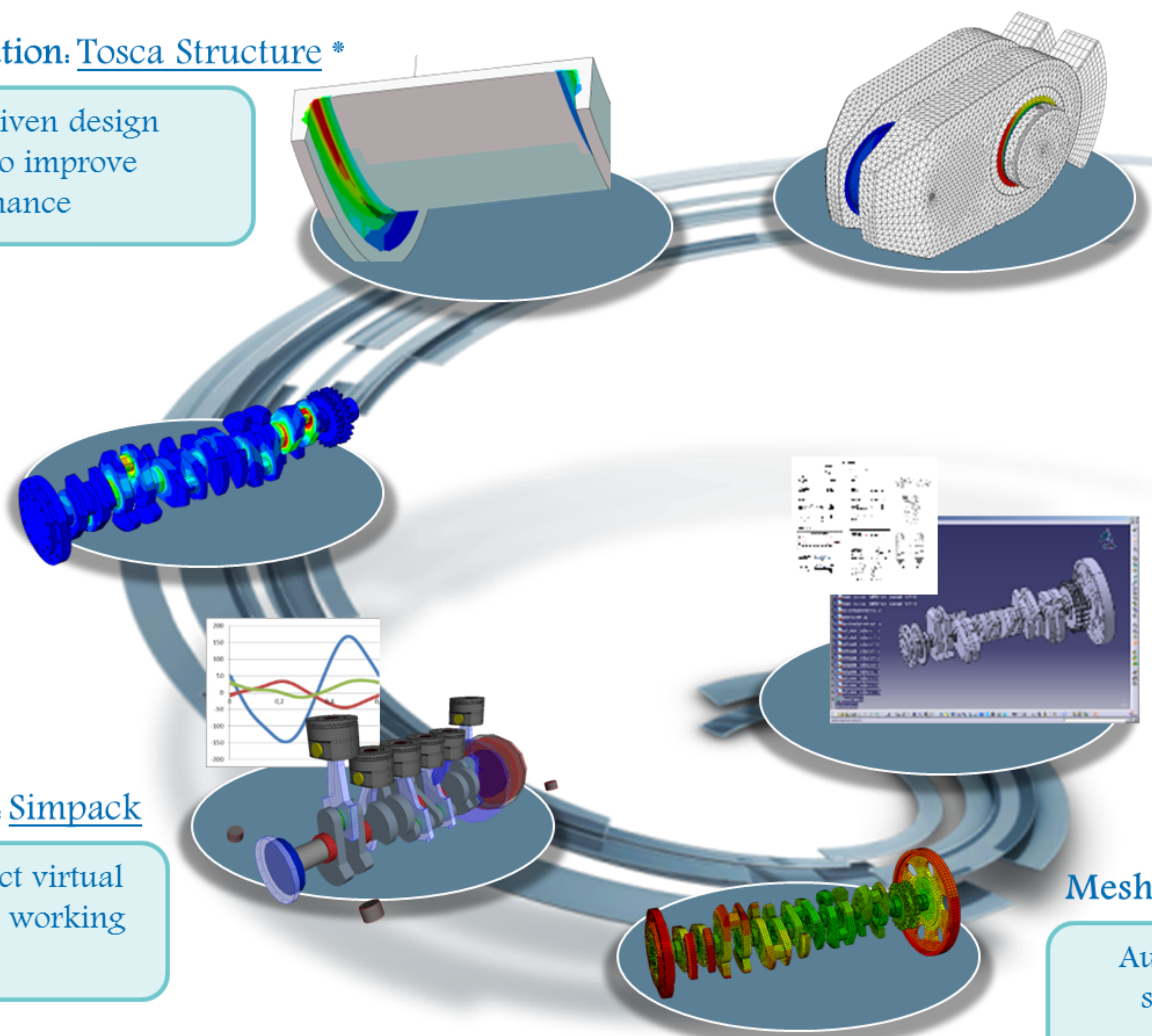
Day 2

- Lecture 5 Design Linking
  - Workshop 6 Design Linking with CATIA CPD
  - Workshop 7 Design Linking with FiberSIM
- Lecture 6 Solid Element Extrusion
  - Workshop 8 Beam with Ply Drop Offs
- Lecture 7 Fill Solid Elements
  - Workshop 9 Simple Blade
  - Workshop 10 Tapered Beam
- Lecture 8 Failure Criteria Plug-in
  - Workshop 11 Cooper Hood – Failure Criteria

SIMULIA

- SIMULIA is the Dassault Systèmes brand for Realistic Simulation solutions

- Portfolio of established, best-in-class products
  - Abaqus, Isight, Tosca, fe-safe, Simpack



Design Optimization: Tosca Structure *

Simulation-driven design refinement to improve performance

Durability Assessment: fe-safe *

Accurate life estimation to achieve certification

FEA Stress Analysis: Abaqus *

Detailed stress analysis using extracted load history from MBS

CAD Geometry: CATIA

Fully parameterized 3D geometry; FEA model generation via associative interface

Multibody Simulation: Simpack

System analysis to extract virtual load history of complete working cycle

Mesh Calibration: Isight *

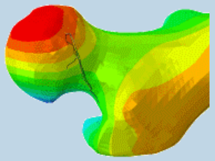
Automated mesh calibration: sufficient mesh quality for accurate results

* Included in extended licensing pool

SIMULIA's Power of the Portfolio

Abaqus

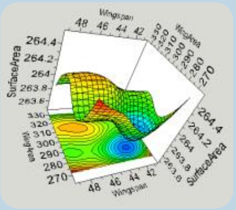
- Routine and Advanced Simulation
- Linear and Nonlinear, Static and Dynamic
- Thermal, Electrical, Acoustics
- Extended Physics through Co-simulation
- Model Preparation and Visualization



Realistic Human Simulation
High Speed Crash & Impact
Noise & Vibration

Isight

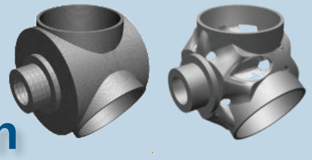
- Process Integration
- Design Optimization
- Parametric Optimization
- Six Sigma and Design of Experiments



Material Calibration
Workflow Automation
Design Exploration

Tosca

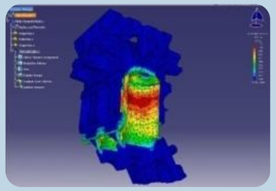
- Non-Parametric Optimization
- Structural and Fluid Flow Optimization
- Topology, Sizing, Shape, Bead Optimization



Conceptual/Detailed Design
Weight, Stiffness, Stress
Pressure Loss Reduction

fe-safe

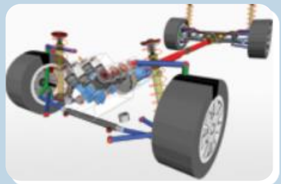
- Durability Simulation
- Low Cycle and High Cycle Fatigue
- Weld, High Temperature, Non-metallics



Safety Factors
Creep-Fatigue Interaction
Weld Fatigue

Simpack

- 3D Multibody Dynamics Simulation
- Mechanical or Mechatronic Systems
- Detailed Transient Simulation (Offline and Realtime)



Complete System Analyses
(Quasi-)Static, Dynamics, NVH
Flex Bodies, Advanced Contact

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Revision Status

Lecture 1	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 2	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 3	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 4	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 5	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 6	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 7	11/17	Updated for Abaqus 2018, CMA 2018
Lecture 8	11/17	Updated for Abaqus 2018, CMA 2018
Workshop 1	11/17	Updated for Abaqus 2018, CMA 2018
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Workshop 9	11/17	Updated for Abaqus 2018, CMA 2018
Workshop 10	11/17	Updated for Abaqus 2018, CMA 2018
Workshop 11	11/17	Updated for Abaqus 2018, CMA 2018

Lesson 1: Ply Modeling

Lesson content:

- CMA Overview
- Glossary
- Why Ply Modeling?
- Defining Materials
- Defining Plies
- Defining Offsets
- Defining the Layup
- Summary
- Comparison with Abaqus/CAE Layups
- Example: Yacht with Abaqus/CAE Layups

2 hours

Lesson 2: Draping Simulation (Part 1)

Lesson content:

- Why Draping Simulation?
- Introduction to Curved Surfaces
- Verification of Layup Properties
- Analysis Results
- Basic Simulation Controls
- Workshop Preliminaries
- Workshop 1: Hemisphere

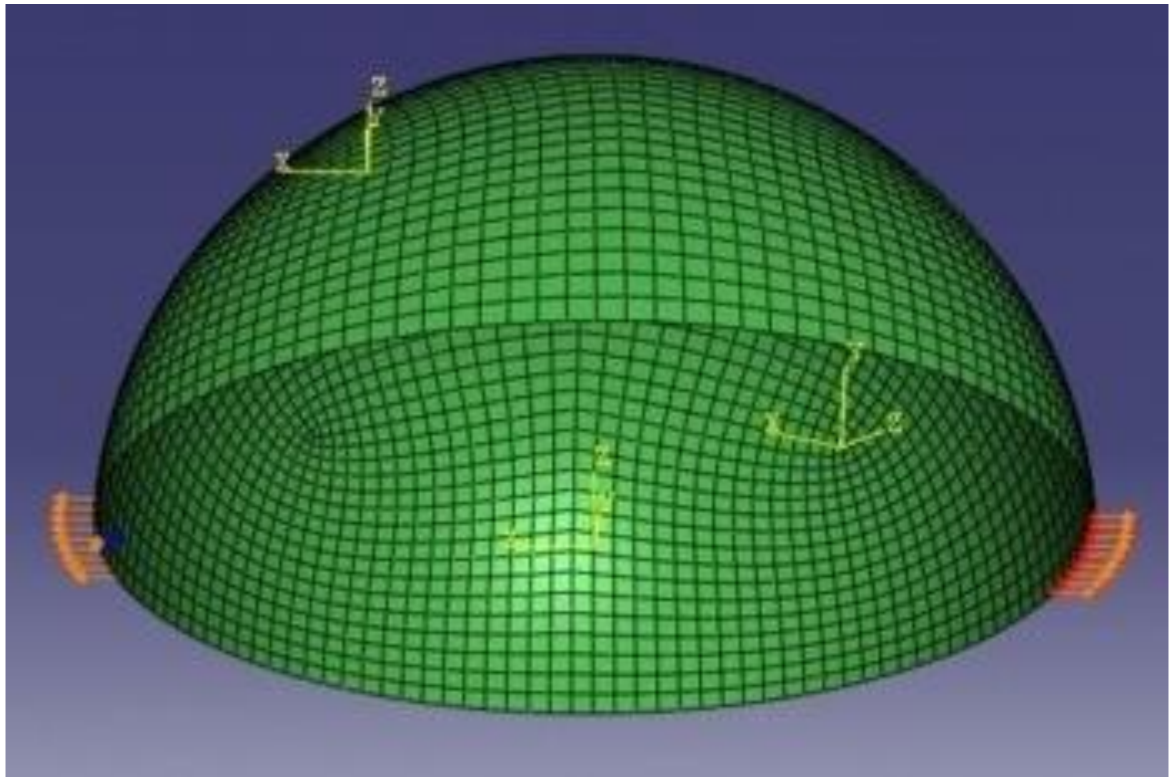
2 hours

Workshop 1: Hemisphere

1. This workshop demonstrates the basic capability of Composites Modeler.

    a. The model consists of a hemisphere of radius 100mm draped using biaxial fabric with a ply layup of [0 +45 -45 90]s

    b. Displacement loading is applied at opposite points on the rim, acting radially outwards.



30 minutes

Lesson 3: Draping Simulation (Part 2)

Lesson content:

- Why Advanced Draping Options?
- Advanced Simulation Controls
- Simulation Problems
- Projection Methods
- Workshop 2: Space Structure Component
- Workshop 3: Curved Frame

2 hours

Workshop 2: Space Structure Component

1. This workshop demonstrates the capability of Composites Modeler to simulate more advanced draping strategies.

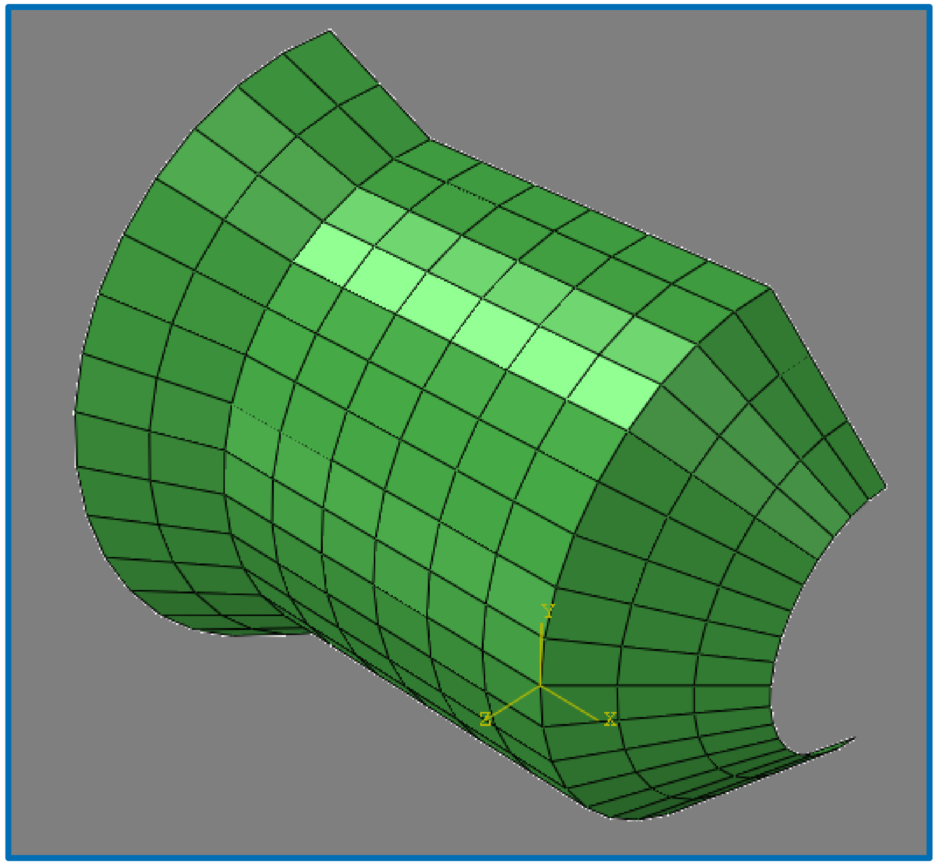
    a. Allows more accurate design and specification of the manufacturing route.

        i. Splits

        ii. Order-of-drape

    b. The example shows a component typical of space structures, containing three distinct geometric regions.

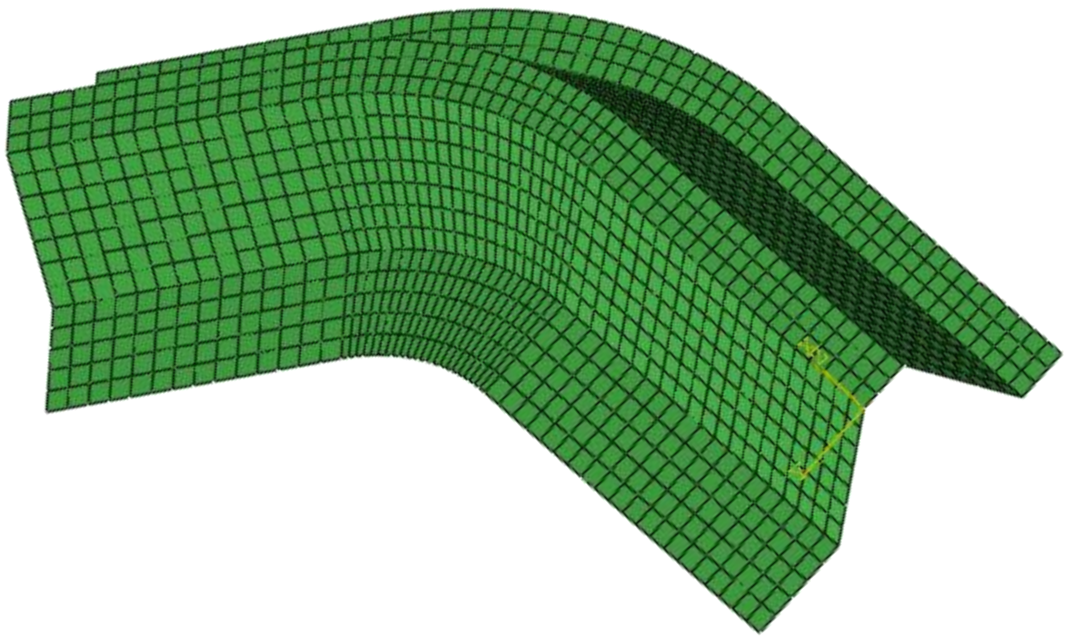
    c. Each region in isolation is developable, but when connected they become non-developable.



30 minutes

Workshop 3: Curved Frame

1. Frames are ubiquitous in the aerospace and many other industries. Curved frames need advanced draping techniques to manufacture consistently with fiber angles in the expected directions. This workshop illustrates the use of the Seed Curve technique to provide an effective constraint for this type of structure



30 minutes

Lesson 4: Property Generation and Mapping

Lesson content:

- Property Generation Overview
- Generating Sections
- CAE Layups
- Layup Mapping
- Workshop 4: Cooper Hood
- Workshop 5: Cooper Hood Remeshing

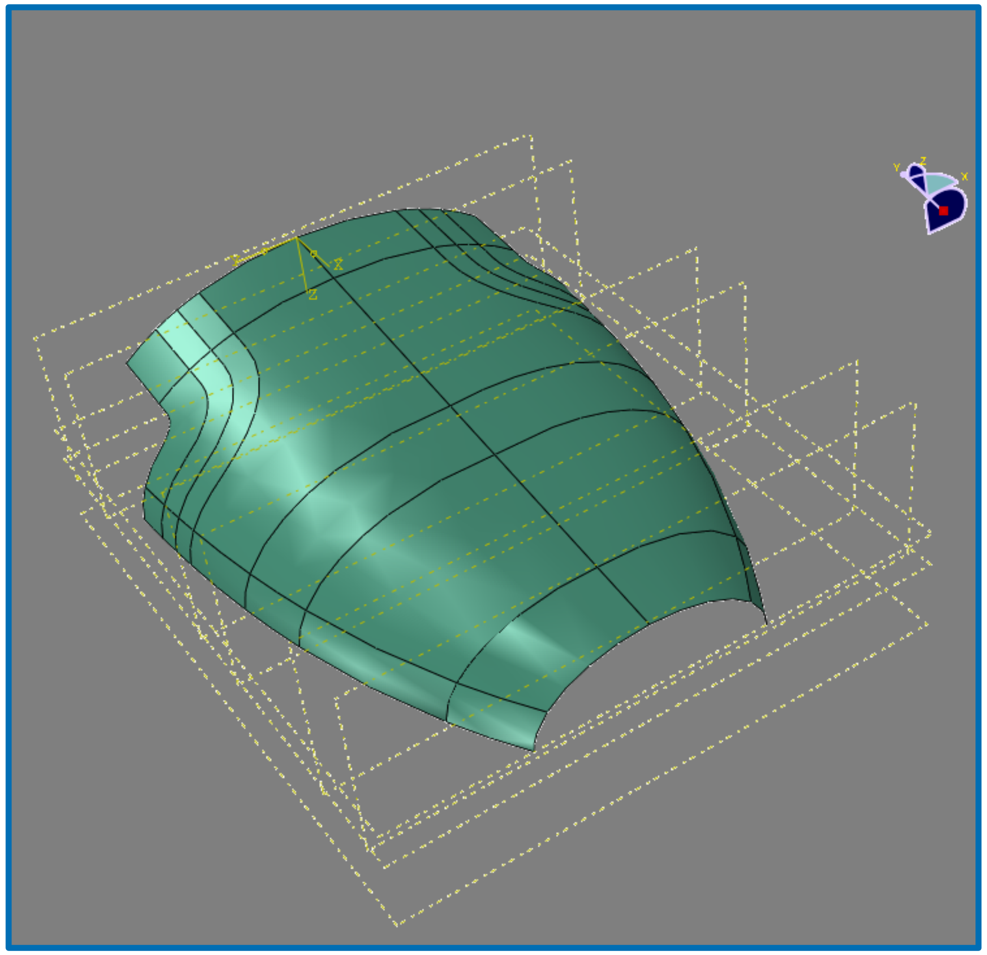
2 hours

Workshop 4: Cooper Hood

1. This model represents the front end of a 1960's era racing car. It is typical of gently doubly-curved structures produced using composites.

2. It is produced in a female mold with surface normals and rosette oriented consistently. The basic layup is defined in a CAE Layup.

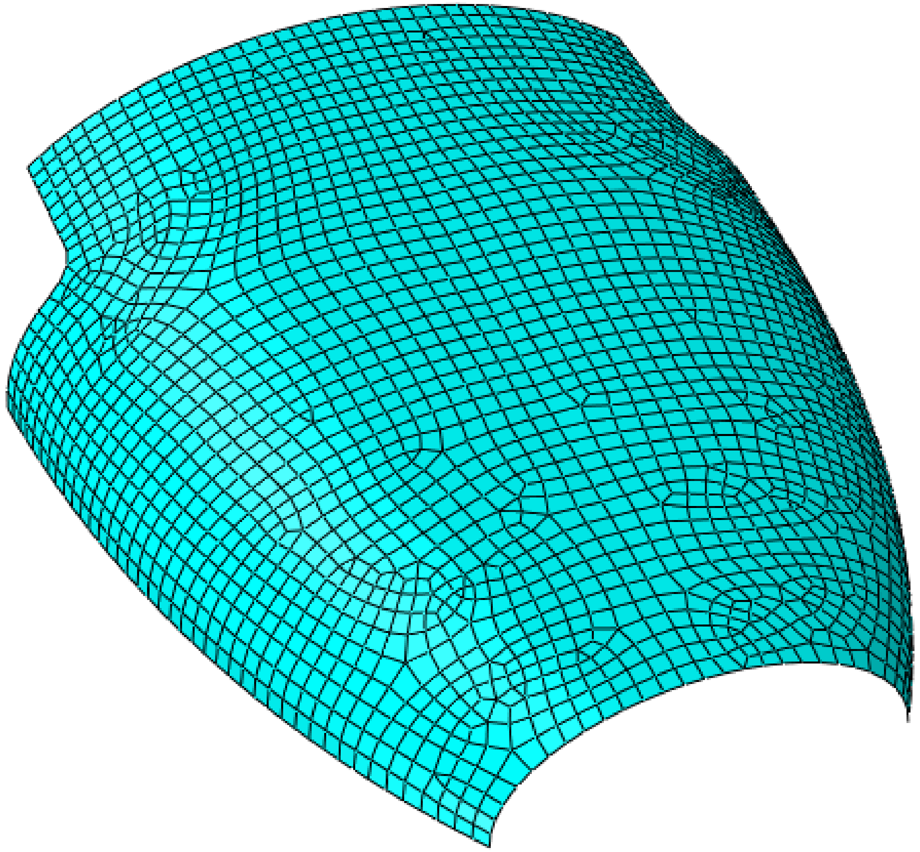
3. In this workshop you will convert the CAE Layup to a CMA Layup (.layup file) to investigate different property generation options.



30 minutes

Workshop 5: Cooper Hood Remeshed

1. In this workshop, the model will be remeshed. The Layup files based on the previous mesh will not be compatible with the new mesh. Hence, you will create a new Layup model based on the new mesh and map the old Layup model onto the new model.



30 minutes

Lesson 5: Design Linking

Lesson content:

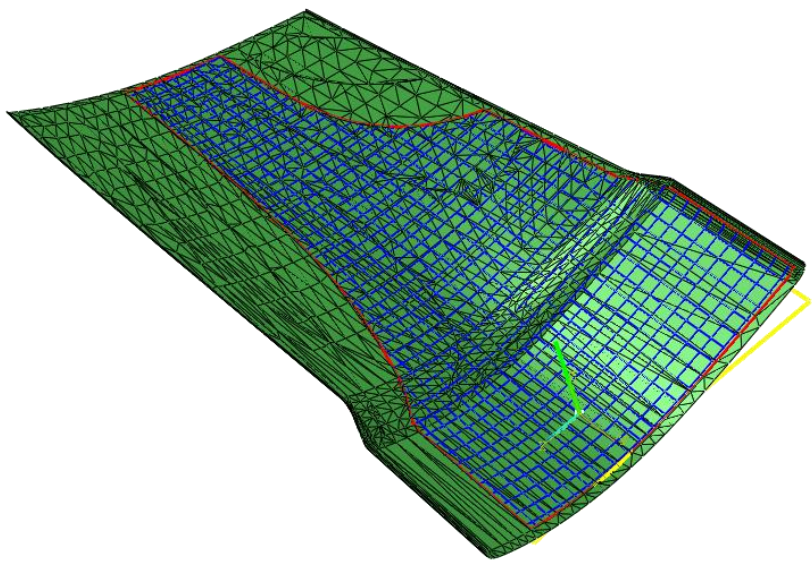
- Composites Data Transfer
- Workshop 6: Design Linking with CATIA CPD
- Workshop 7: Design Linking with FiberSIM

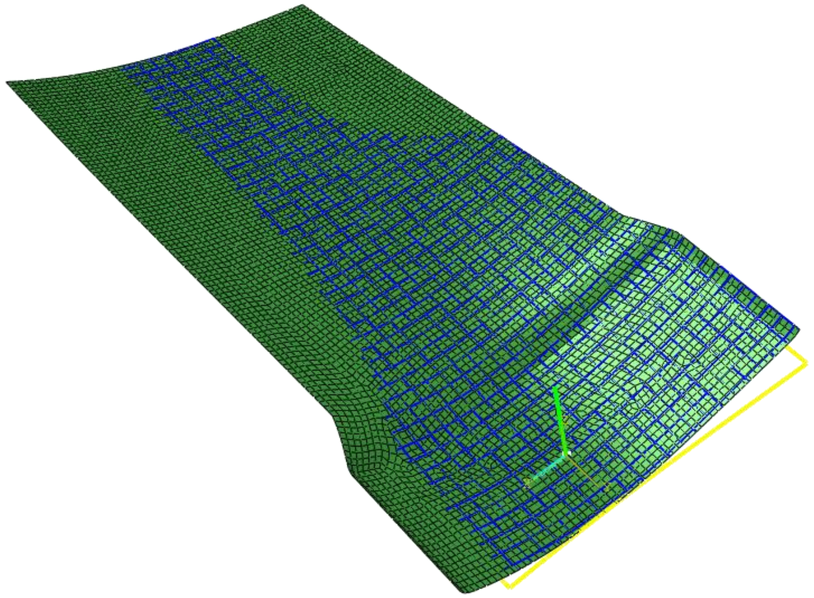
2 hours

Workshop 6: Design Linking with CATIA CPD

1. In this workshop CMA is used to transfer composites data from design to analysis.

    a. The geometry and stacking are defined in CATIA CPD.
    b. A shell finite element mesh is defined in Abaqus/CAE.



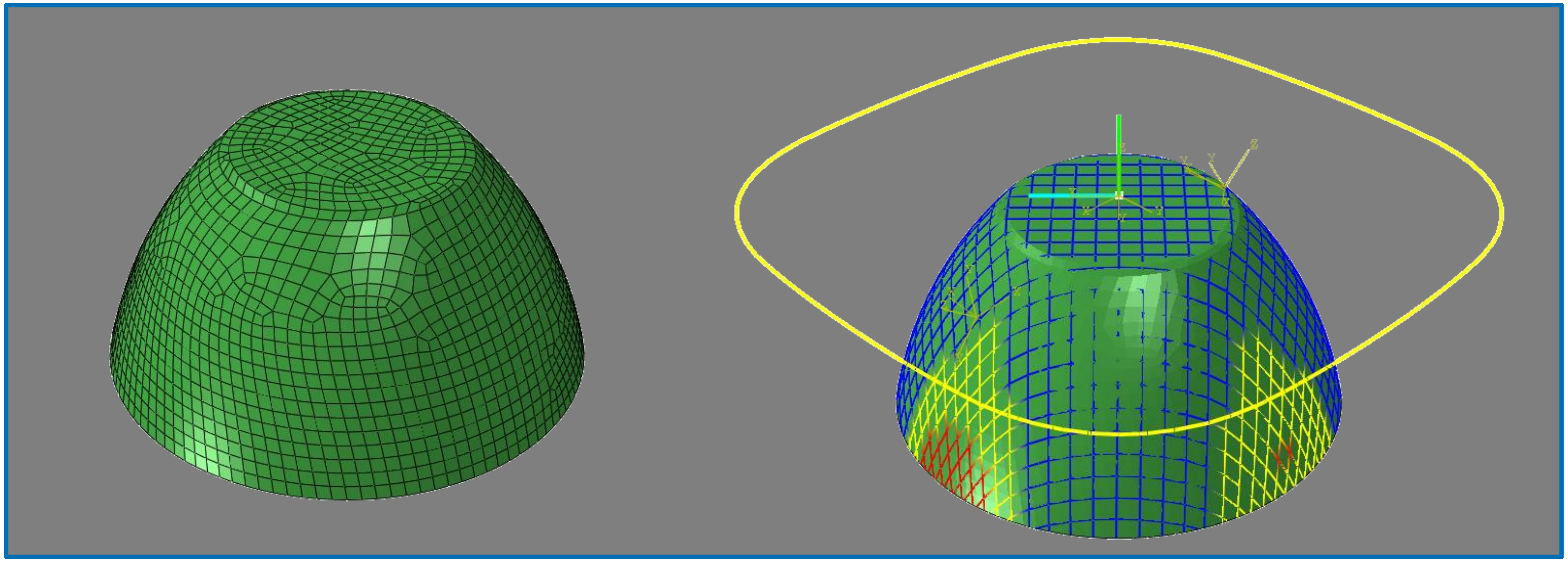


45 minutes

Workshop 7: Design Linking with FiberSIM

1. In this workshop the CMA mapping tools are used to define an CMA Layup file mapped onto an orphaned mesh

   a. Layup data are defined in FiberSIM
   b. A shell finite element mesh is defined in Abaqus/CAE



45 minutes

Lesson 6: Solid Element Extrusion

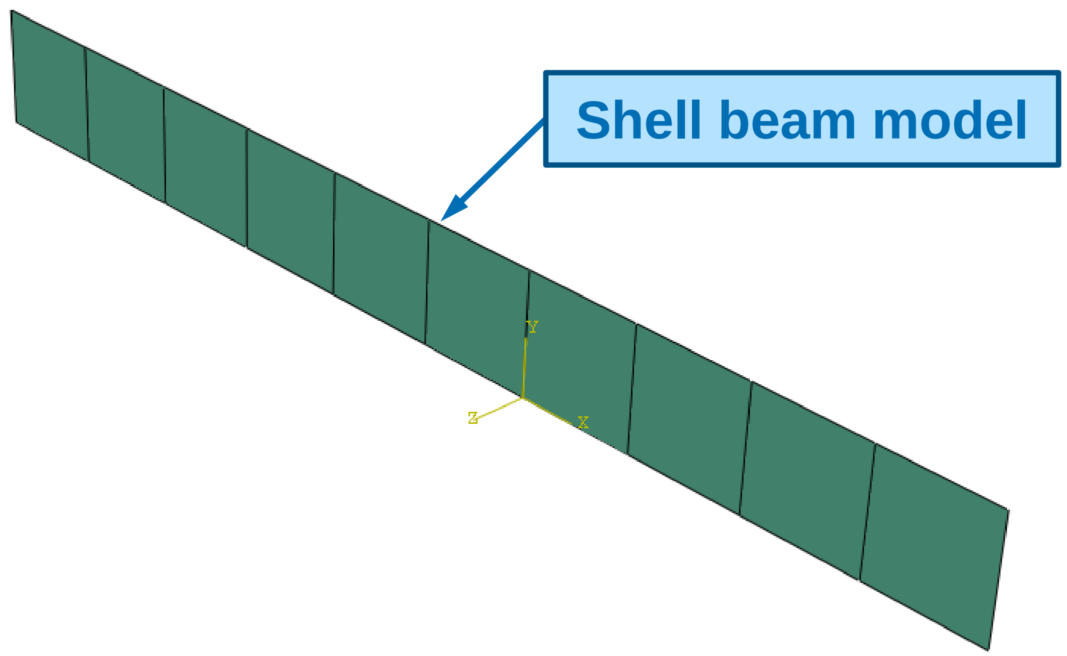
Lesson content:

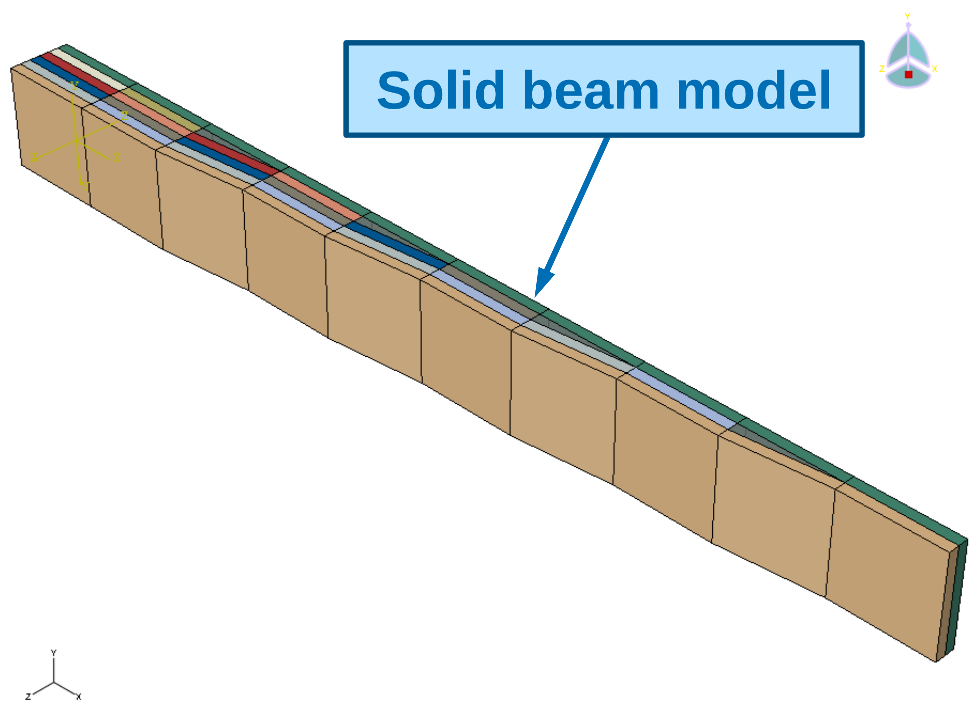
- Overview of Solid Elements
- Solid Element Extrusion
- Workshop 8: Beam with ply drop offs

90 minutes

Workshop 8: Beam with Ply Drop Off

1. In this workshop, six plies are assigned to a beam with internal drop offs applied along the length. The beam is loaded by fixing the thicker end and applying a unit axial tensile displacement to the thinner end. Plies are initially defined on the shell model; the solid model with drop-offs is then developed.





1 hour

Lesson 7: Fill Solid Elements

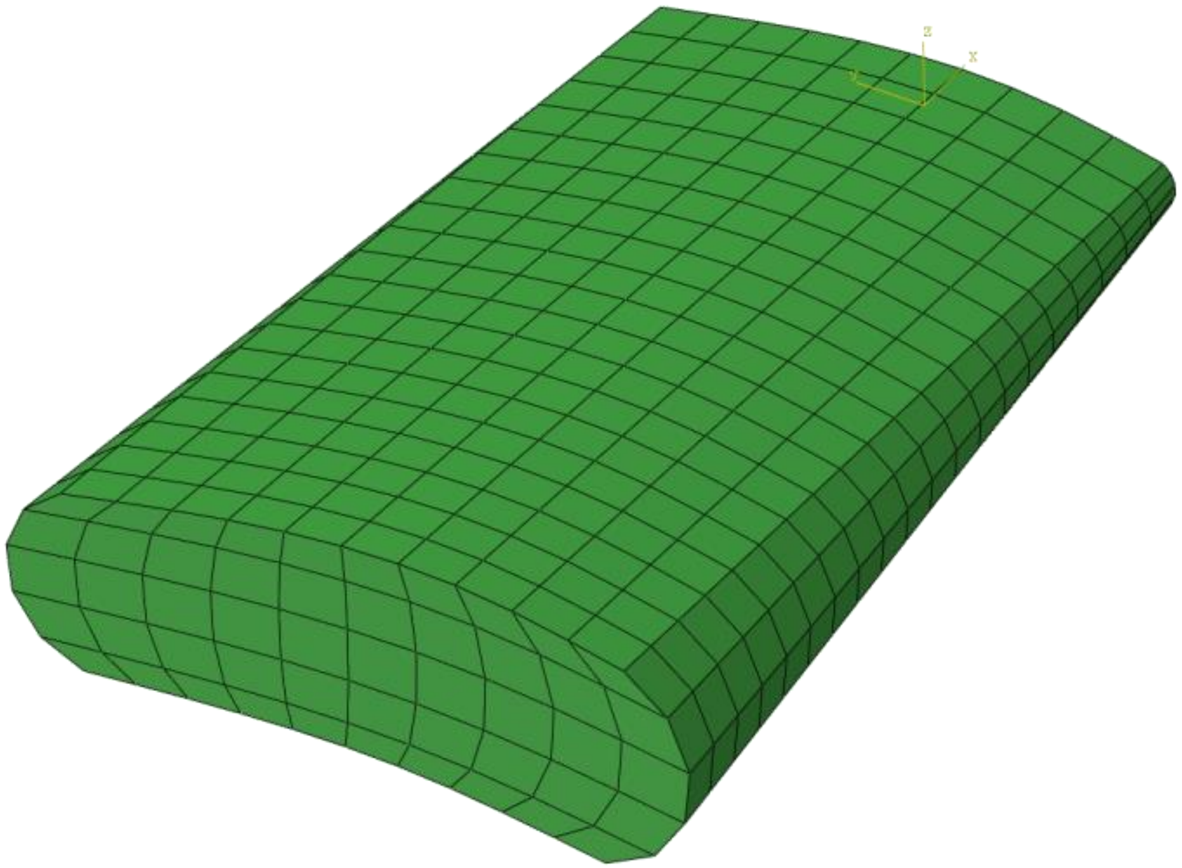
Lesson content:

- Overview of Fill Solid
- Filling Solid Elements
- Workshop 9: Simple Blade
- Workshop 10: Tapered Beam

3 hours

Workshop 9: Simple Blade

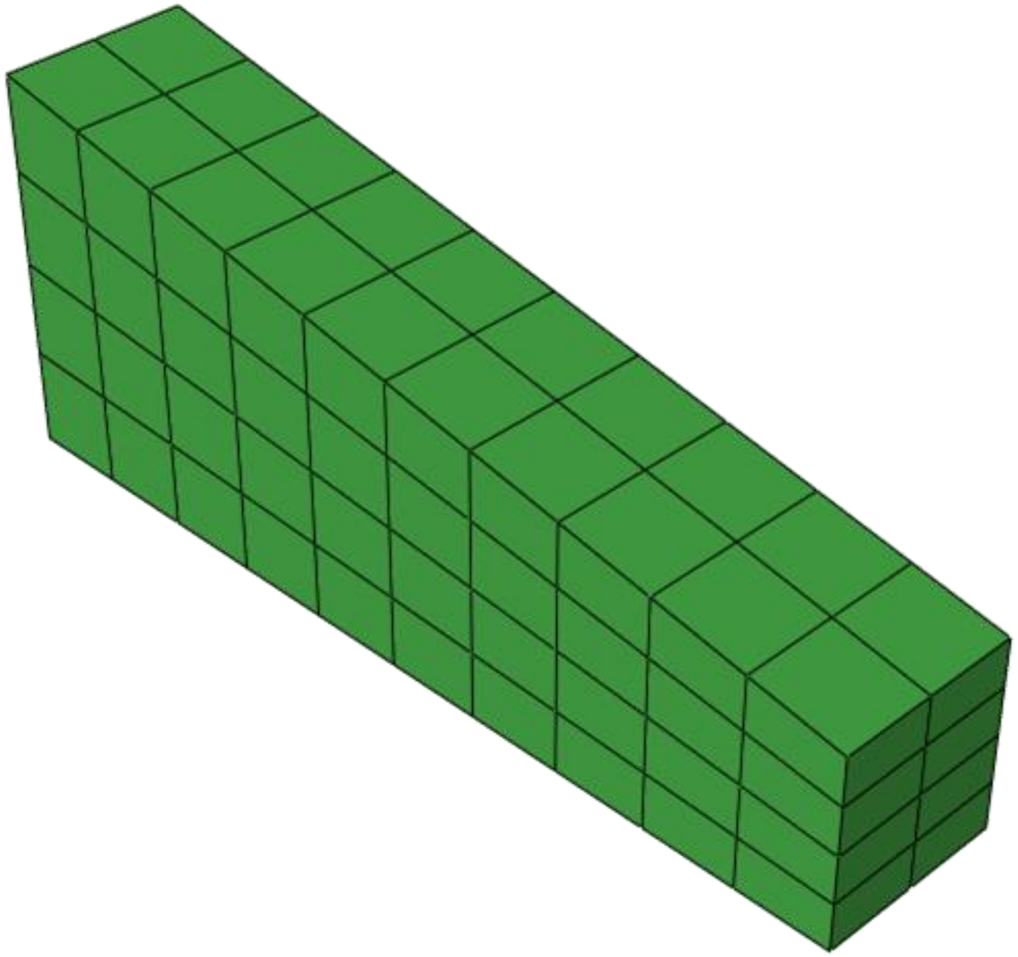
1. In this workshop, a simplified model with a constant number of elements through the thickness is used to illustrate Fill Solid Elements capability. The model represents the key features of certain important solid composites structures such as turbine blades. A spreadsheet is used to define the stacking.

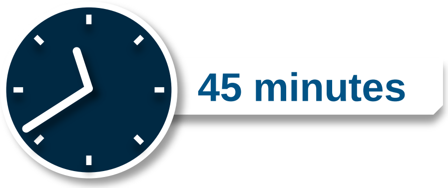


45 minutes

Workshop 10: Tapered Beam

1. This workshop consists of a tapered section made of C3D8 elements with a constant number of elements through the thickness. It will be used to illustrate the Fill Solid Elements capability. A layup file is used to define the stacking.





Lesson 8: Failure Criteria Plug-in

Lesson content:

- Failure Criteria Plug-in
- Workshop 11: Cooper Hood – Failure Criteria

1 hours

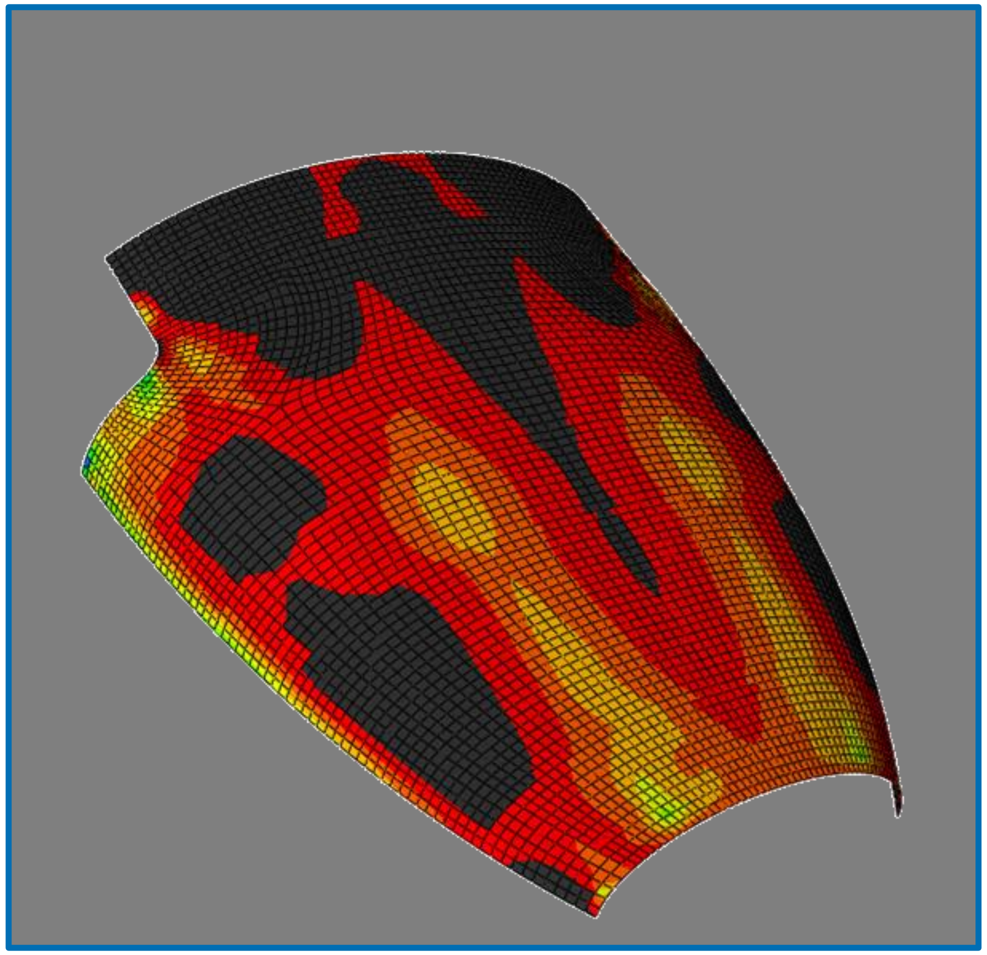
Workshop 11: Cooper Hood – Failure Criteria

1. This workshop demonstrates the Failure Criteria plug-in available within Composites Modeler.

   a. Built-in failure criteria available:

      i. TsaiWu
      ii. Maximum
      iii. Hill
      iv. Hoffman
      v. Hankinson
      vi. Cowin

   b. Results from the Cooper Hood example will be used.



30 minutes