Student Notes:

CATIA V5 Training
Foils

Realistic Shape Optimizer

Version 5 Release 19
January 2009

EDU_CAT_EN_RSO_FF_V5R19

Student Notes:

About this course

Objectives of the course

Upon completion of this course you will be able to:

- Deform a surface using the Displacement file resulting from Finite Element Analysis

Targeted audience

Surface designers, Tooling designers

Prerequisites

Students attending this course should be familiar with the basics of wireframe and surfaces creation

4 hours

Student Notes:

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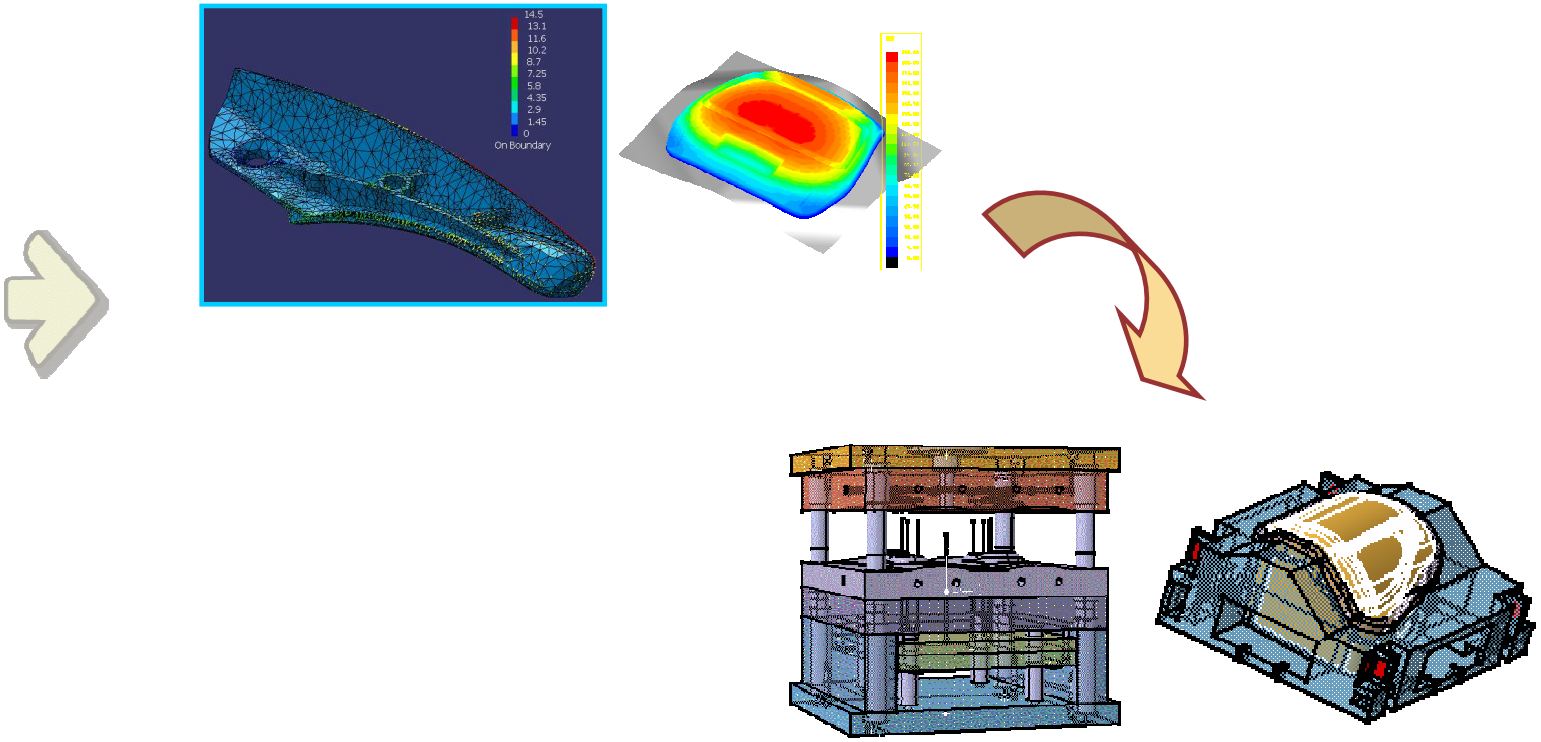
Student Notes:

Introduction to Realistic Shape Optimizer

In this lesson, you will become familiar with RSO basics.

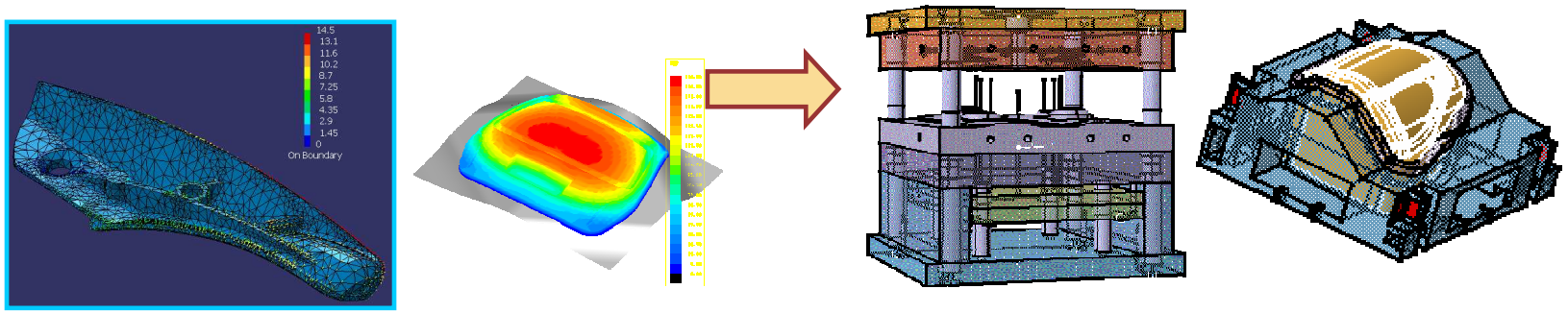


Student Notes:

Why Do You Need RSO? (1/2)

- Context 1: Use results of a finite element analysis (FEA)
  - A design part has been analyzed by a finite element method.
  - The finite element method outputs a description of the part deformation.
  - The deformation has to be applied to the CAD part to get the corresponding deformed CAD part.

- Examples:
  - Injection simulation for the computation of shrinkage: the shrinkage is evaluated by finite element methods and has to be compensated when designing the mold.
  - Computation of spring-back: spring-back can be evaluated by a finite element simulation and needs to be compensated at the die face design level.
  - Propellers or turbine blades are designed in use (movement, temperature…) by specialized software, their shape when still at ambient temperature has to be found at production stage.

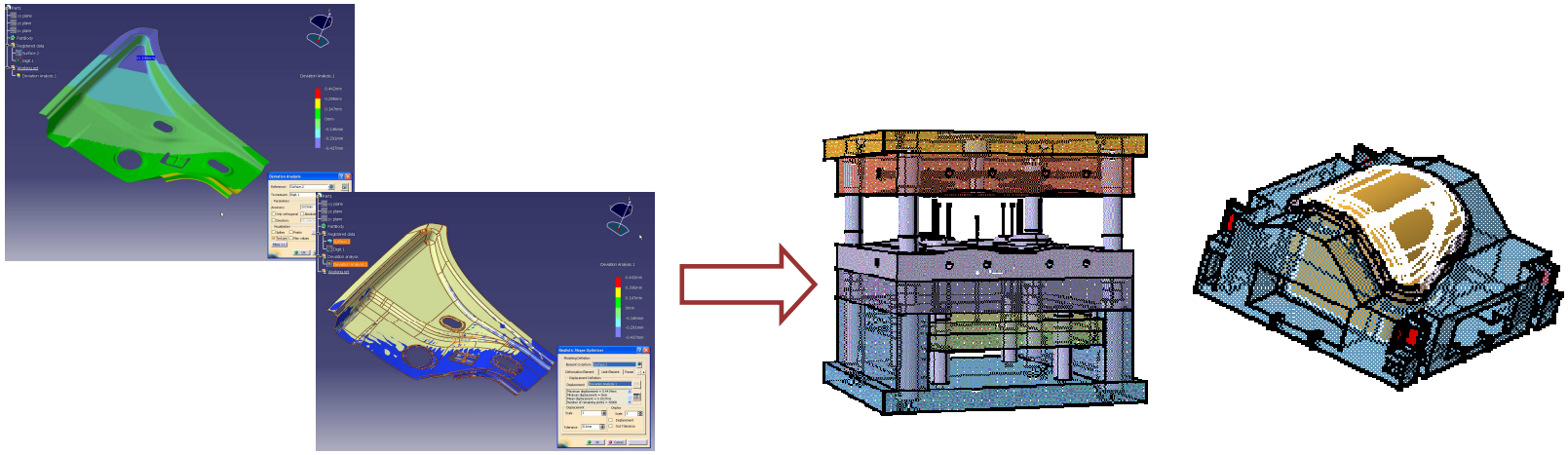


Student Notes:

Why Do You Need RSO? (2/2)

- Context 2: Use results of a deviation analysis
  - A reference part is available in CATIA
  - A prototype or sample has been manufactured
  - The manufactured part is compared to the reference part by Deviation Analysis
    - Requires the use of CATIA Quick Surface Reconstruction workbench (QSR)
  - A CAD model of the real part is required

- Examples:
  - Integration of real part in digital mock-up for further analysis
  - Tuning of tooling (specially stamping dies)



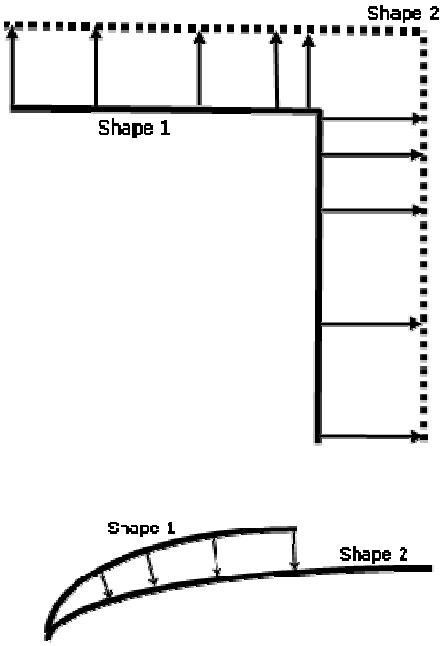
Student Notes:

WARNING

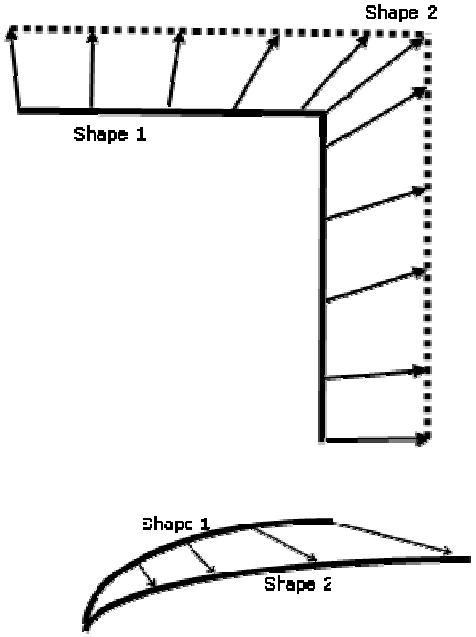
A Deviation Analysis is not an exact representation of a deformation !

The displacements created by a Deviation Analysis between two shapes are different from the displacements to apply to transform a shape into the other one, especially when the initial shape presents sharp edges or curvature variations or when the deformation includes a "stretching" of the initial shape.

Deviation Analysis:



Required displacements:



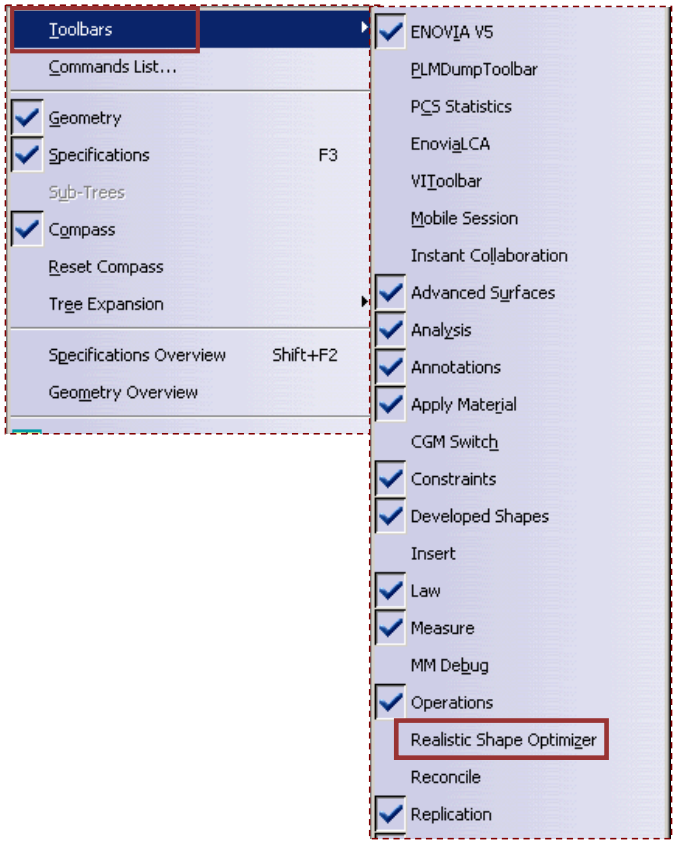
Student Notes:

Accessing the Workbench

- RSO is accessible from Core and Cavity Design or Generative Shape Design workbenches
- This tool bar is active by default in CCV workbench
- In GSD it has to be activated via View > Toolbars

Core & Cavity Design

Generative Shape Design



RSO tool bar:

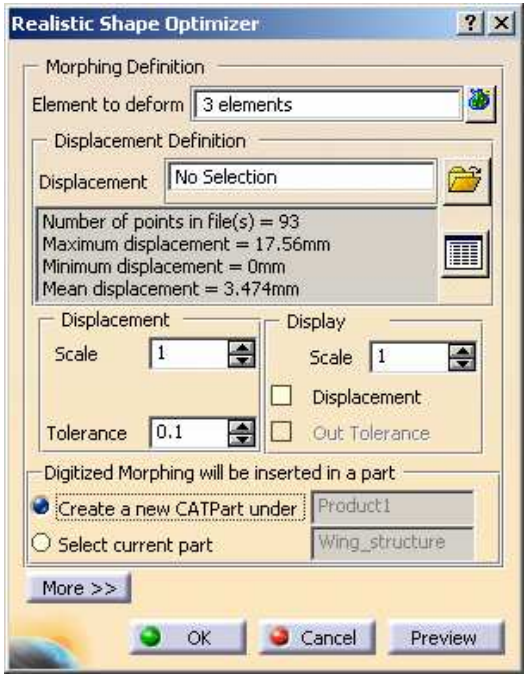
Digitized Morphing

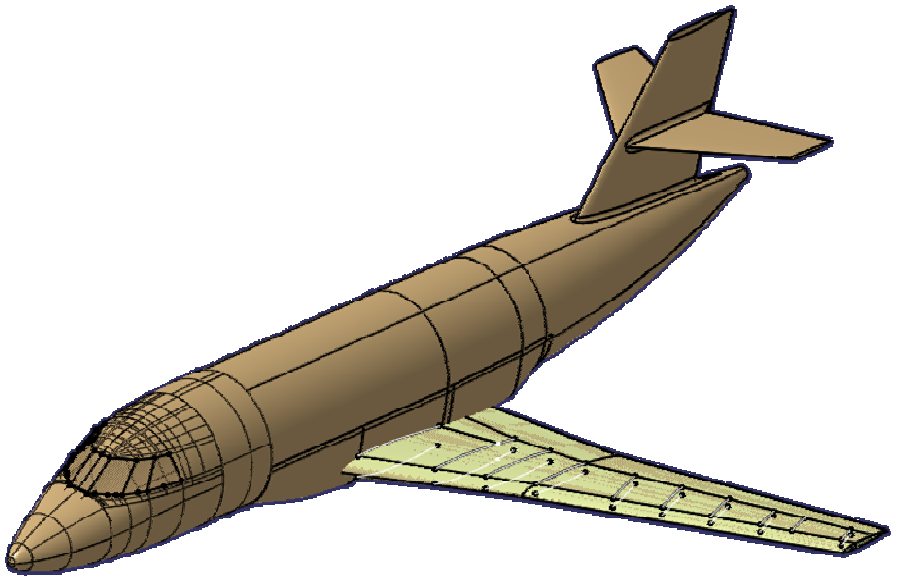
Update Digitized Morphing

Student Notes:

Surface Deformation

In this lesson you will learn about Deforming a Surface with a Displacement File and Update a Deformation Feature.





Student Notes:

Digitized Morphing: Inputs

The Input Data for Digitized Morphing is:

- **Surface(s) (multi-selection available)**
  the surface(s) can be any CATIA V5 or imported surface. They can be associative or not.

  Warning:
  - **Today the command does not support multi-output bodies, it outputs one feature for each selected surface.**
  - **In case of multi-selection the deformation field is re-computed for each feature. To avoid excessive computation time you can activate Datum Mode.**

  - **It is better to join surfaces before performing the deformation to preserve the connections between the input surfaces. (the topology is strictly preserved)**

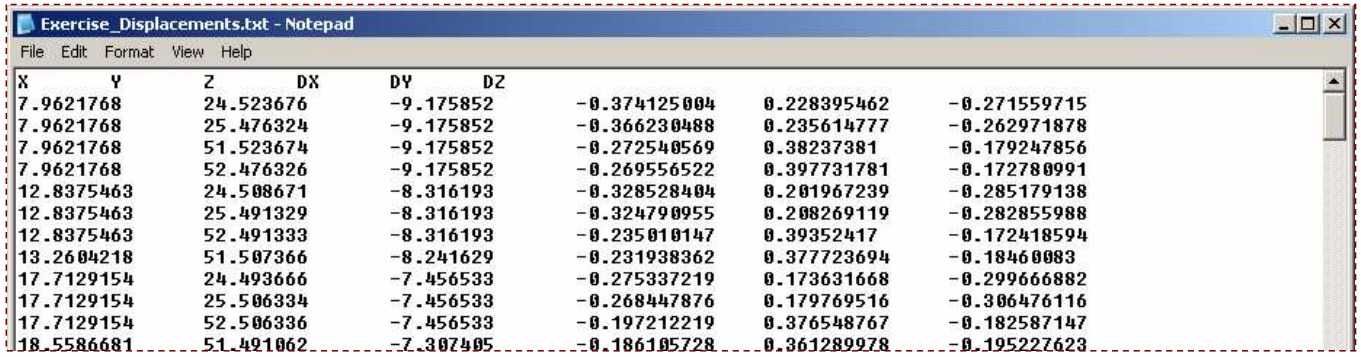
- **Some computation and display parameters.**
- **One or several displacement files.**

Student Notes:

Displacement Files (1/2)

A Displacement File is a simple text file with 6 columns of real values.

- **Real values represent Point Coordinates and corresponding Displacement along the main axes.**
- **The first line with text (title, column headers, …) will be skipped**

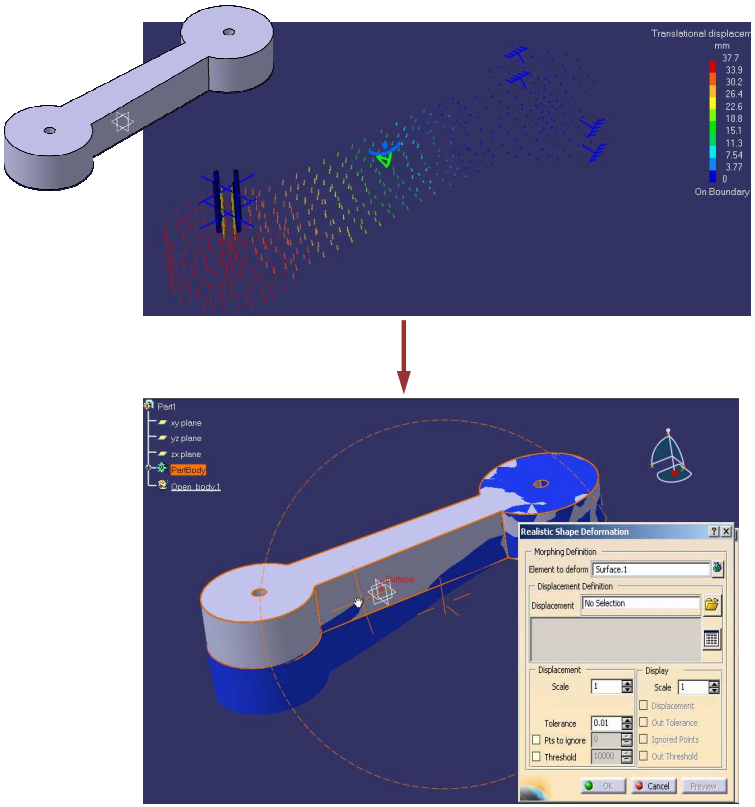


Student Notes:

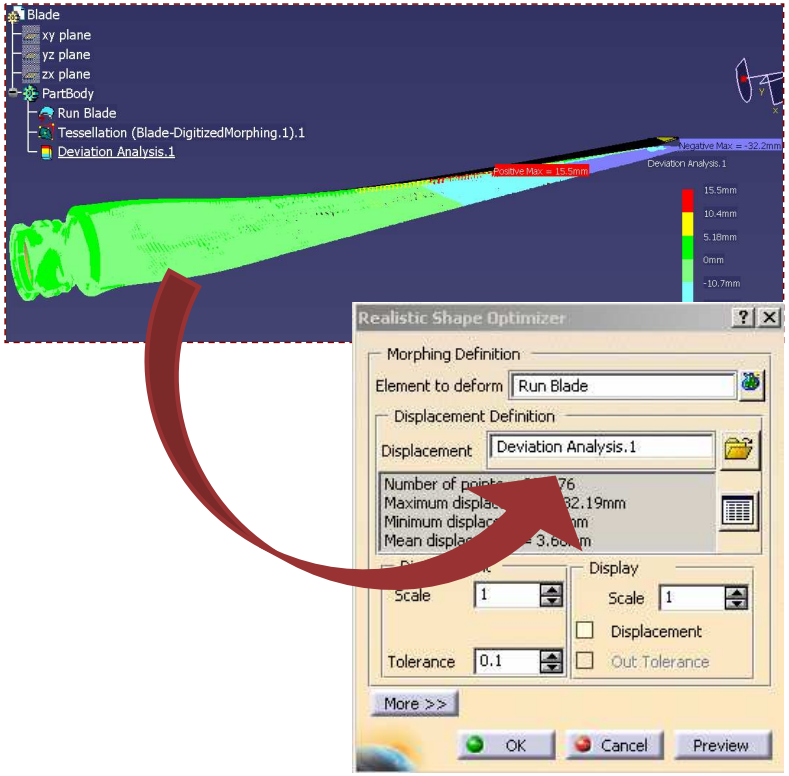
Displacement Files (2/2)

A Displacement File may be:

- A result of a CATIA Analysis & Simulation computation (CAT Analysis)



- A result of deviation analysis in Quick Surface Reconstruction Workbench (QSR).



Student Notes:

User Interface (1/4)

First tab: Deformation Element

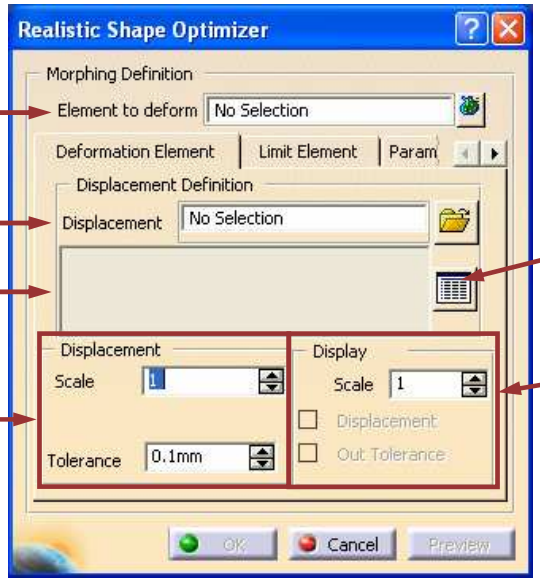
Access to list of selected displacement file(s)

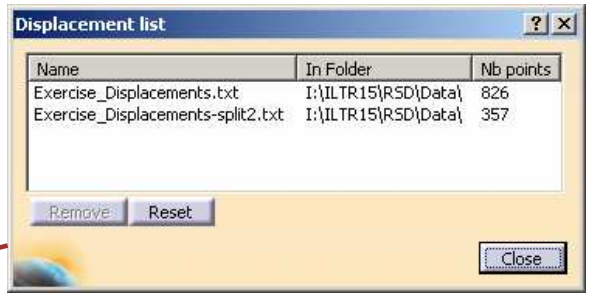
Surface(s) to deform

Displacement file(s)

Statistics on the selected displacement file(s)

Displacement Parameters:
Scale: Ratio to be applied to displacements
Tolerance: Accuracy of surface approximation

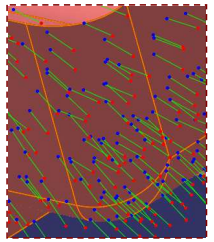


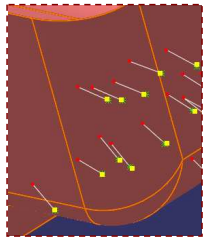


Display Parameters

Displacement: show displacements as points and lines, the length of the lines is given by the Scale factor.

Out Tolerance: once a deformation computation has been done you can highlight points where accuracy has not been reached.

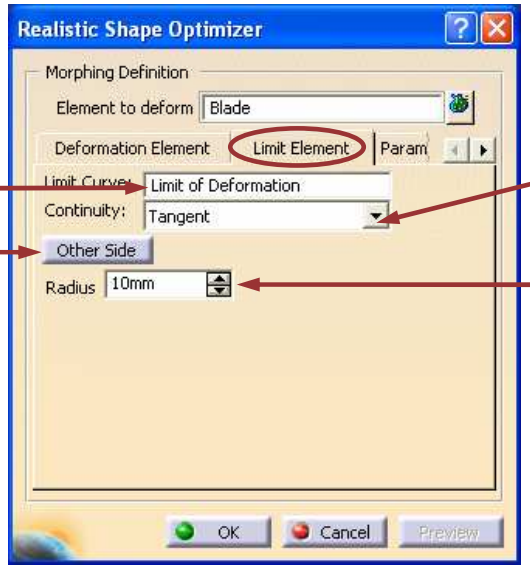




Student Notes:

User Interface (2/4)

Second tab: Limit Element



Limit curve (only one)

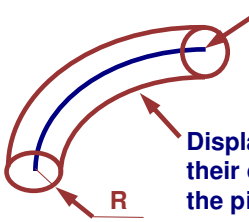
Selection of side to keep and side to deform

Continuity to preserve along the limit line between deformed and non-deformed areas.

Point
Tangent

Choice of radius for the elimination of displacements near the limit line to avoid conflicts: all points located inside pipe with given radius are ignored.

Deformed side is highlighted

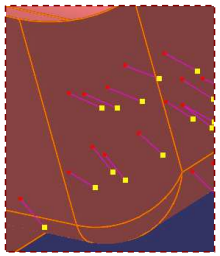


Student Notes:

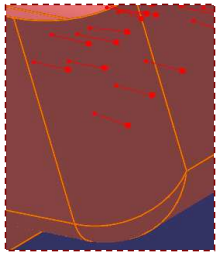
User Interface (3/4)

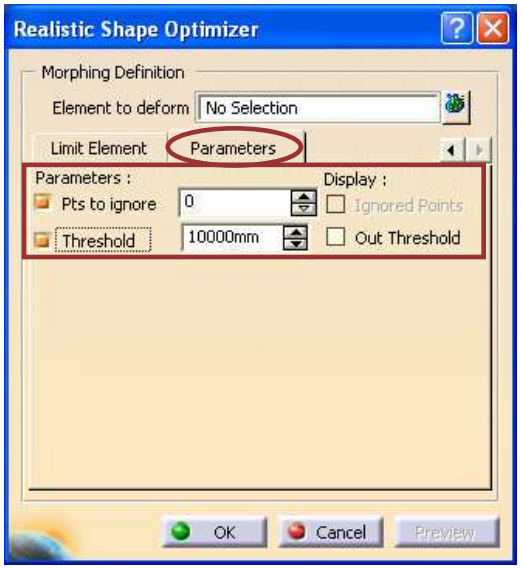
Third tab: Parameters

Pts to ignore = Ratio (%) of points that can be ignored to improve the quality of the result = after a deformation computation, the displacements where the accuracy is the lowest are removed and a second computation is performed (= erroneous or unreliable points are filtered out); you can highlight ignored points for checking.



Threshold: Maximum value for displacement length, greater displacements are ignored; you can highlight points out of threshold for checking.

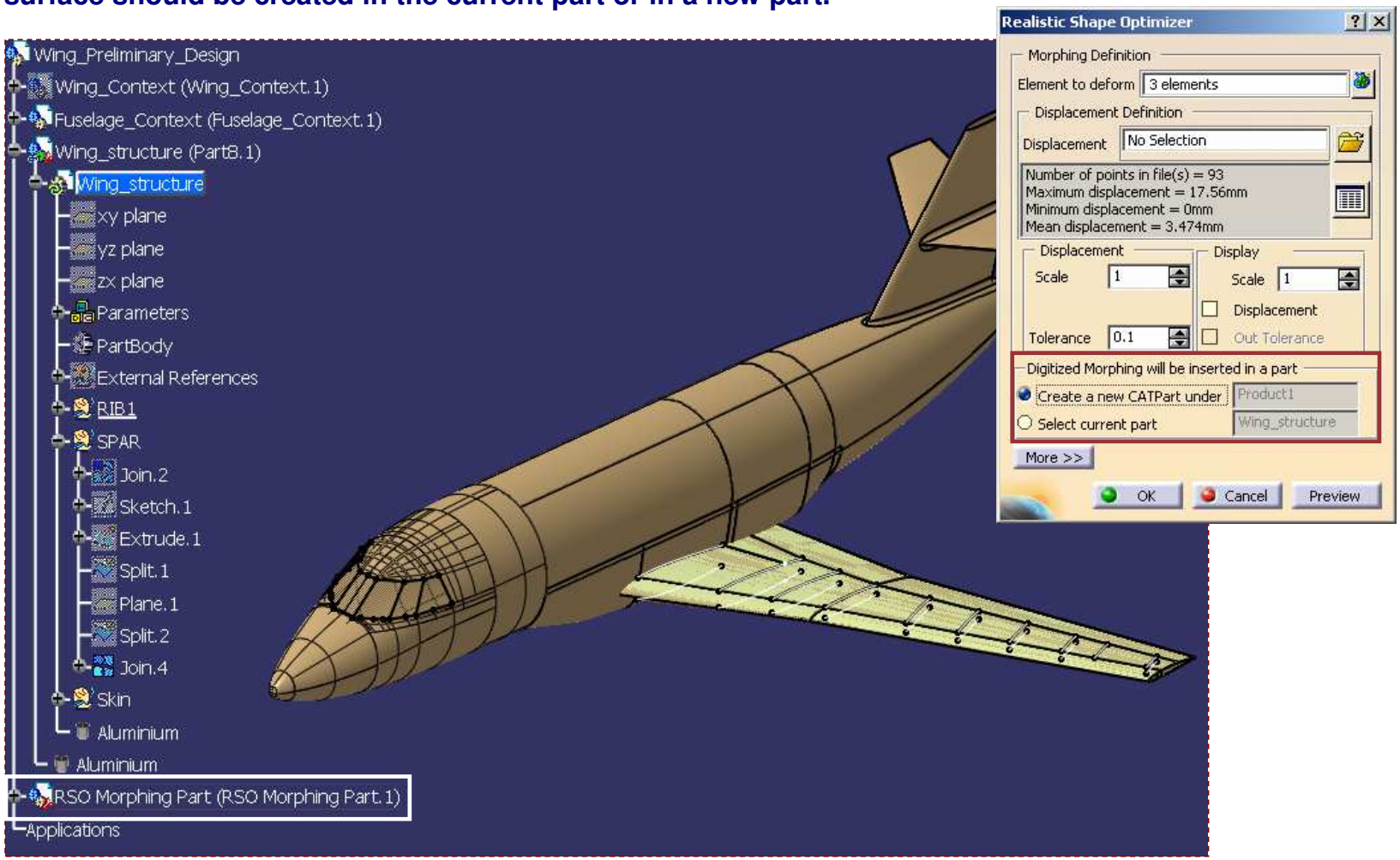




Student Notes:

User Interface (4/4)

When working in product mode you can also choose if the deformed surface should be created in the current part or in a new part.



Student Notes:

Update Digitized Morphing 

- The Update command can be used to update the Digitized Morphing features after a change in the displacement file(s)
  - In the case of features created from a Deviation Analysis or from translational displacement vectors stored in a CATAnalysis the update can be done with the standard update mechanism of CATIA (automatic or manual update with ).
- When you select the command, all Digitized Morphing features in the current part are analyzed to check if the displacement file(s) have changed since the feature creation.
- A displacement file is said to have changed if its creation date is changed (the feature includes a time stamp)
- If no displacement file has been modified you get a message

- Otherwise the list of features with modified displacement files is shown and you can select the features to update:

Student Notes:

To Sum Up

In this course you have seen:

- How to deform a surface or a set of surfaces using a displacement file, a deviation analysis or an analysis result
- How to update Digitized Morphing features