CATIA V5 Training

Foils

Quick Surface Reconstruction

Version 5 Release 19
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EDU_CAT_EN_QSR_FI_V5R19

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Instructor Notes:

About this course

Objectives of the course

Upon Completion of this course you will be able to:

-Create Scans from point cloud data

-Create curves from scans

-Create surfaces from scans

-Create model and fillet model

-Create Deviation analysis and Annotations

Targeted audience

Surface Designers

Prerequisites

Students attending this course should have experience in the following domain(s): CATIA V5 fundamentals, Digitized Shape Editor and Surface Design

1 day

Instructor Notes:

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Instructor Notes:

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Instructor Notes:

Table of Contents (3/3)

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Instructor Notes:

Quick Surface Reconstruction: Introduction

In this lesson, you will become familiar with the user interface and the general process of Quick Surface Reconstruction.
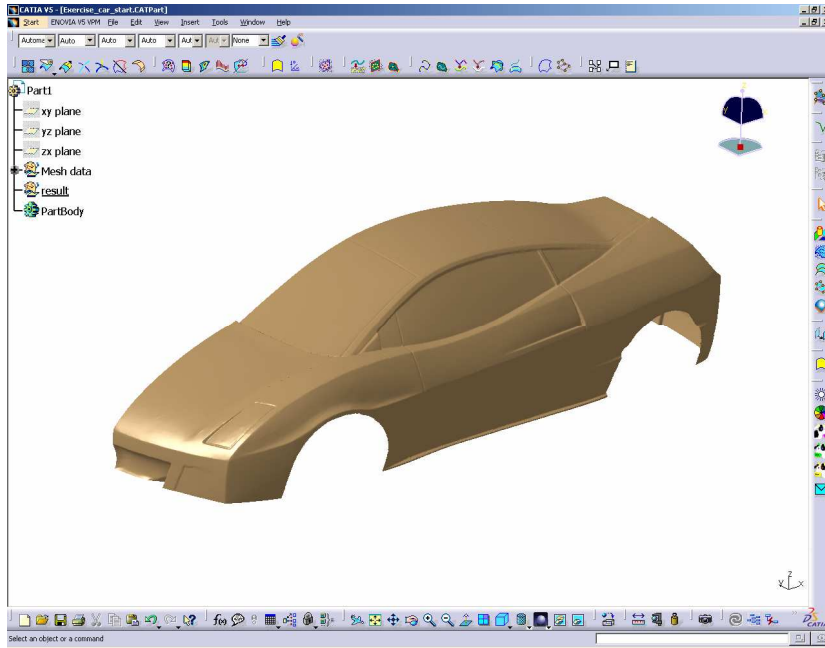
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Instructor Notes:

Accessing the Workbench

The 'Quick Surface Reconstruction' workbench can be accessed from Start > Shape > Quick Surface Reconstruction.

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Instructor Notes:

User Interface (1/2)

16 functions specific to QSR
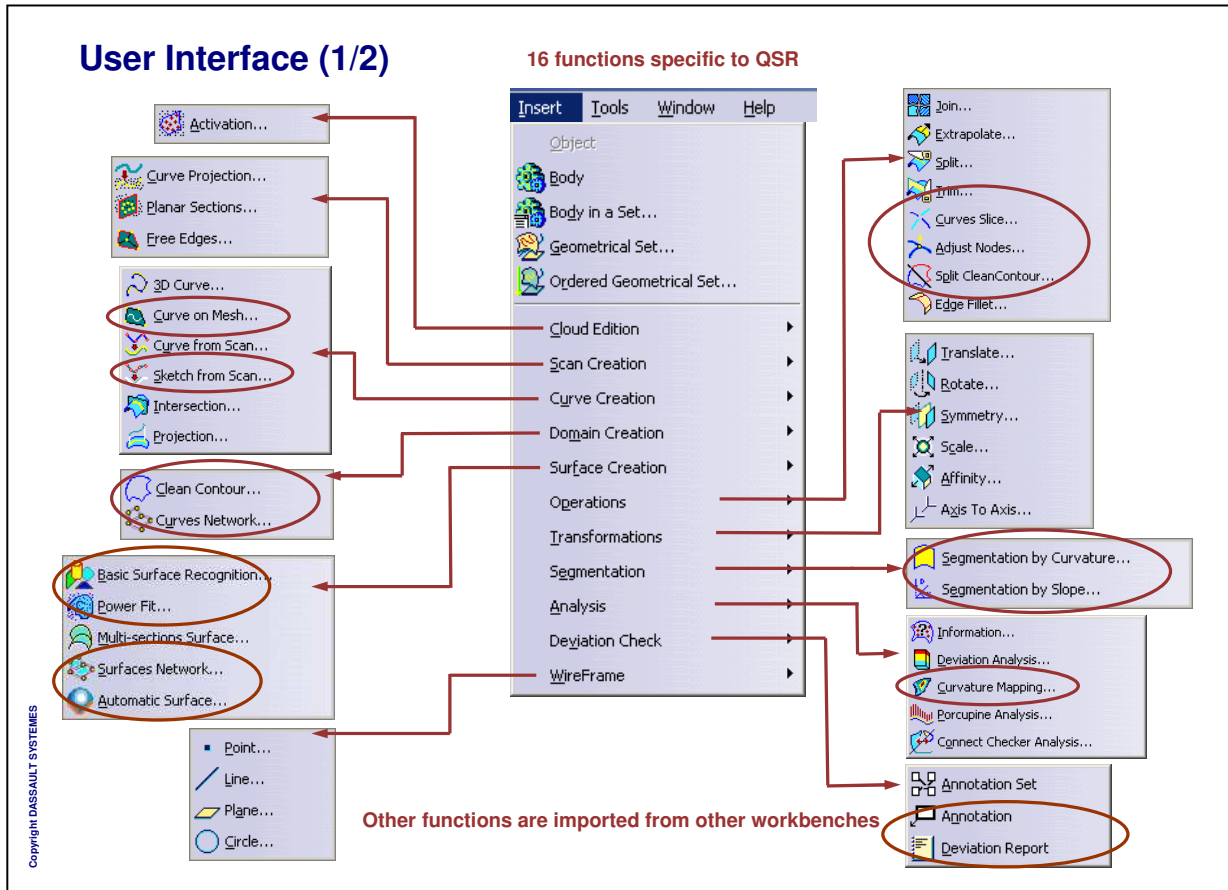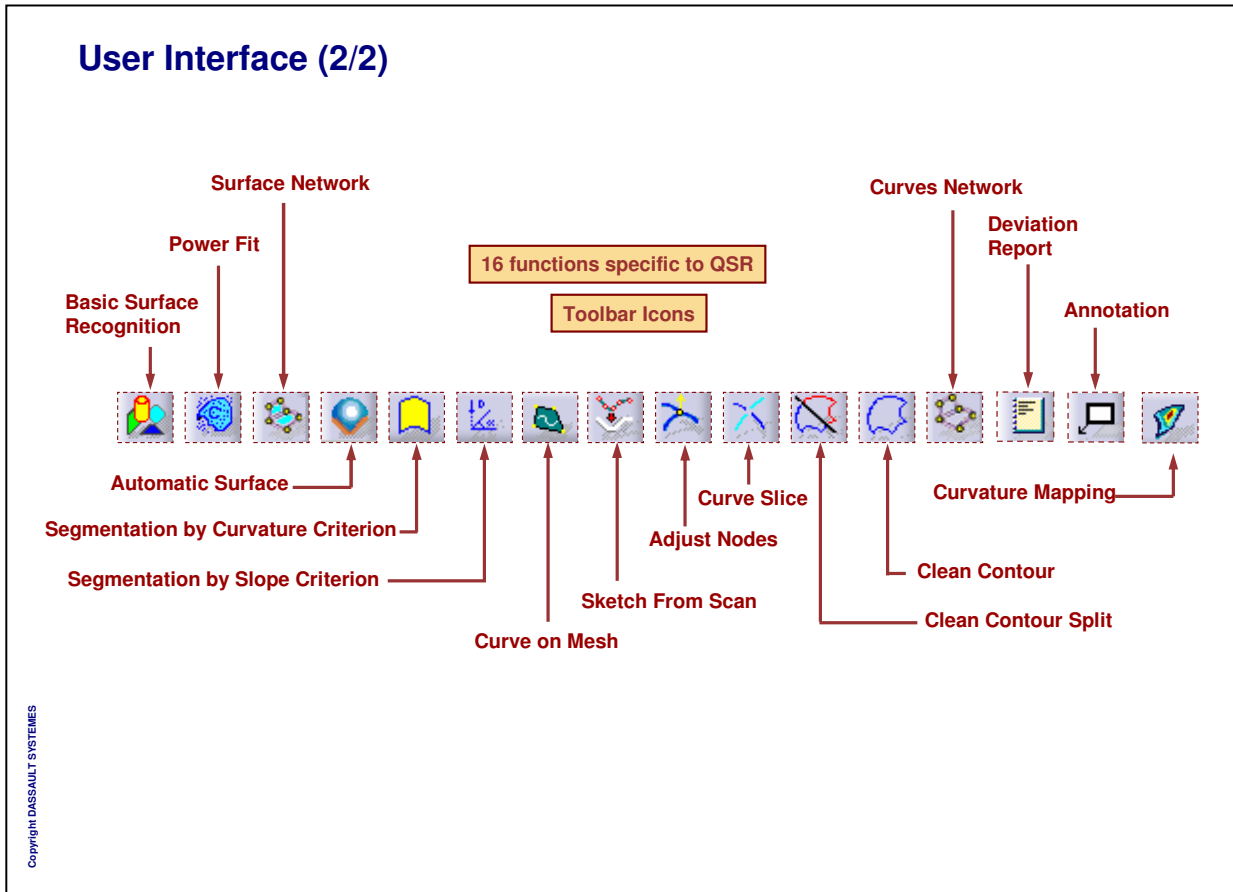

Other functions are imported from other workbenches

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Insert   Tools   Window   Help

Object
Body
Body in a Set...
Geometrical Set...
Ordered Geometrical Set...

Cloud Edition
Scan Creation
Curve Creation
Domain Creation
Surface Creation
Operations
Transformations
Segmentation
Analysis
Deviation Check
WireFrame

Activation...

Curve Projection...
Planar Sections...
Free Edges...

3D Curve...
Curve on Mesh...
Curve from Scan...
Sketch from Scan...
Intersection...
Projection...

Clean Contour...
Curves Network...

Basic Surface Recognition...
Power Fit...
Multi-sections Surface...
Surfaces Network...
Automatic Surface...

Point...
Line...
Plane...
Circle...

Join...
Extrapolate...
Split...
Trim...
Curves Slice...
Adjust Nodes...
Split CleanContour...
Edge Fillet...

Translate...
Rotate...
Symmetry...
Scale...
Affinity...
Axis To Axis...

Segmentation by Curvature...
Segmentation by Slope...

Information...
Deviation Analysis...
Curvature Mapping...
Porcupine Analysis...
Connect Checker Analysis...

Annotation Set
Annotation
Deviation Report

Instructor Notes:

User Interface (2/2)

Surface Network

Power Fit

Curves Network

Deviation Report

16 functions specific to QSR

Toolbar Icons

Basic Surface Recognition

Annotation

Automatic Surface

Curvature Mapping

Segmentation by Curvature Criterion

Curve Slice

Segmentation by Slope Criterion

Adjust Nodes

Clean Contour

Sketch From Scan

Clean Contour Split

Curve on Mesh

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Instructor Notes:

Plastic Bottle

Master Exercise Presentation

2 hrs

In this exercise, you will learn how to rebuild a surface model from a tessellated cloud of points.

The exercise steps are presented at the end of every lesson in order to let you practice the tools you learnt in that lesson.

In this process you will perform the exercise steps in the following order:

- **Creating Scans**
- **Creating Curves**
- **Creating Surfaces**
- **Creating the Rough Model**
- **Filleting the Model**

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Instructor Notes:

Creating Scans

In this lesson, you will learn to create Scans from the Point Cloud data using the different tools of scanning.
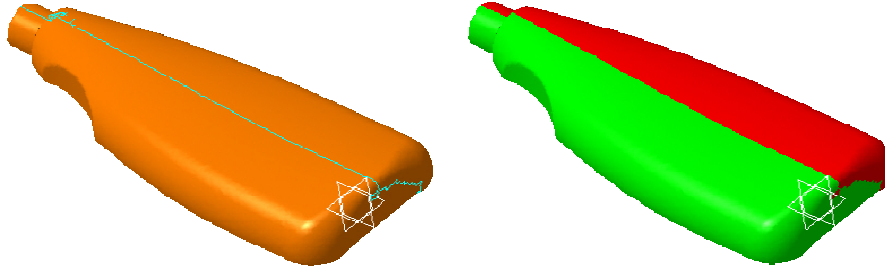
Instructor Notes:

Using Curvature Analysis (1/4)

This function creates scans with the points where the evaluated curvature or curvature radius of the mesh has a given value (iso-curvature)

A. **Influent Radius: Define the radius value. By default it is 1/100 of the diagonal of the bounding box of the mesh.**

B. **Parameters: Define the curvature value or select a point of the mesh.**

C. **Type: Define the analysis type**
   a. **Curvature**
   b. **Radius**

Real-time display of curvature value at cursor position

Iso-curvature display
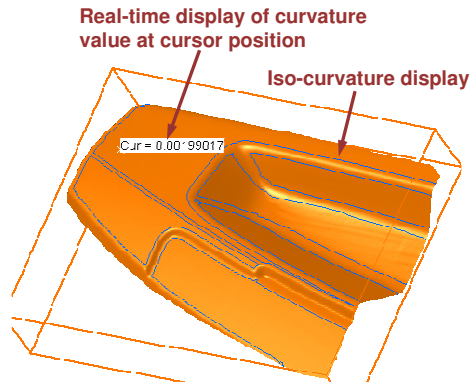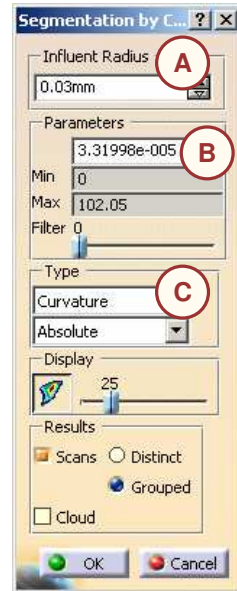
Instructor Notes:

Using Curvature Analysis (2/4)

D. **Filter: Define a filtering value to suppress unwanted small loops (from 0 to 500).**

Filtering value set to 0
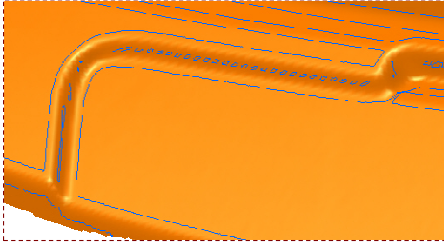
Filtering value set to 500
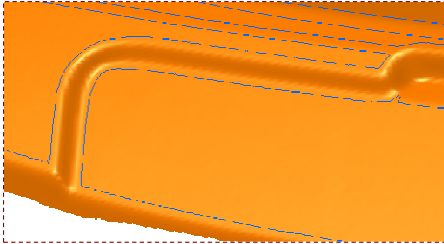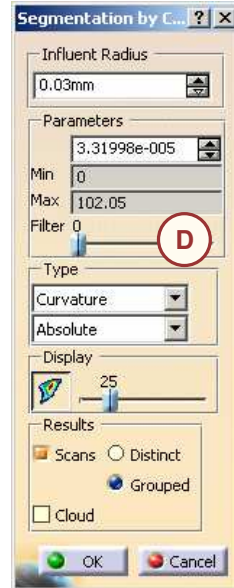
Instructor Notes:

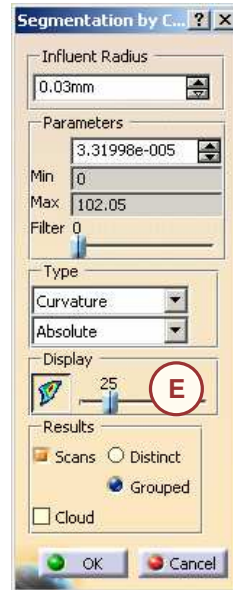## Using Curvature Analysis (3/4)

E. **Display: Display the temporary curvature mapping. Define the color partition value using the slider.**
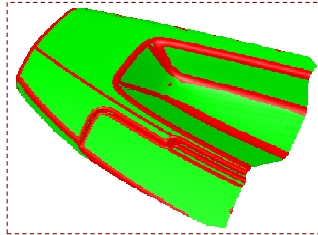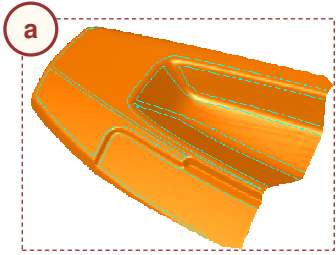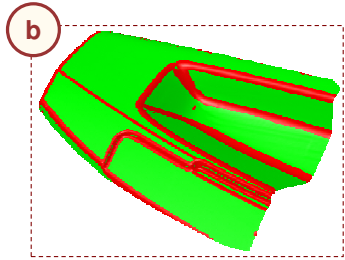
Display value set to 25

Instructor Notes:

Using Curvature Analysis (4/4)
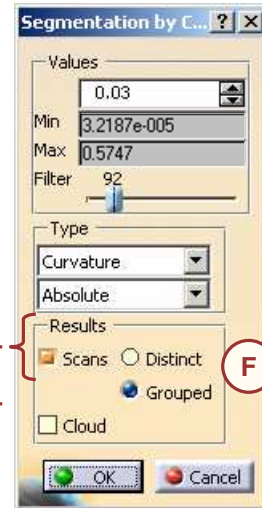
F. **Results: Choose output options for the result.**
  a. **Scans**
  b. **Cloud**

a

Create iso-curvature scan(s)

b

Split the mesh into two sub-meshes defined by the iso-curvature scan(s)

Segmentation by C... ? X

- Values
  - 0.03
  - Min 3.2187e-005
  - Max 0.5747
  - Filter 92

- Type
  - Curvature
  - Absolute

- Results
  - ☑ Scans ○ Distinct
  - ● Grouped
  - ☐ Cloud

F

OK   Cancel

Geometrical Set.1
  Cloud Tessellation.1
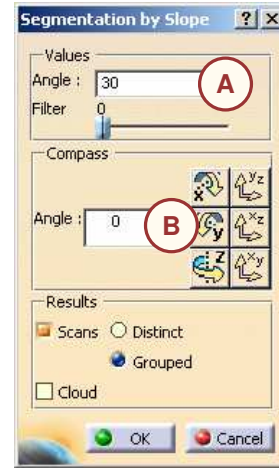 SubMesh.1
  SubMesh.2
  Scans.1
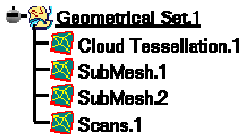
Instructor Notes:

Using Isoslope Computation (1/2)

This function creates scans composed of the points where normal to the mesh has a given angle with a reference direction.

A. **Angle Values:** Define the angle value or select a point on the mesh.

B. **Compass Angle:** Define the reference direction using the compass or using the icons of the box.
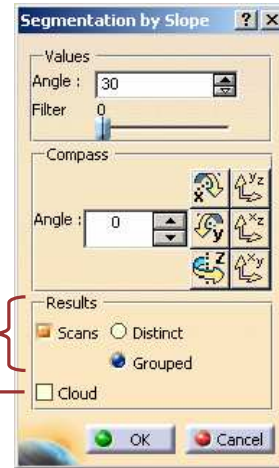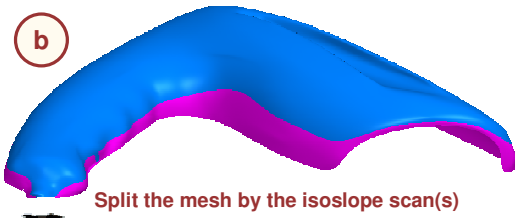
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Segmentation by Slope
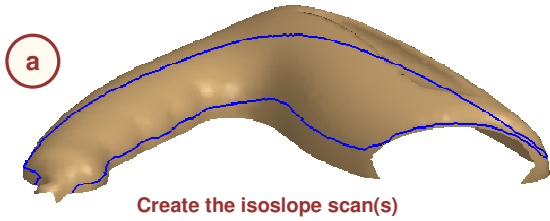
Values
Angle : 30 (A)
Filter 0

Compass
Angle : 0 (B)

Results
Scans ○ Distinct
● Grouped
□ Cloud

OK   Cancel

Alpha = 48.0263
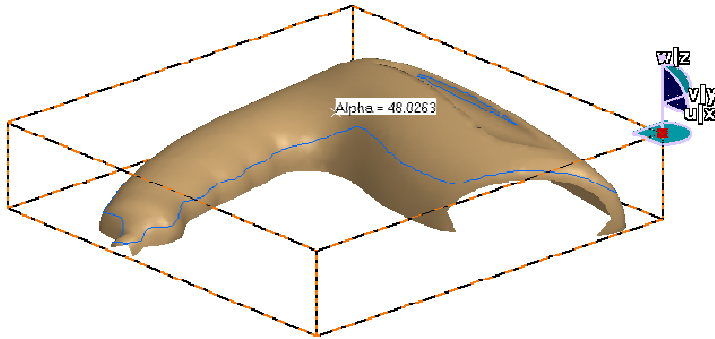
Instructor Notes:

Using Isoslope Computation (2/2)

C. **Results: Choose output options for the result.**
- a. **Scans**
- b. **Cloud**

a

Create the isoslope scan(s)

b

Split the mesh by the isoslope scan(s)

Scans can also be created with DSE commands available in QSR

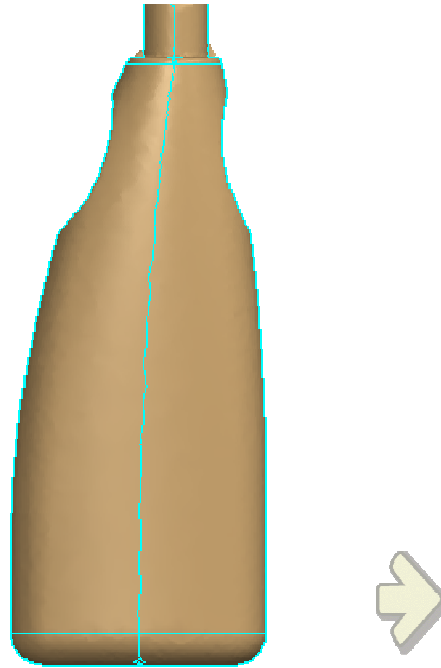*Project Curves*   *Planar Sections*   *Create Free Edges*
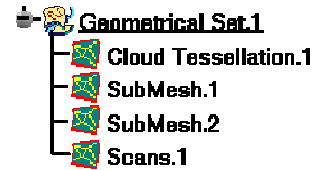
Instructor Notes:

Plastic Bottle

Step 1: Creating Scans

🕐 *15 min*

During this step, you will create scans from the digitized data by an isoslope computation and by planar sections.
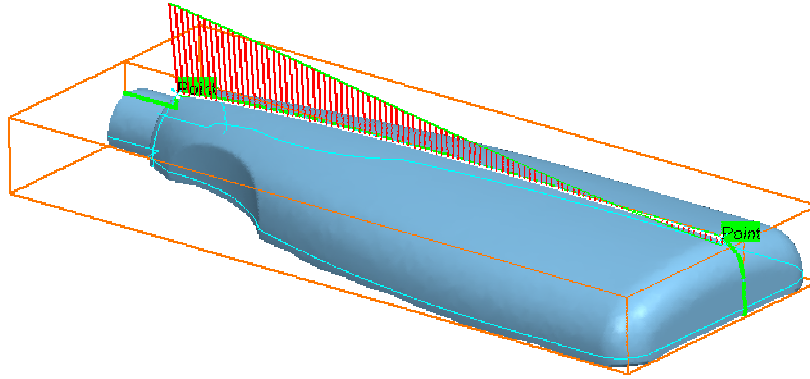
Instructor Notes:

Creating Curves

In this lesson, you will learn how to create and process curves.

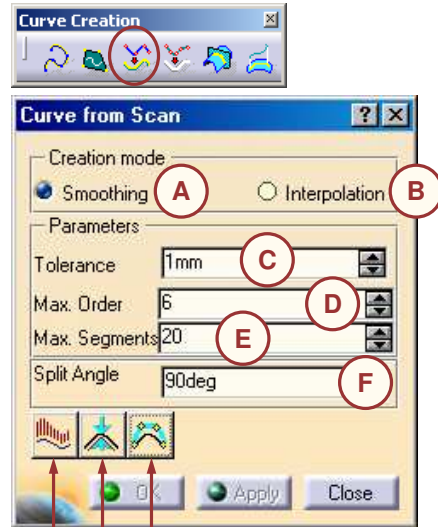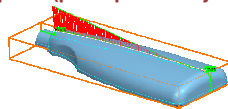**Copyright DASSAULT SYSTEMES**

Instructor Notes:

Creating Curves From Scans (1/3)

This function creates curves by smoothing or interpolating a scan:

A. **Smoothing: Approximation by a NURBS curve (one curve between two splitting points) within a given accuracy.**

B. **Interpolation: The curve goes exactly through the points of the scan.**

C. **Tolerance: Define the smoothing accuracy equal to max. accepted distance between curve and scan points.**

D. **Max. Order: Define the order of each curve's segment.**

E. **Max. Segment: Define the maximum number of segments for each curve till the accuracy is reached with the specified order.**

F. **Split Angle: Define an angle value for automatic equal splitting to improve the accuracy by increasing the number of curves.**

Activate the curvature display option (porcupine analysis)

Displays the order and number of segments

Displays the maximum Deviation

Curves can also be created with GSD commands available in QSR - Intersection and Projection.

Instructor Notes:

Creating Curves From Scans (2/3)

Add splitting points manually by clicking on scan points, usually to preserve sharp corners or curvature discontinuities

Right-click the point to choose the options

Remove point
Remove all points

You can choose to remove a point or all points from contextual menu

Impose tangency

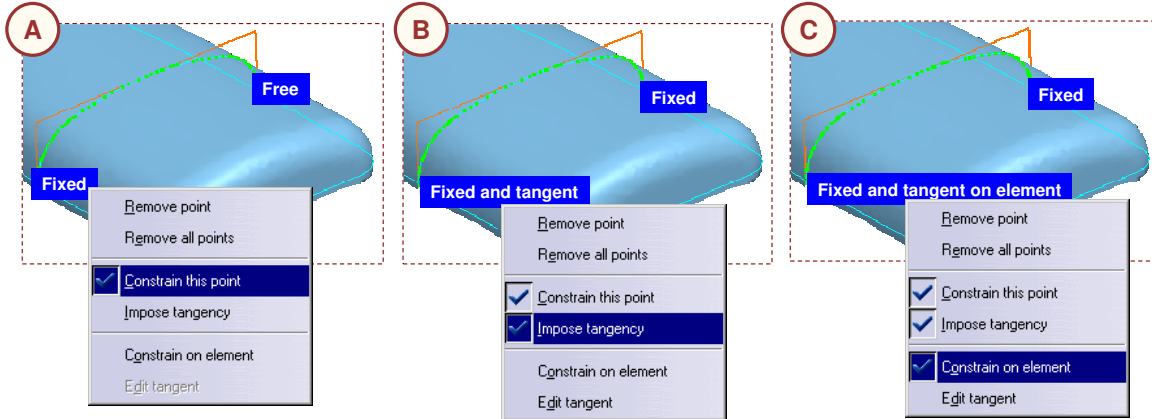You may also choose a continuity level for the curves meeting at the splitting point

Instructor Notes:

Creating Curves From Scans (3/3)

For the endpoints you may also choose:

A. To free or fix the endpoint

B. To impose a tangency direction

C. To constrain the point on an element, usually an existing curve

A

Free

Fixed

Remove point
Remove all points
✓ Constrain this point
Impose tangency
Constrain on element
Edit tangent

B

Fixed

Fixed and tangent

Remove point
Remove all points
✓ Constrain this point
✓ Impose tangency
Constrain on element
Edit tangent

C

Fixed

Fixed and tangent on element

Remove point
Remove all points
✓ Constrain this point
✓ Impose tangency
✓ Constrain on element
Edit tangent

Instructor Notes:

Creating Sketches From Scans (1/2)

This function approximates planar scans by editable sketches.

A. **Element: Element(s) to process**
B. **Threshold: You can define splitting points manually by clicking on scan points or automatically using Threshold. You can add splitting points by decreasing the value of the threshold.**
C. **Tolerance: Expected tolerance equals to the maximum distance between scan and sketch.**

Multi-selection button to select several sketches
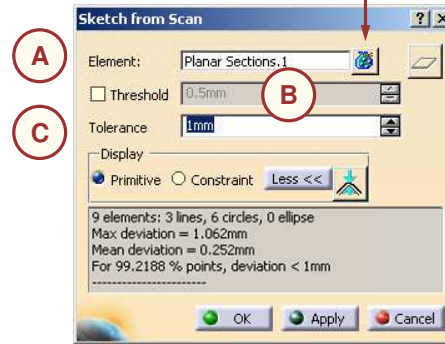
Display deviation values for each element
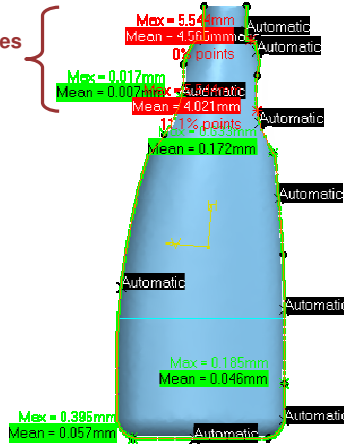
Instructor Notes:

Creating Sketches From Scans (2/2)

You can choose the continuity at splitting points using Constraint display option. Right-click labels to change continuity types or remove splitting points.
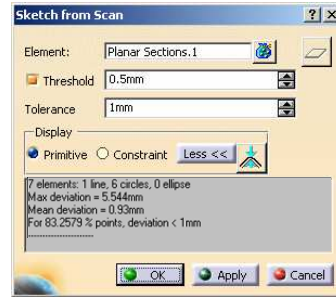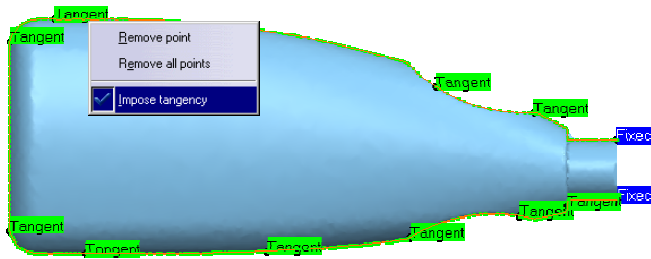
You can choose the type of sketch element to create between 2 splitting points using Primitive display option. Right-click labels to change element types.
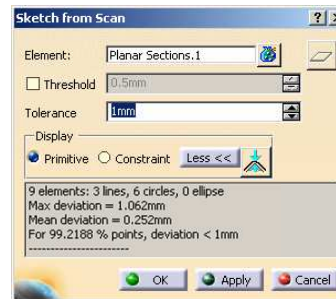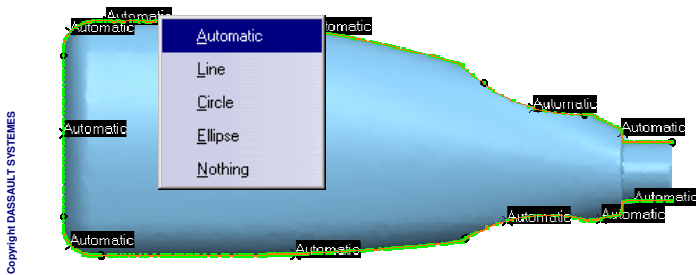
Instructor Notes:

Creating a 3D Curve (1/3)

Curves can also be created directly with 3D curve (FreeStyle operator)

A. **Creation Type: Interpolation by control points Smoothing**
   a. **Through Point**
   b. **Control Point**
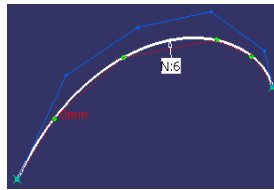   c. **Near Point**

B. **Point Handling**
   a. **Insert Point**
   b. **Remove Point**
   c. **Constraint point on an element (curve, cloud)**

C. **Options: choose an accuracy and**
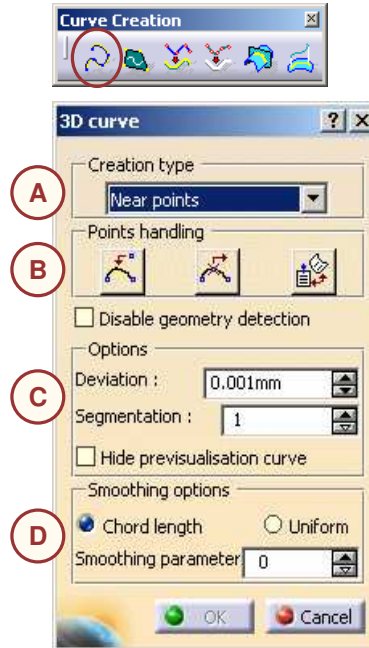   **a maximum number of segments**

D. **Smoothing Options:**
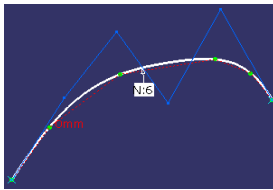
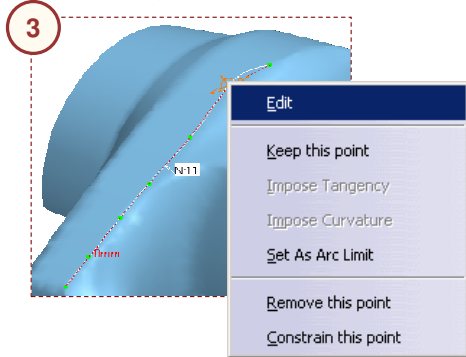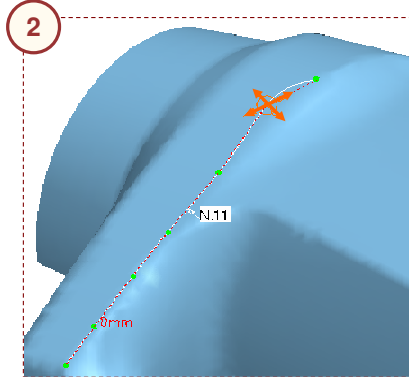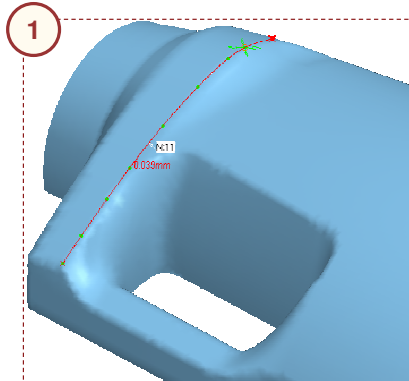**Chord Length option**   **Uniform option**

**Instructor Notes:**

Creating a 3D Curve (2/3)

Let us create a 3D curve on a point cloud.

1. **Select points on a cloud or on any existing element (curve, point…) otherwise points are taken in the current privileged plane (defined by the compass).**

2. **When a point is constrained on a curve you can move it along the curve with manipulators.**

3. **Right-click a point: to edit its position in space or on its support element to impose a tangency or a curvature to remove or constrain the point.**

Edit

Keep this point

Impose Tangency

Impose Curvature

Set As Arc Limit

Remove this point

Constrain this point

Instructor Notes:

Creating a 3D Curve (3/3)

4. **Define the tangency direction at a point using the green circles as manipulators.**

5. **Right-click the curve tangent (green arrow) to access tangent definition options**

Edit

Use compass normal

Constrain on element

Snap on elements
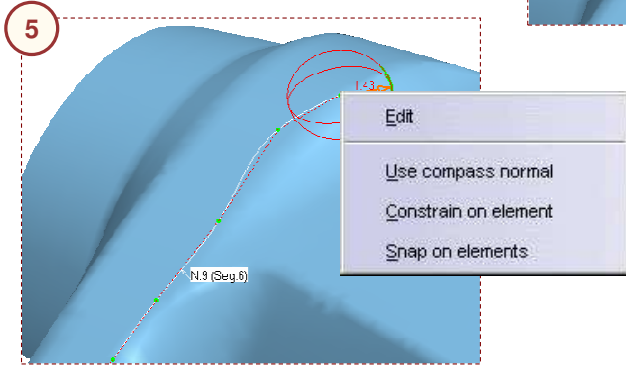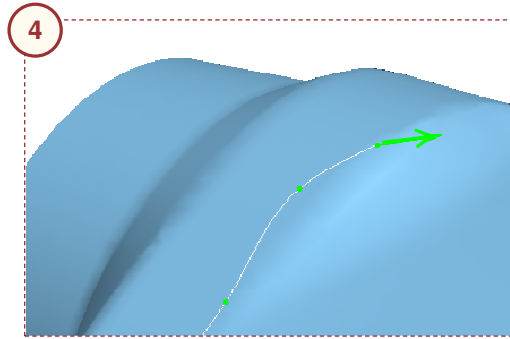
Instructor Notes:

Trimming Non-Intersecting Curves

This function is used to split curves which do not exactly intersect.

A. **Selected Curves:** Select the curves to process by picking or by trap.

B. **Distance at Nodes:** Visualization of the gap between each couple of curves to slice.

C. **Max. Distance:** Define the maximum distance between two curves to detect an intersection.

D. **Filtering:** Define the minimum length of the created curves (optional)
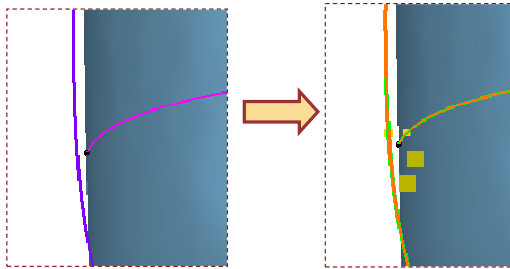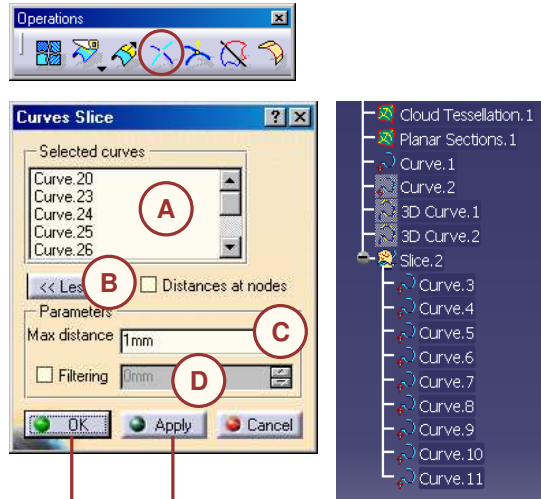
On APPLY, detected intersections are highlighted by a square

On OK, a new geometrical set is created, it contains the curves that have been sliced.

Instructor Notes:

Adjust Nodes (1/2)

This function is used to connect several curves to a common vertex

A.   **Selected Curves:** Select curves to adjust.

B.   **Max. deviation: You can choose a maximum deformation value. If it is reached, a warning message is displayed and the adjustment fails.**

C.   **Max. Angle G1: You can also choose to give curves the same tangent plane if their original angle is smaller than the specified value**
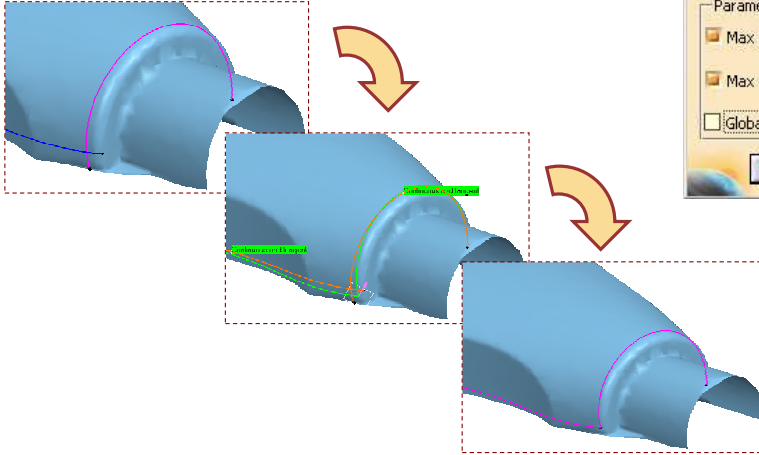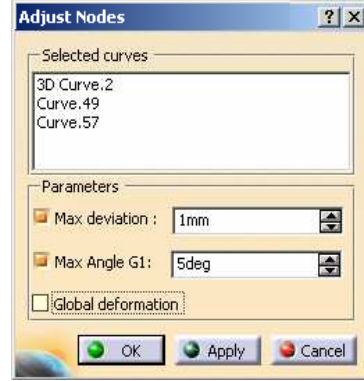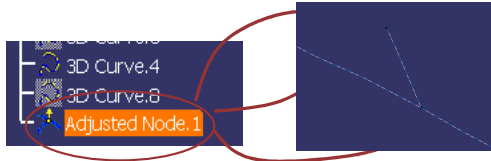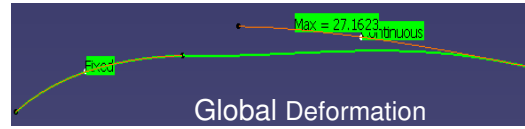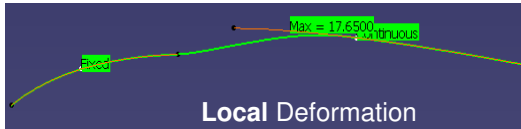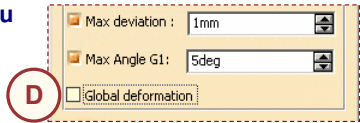
Instructor Notes:

Adjust Nodes (2/2)

D. **Global Deformation: With the Global deformation option you can change the shape of the adjusted curves**
    a. **Local: The deformation is distributed on 1/3 of the curve**
    b. **Global: The deformation is spread all along the curve**

☐ Max deviation :	1mm
☐ Max Angle G1:	5deg
☐ Global deformation	

D

Local Deformation

Global Deformation

On OK, a new feature is created, the modified curves are joined so that they are now considered to be one element.

3D Curve.4
3D Curve.8
Adjusted Node.1

With a right-click the label, you can choose to freeze the curve or choose if you want a simple or tangent adjustment

Continuous and tangent
  ✔ Continuous and tangent
    Continuous
    Fixed

When you want to use a curve which is a sub-element of an Adjust Node feature (to do another Adjust Node for instance), you have to use the Geometrical Element Filter to select it.

User Selection Filter

Instructor Notes:

Cleaning Contour (1/2)

This function can be used to prepare curves before surface creation, for example: by Powerfit. It makes them compatible by giving them the same endpoints and on option the same tangent planes.

A. **Elements to join:** Select the curves to process by clicking or by a trap.

B. **Closed Contour:** Check this option if the created contour must be closed.

C. **Automatic Tangent Constraint:** Activate the tangency continuity constraint to make intersecting curves tangent.

D. **Max Angle G1:** If the tangency constraint is active: define the maximum angle; if the angle between 2 curves is greater than the value, the curves are not made tangent.
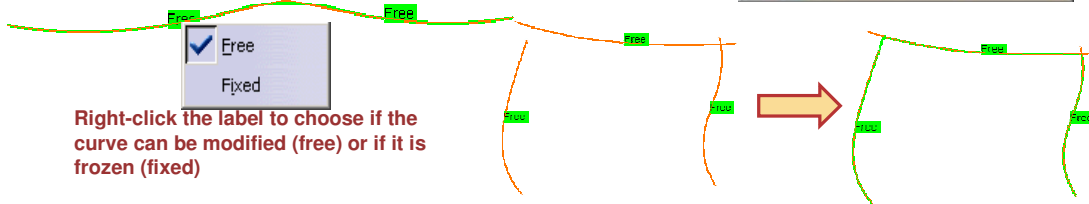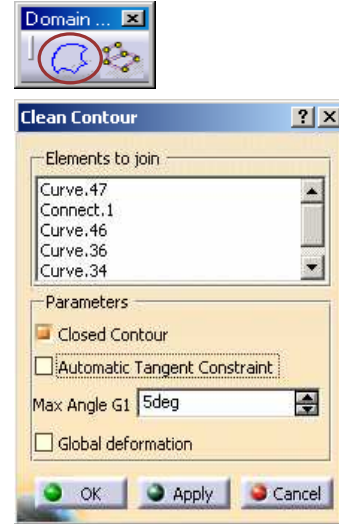
**Right-click the label to choose if the curve can be modified (free) or if it is frozen (fixed)**
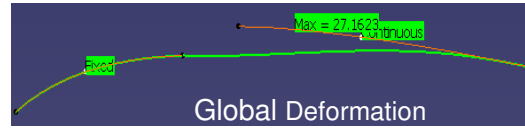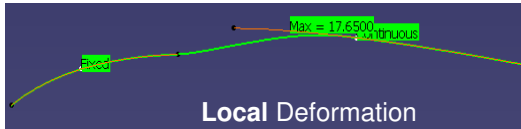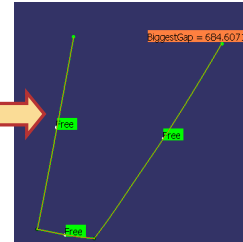
Instructor Notes:

Cleaning Contour (2/2)

Global Deformation: With the Global deformation option you can
change the shape of the adjusted curves
- a. **Local:** The deformation is distributed on 1/3 of the curve
- b. **Global:** The deformation is spread all along the curve

Local Deformation   Global Deformation
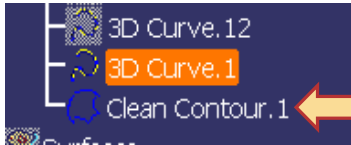
**The result is a new feature
joining the modified curves.**

**When you want to use a curve which is a sub-element of a
Clean Contour feature (to do an Adjust Node for instance),
you have to use the Geometrical Element Filter to select it.**

Instructor Notes:

Trimming a Clean Contour

This function can be used to split a cell created by Clean Contour into 2 new cells

A. **Elements to cut: Select the clean contour to process (join). Selected clean contour must be closed.**

B. **Cutting Elements: Select the splitting curve(s). Splitting curves must be connex. Splitting curves must have only 2 intersections with the clean contour.**

C. **Max Distance: Define the maximum distance between two curves to detect an intersection.**
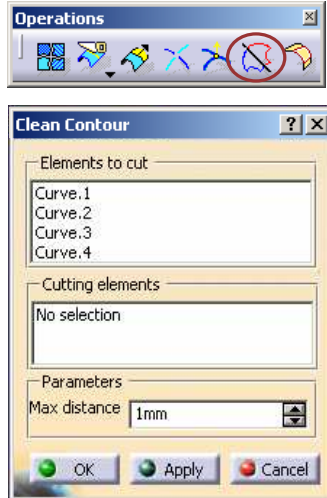
The result is a new geometrical set with modified curves and join surfaces corresponding to new clean contours

CleanContour and splitting curve

Splitting CleanContour

CleanContour split in to two parts
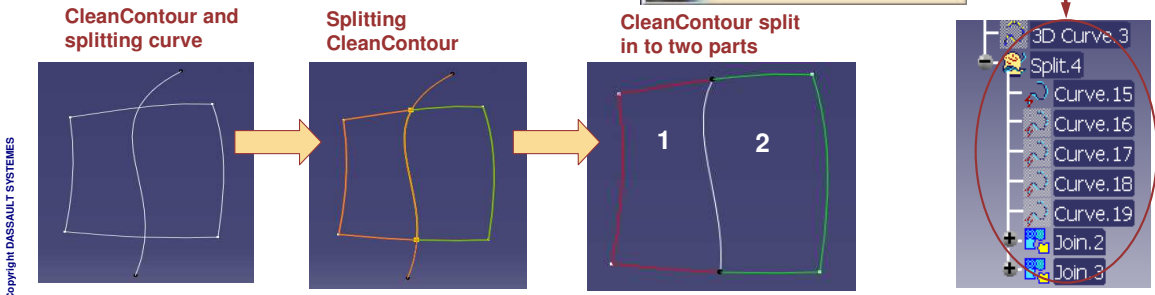
Instructor Notes:

Curve On Mesh (1/3)

This function is used to create a curve on the support mesh.

A. **Support Mesh: Select the Cloud Mesh.**

B. **Parameters: You can specify the Smoothing Tolerance, as well as the maximum order (Max. Order) and maximum number of segments (Max. Segments) of the curve.**

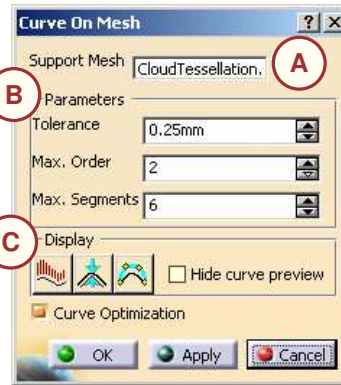**C.** **Display: By selecting the following button you can visualize,**

The curvature analysis of the resulting curve.
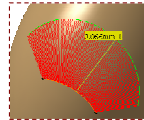
The Maximum deviation of the resulting curve

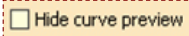**The order and the number of segments of the resulting curve.**

Instructor Notes:

Curve On Mesh (2/3)
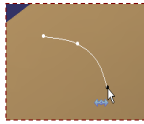
D. **Hide curve preview:** Select the Cloud Mesh.
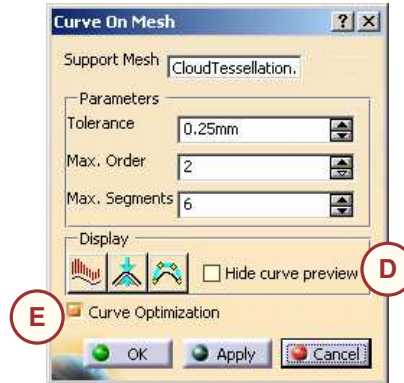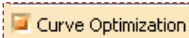
☐ Hide curve preview

By default, the pointer on the mesh indicates the next pick.

By selecting the box, the last picked endpoint is colored in red, and there is no indication of the next pick.

D. **Curve Optimization:** By default the check box is selected.

☑ Curve Optimization

When the mesh support is a large one, you can clear this check box to improve performances during the creation of the curve.
In this case, however, the command will not optimize the number of segments nor the order of the curve, meaning the maximum allowed values you have entered can be reached.
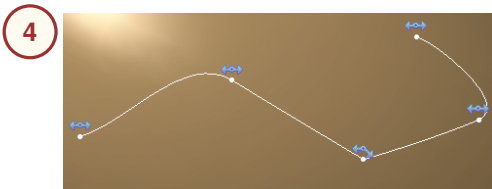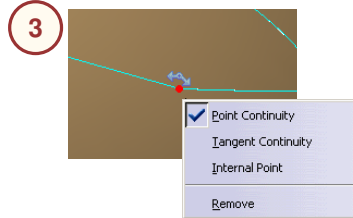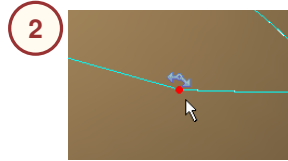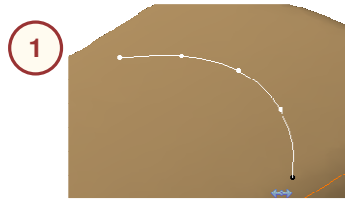
Instructor Notes:

Curve On Mesh (3/3)

Let us create a 3DCurve on mesh.

1.   Select points on a mesh to build the curve.

2.   Press Ctrl key: You can edit the position of the point on the mesh. You can also see the current type of constraint at that point.

3.   Press Ctrl+ Right-click the point: You can edit its continuity type or remove the point.

4.   Press Ctrl+Shift key: You can visualize all the constraints of the current curve.

Support mesh can be multi-cells element.

___

Instructor Notes:

Plastic Bottle

Step 2: Creating Curves

30 min

In this step, you will create curves on the digitized data by smoothing the scans created in step 1 and modifying the resulting curves with Wireframe and Surfaces.
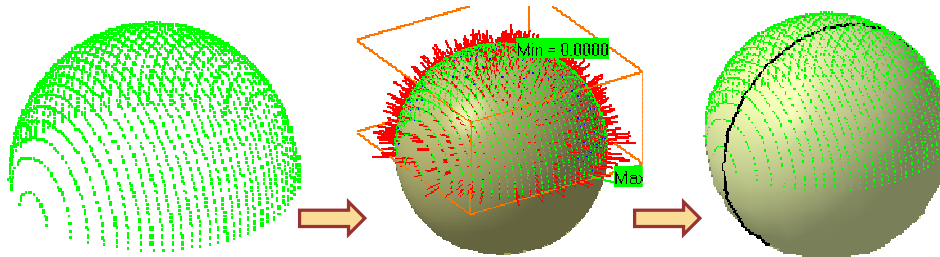
Instructor Notes:

Creating Surfaces

In this lesson, you will learn how to create surfaces.
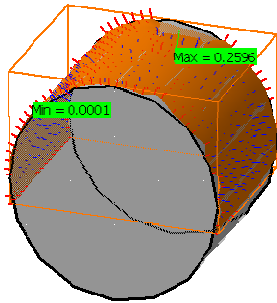
Instructor Notes:
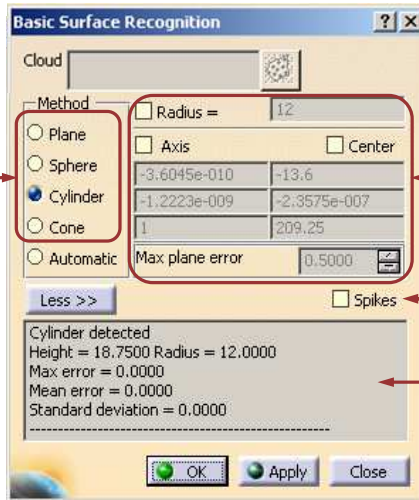
Creating Canonical Surfaces (1/2)

**This function identifies a canonical surface from an area of a cloud.
It creates associative features which can be modified afterwards.**

Choose the expected canonical shape if you know it

Give all known information about the feature to create, for example sphere center or cylinder axis

The deviation can also be visualized with spikes

On clicking APPLY, statistics on the distance between the cloud and the detected canonical shape are given to evaluate the result

**Note: Surfaces can also be created with GSD commands available in QSR
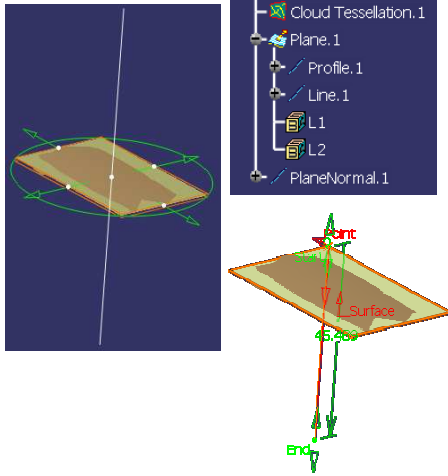For Example: Multi-Section Surfaces**

Instructor Notes:

Creating Canonical Surfaces (2/2)

When creating a plane, by clicking on Apply button the detected plane can be modified by manipulators so that it fits the area (orientate, trim or extend).

It may also be modified afterwards by selecting its components in the specification tree

In other cases the canonical shape can be modified afterwards by selecting its elements in the specification tree
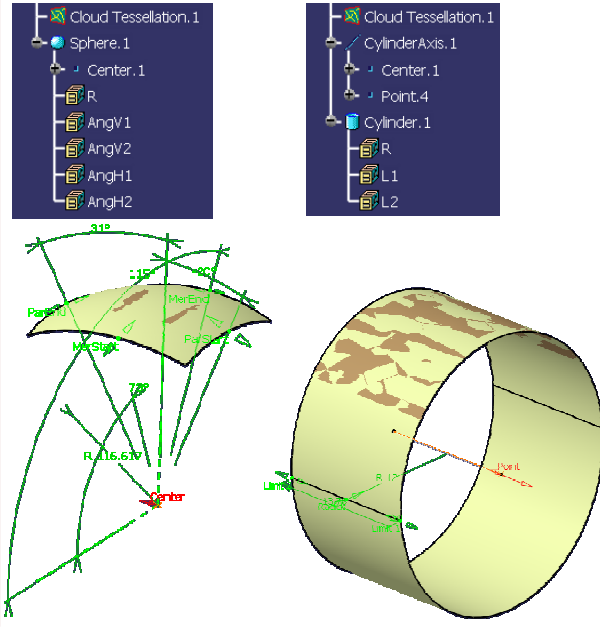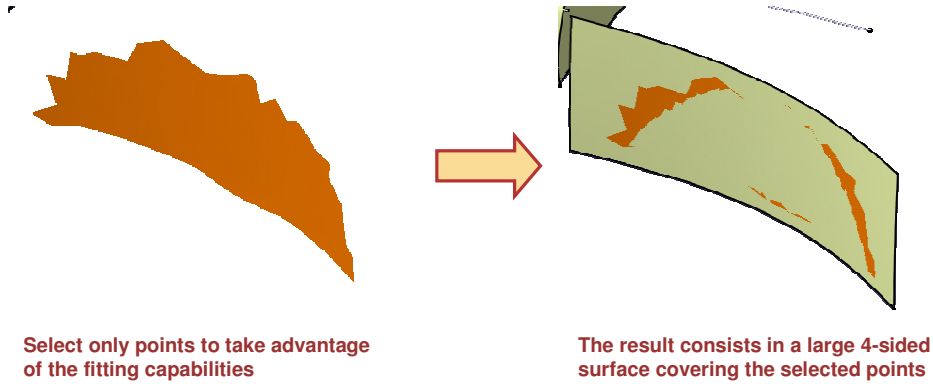
Instructor Notes:

Creating Free Form Surfaces (1/5)

Power Fit combines the power of a filling function and a fitting function.
It approximates a NURBS surface from:

- **A cloud of points: The surface is fitted to the cloud**
- **Boundary curves: The surface is limited by the curves, the boundary curves do not need to define a closed contour.**

If no cloud is given the function works like a Fill. But Power Fit can also create a surface on a cloud with no specified boundary:
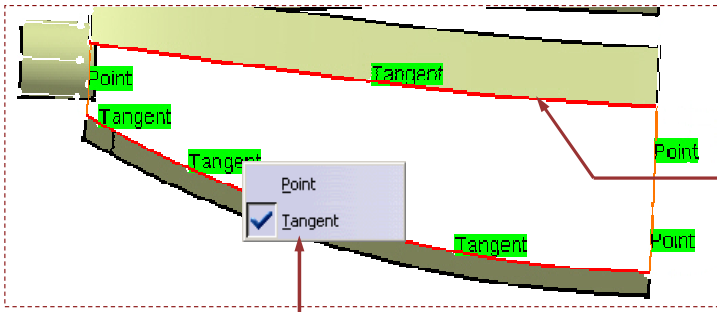

Select only points to take advantage of the fitting capabilities

The result consists in a large 4-sided surface covering the selected points
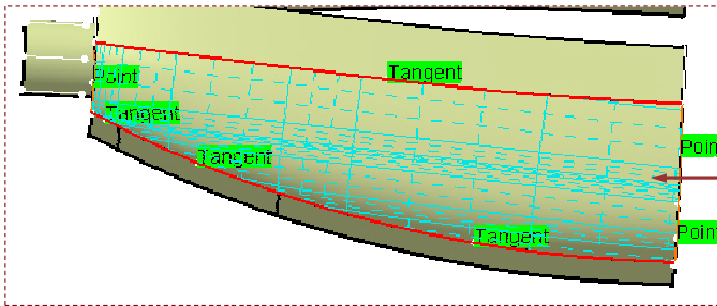
Instructor Notes:

Creating Free Form Surfaces (2/5)

Select a cloud of points and boundary curves to take advantage of both fitting and filling capabilities

Right-click the labels to choose the continuity level

The result is a trimmed surface covering the selected points

The support surface is a regular 4-sided surface

Instructor Notes:

Creating Free Form Surfaces (3/5)

A. **Tolerance: Define maximum deviation expected between the final surface and the points of the selected cloud.**

B. **Cloud: Define the cloud of points (if any). Define an initialization surface if required. The created surface will respect the parameterization of the init surface.**

C. **Init Surface: Define the boundary curves (if any).**

D. **Segments and Order: Define the maximum number of spans in the resulting surface and the order of each span.**

E. **Advanced: Check this option to access the advanced NURBS computation parameters.**

F. Define the use of the boundary curves:

    a. **Constraint: the boundary curves define the surface boundaries (within tolerance)**

    b. **Trim: the surface is computed only by fitting the points. Boundary curves are then projected to the surface and the surface is trimmed by the projection. The distance between the curves and the surface can thus be greater than the tolerance.**

   c. **Selection: the curves are used only to select the points of the cloud that will actually be used for fitting.**
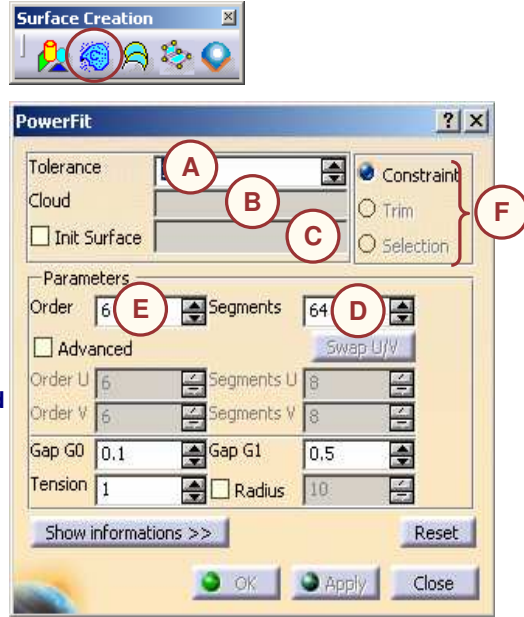
Instructor Notes:

Creating Free Form Surfaces (4/5)

A. **U and V Order: Define the order of the spans in each parametric direction (U,V)**

B. **U and V Segment: Define the maximum number of spans in each direction (U,V)**

C. **G0 and G1 Gap: Choose G0 and G1 gaps to set point and tangency tolerances between neighboring surfaces.**

D. **Tension: Define the surface tension: the value is between 0 and 4, 4 means a flexible surface and 0 a more rigid one.**

E. **Radius: Activate this option to ignore points located in a pipe around the boundary curves. It is useful when curves are not accurately lying on the cloud of points**
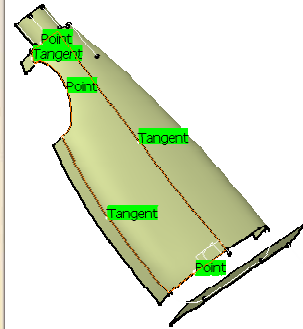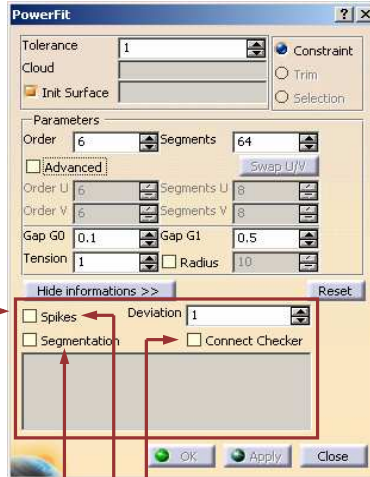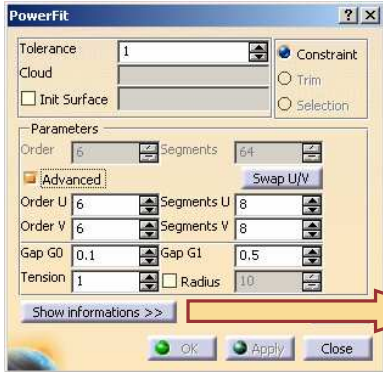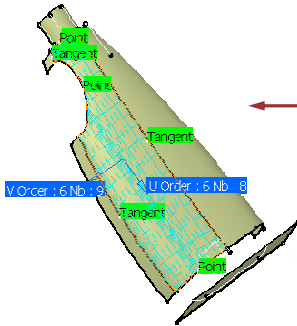

pipe

boundary curves
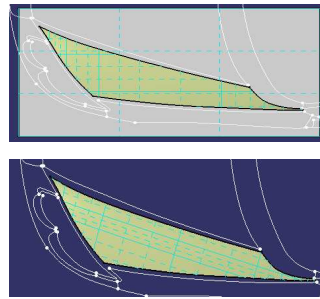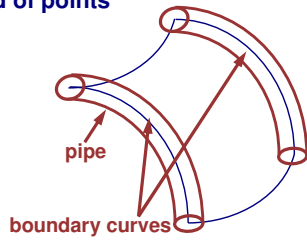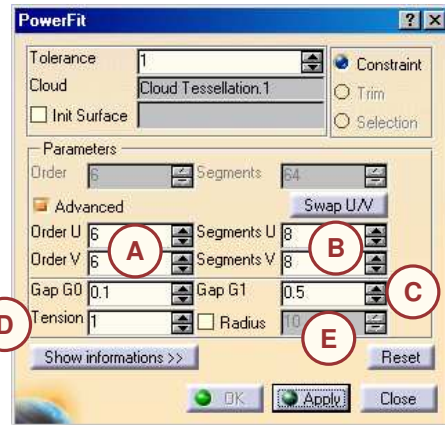
Instructor Notes:

Creating Free Form Surfaces (5/5)

Click Show Information to get more details about the created surface

You can also check the deviation with Spikes or check the connections with neighboring surfaces with Connect Checker

You can display the segmentation to check the parametric distribution of the surface
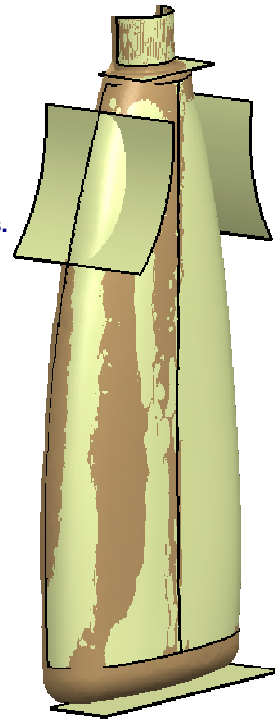
Instructor Notes:

Plastic Bottle

Step 3: Creating Surfaces

30 min

During this step, you will create surfaces on the digitized data by identifying some canonical shape and creating free form surfaces.
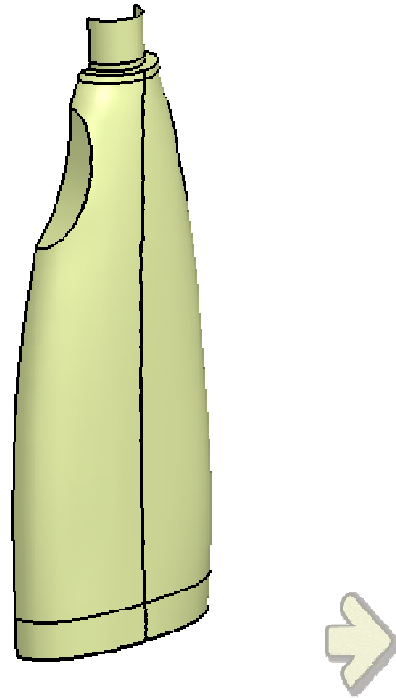
Instructor Notes:

Plastic Bottle

Step 4: Creating the Rough Model

15 min

During this step, you will complete the model by extrapolating and trimming surfaces.
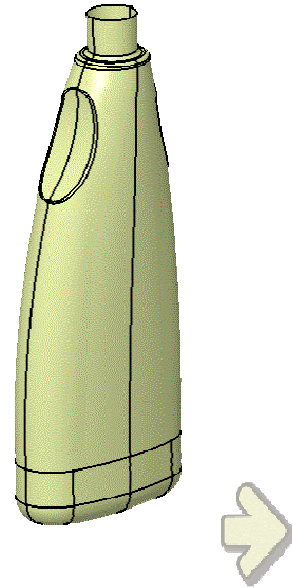
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Instructor Notes:

Plastic Bottle

Step 5: Filleting the Model

20 min

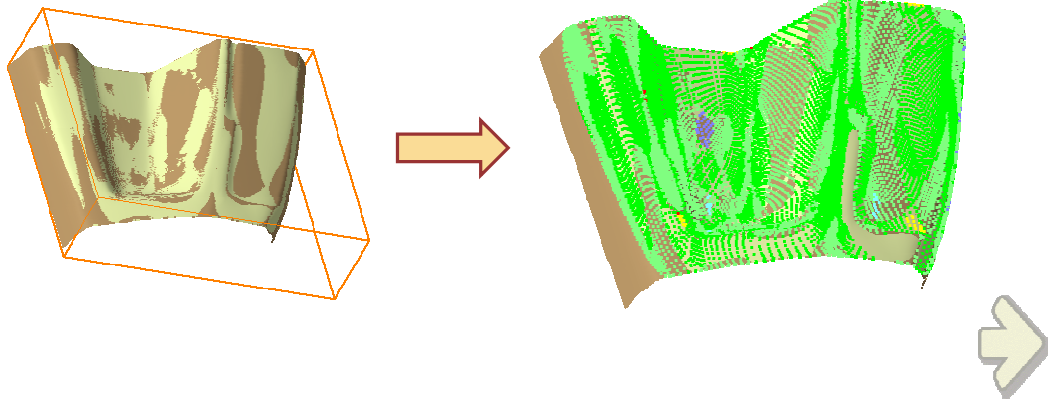**During this step, you will complete the model by filleting edges.**

Instructor Notes:

Checking Deviation

In this lesson you will learn how to:

- *Perform Deviation Analysis*
- *Create annotations on the Deviation Analysis results*
- *Generate reports of the Deviation Analysis*
- *Create curvature mapping*

Instructor Notes:

Performing a Deviation Analysis (1/5)

Deviation analysis computes the geometrical deviation of a data (curve or a surface) from a reference data.
Based on the deviation values, the results are displayed in different colors. Each color represents a range of deviation values.

A. Reference: The reference element for deviation analysis.

B. To measure: The element for which deviation analysis is to be calculated.

C. Parameters:
- **Accuracy: It is a computation accuracy.**
- **Only orthogonal: It displays the points within a common region between two surfaces.**

Reference

To measure

It displays the deviation for whole surface

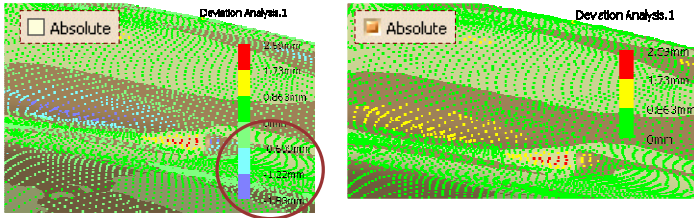**It displays the deviation of common region between two surfaces**
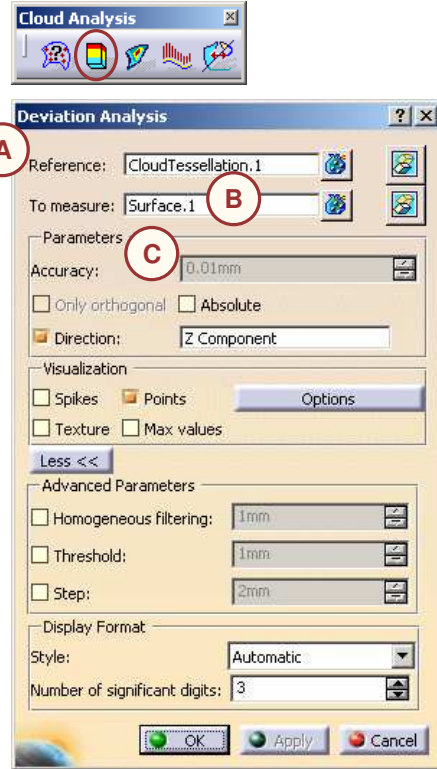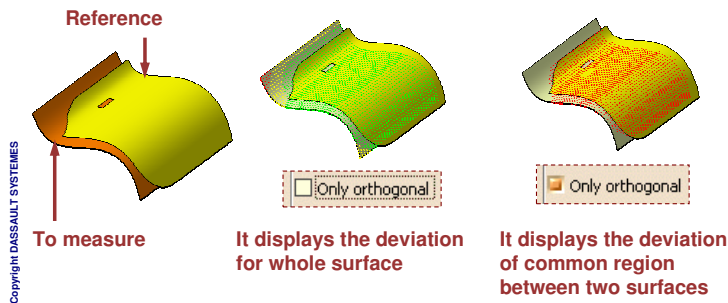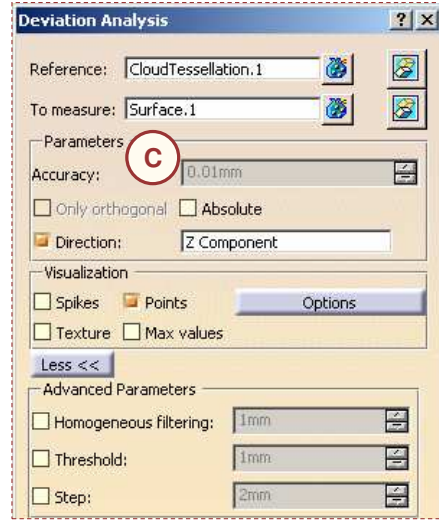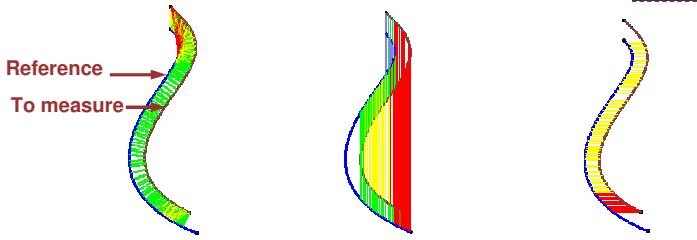
Instructor Notes:

Performing a Deviation Analysis (2/5)

C. Parameters:

- **Absolute: It performs the analysis with positive values only.**

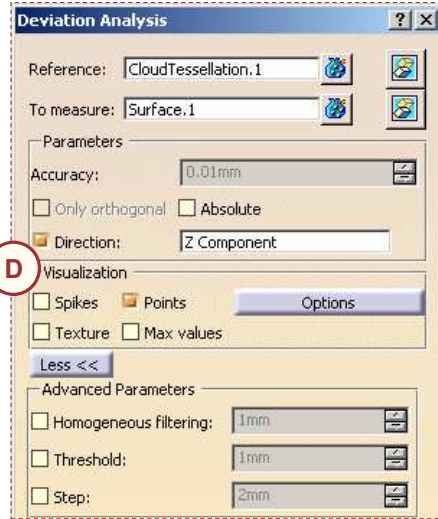- **Direction: It performs the analysis with respect to the specified projection direction.**

Reference
To measure

Instructor Notes:

Performing a Deviation Analysis (3/5)

D. **Visualization:** The options in the visualization field of the dialog box allow you to display the results in various graphical formats.

Spikes

Points

Texture

Positive Max: = 92.2mm   Negatve Max = -102mm

Max values

Deviation Analysis

Reference: CloudTessellation.1

To measure: Surface.1

Parameters

Accuracy: 0.01mm

Only orthogonal   Absolute

Direction: Z Component

Visualization

Spikes   Points   Options

Texture   Max values

Less <<

Advanced Parameters

Homogeneous filtering: 1mm

Threshold: 1mm

Step: 2mm
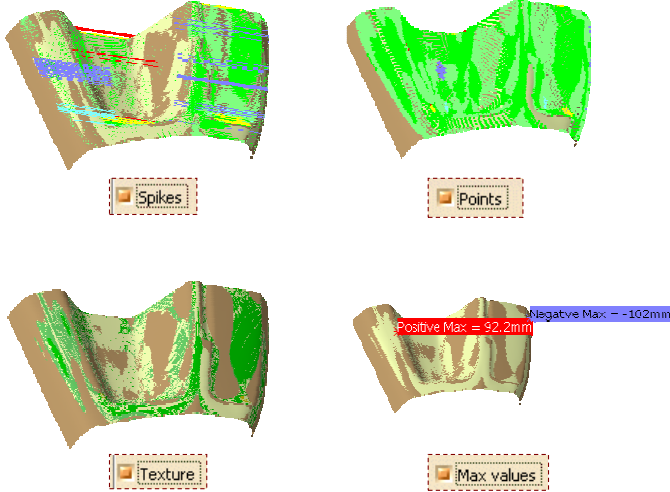
Instructor Notes:

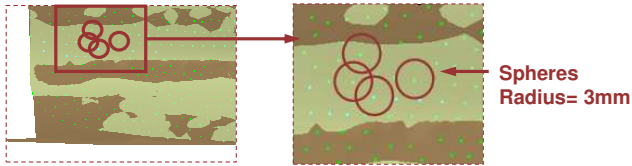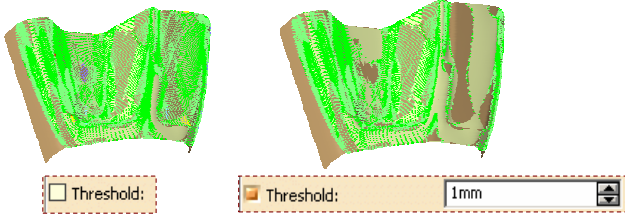# Performing a Deviation Analysis (4/5)

E. Advanced Parameters:
- **Homogeneous filtering: It reduces the number of points using the sphere radius value.**

Spheres Radius= 3mm

Homogeneous filtering: 3mm

It only keeps the center point of the sphere

- **Threshold: It removes the points that have a deviation higher than the value specified in the Threshold field.**

Threshold:

Threshold: 1mm

Deviation Analysis

Reference: CloudTessellation.1

To measure: Surface.1

Parameters

Accuracy: 0.01mm

Only orthogonal   Absolute

Direction: Z Component

Visualization

Spikes   Points   Options

Texture   Max values

Less <<

E

Advanced Parameters

Homogeneous filtering: 1mm

Threshold: 1mm

Step: 2mm

- **Steps: It controls the length of the discretization triangles for surfaces or volumes, or of the segments for curves.**
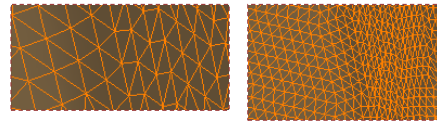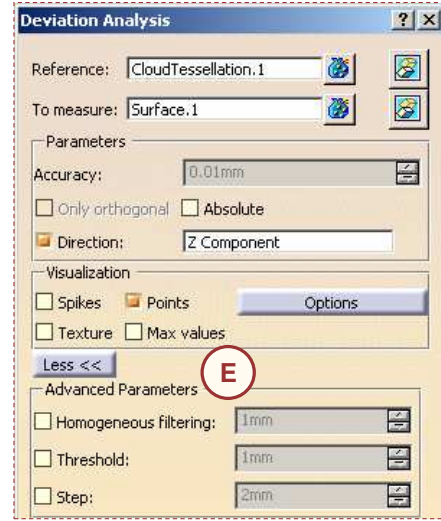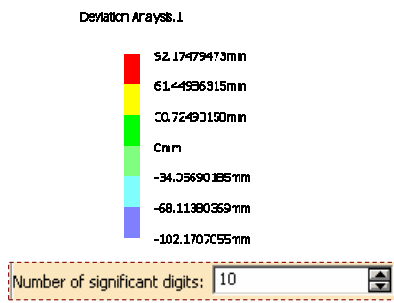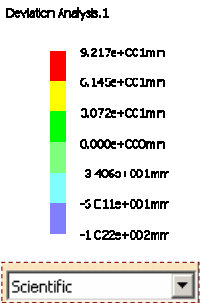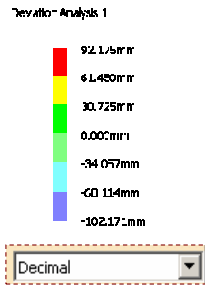
Instructor Notes:

Performing a Deviation Analysis (5/5)

F. **Display Format:** It shows different styles of color scale and controls the decimal digits.

Instructor Notes:

Creating Annotations

Once you have performed a Deviation Analysis, you can create annotations on the Deviation Analysis results. This task will show you how to create Annotations.

◆ **As you select the Annotations tool, a deviation check node and an Annotation set is created in the specification tree.**

◆ **You can create as many Annotation sets as required.**

The Annotation dialog box consists of the following options:

A. Annotation Set: It is a set under which the annotations will be created.

B. Deviation Analysis: It is the analysis on which the annotations will be created.

C. Display: It displays the display format of the annotations.
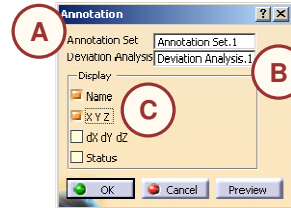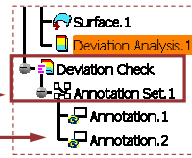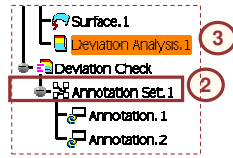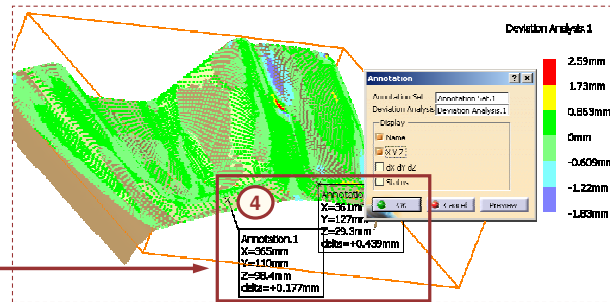
You can annotate the specific point

Instructor Notes:

Creating Deviation Reports

Once you have performed a Deviation Analysis, you can create a Deviation Report from it. Using the various tabs of the Deviation Report dialog box you can specify the information, images, etc., that are to be included in the report.

The Deviation Analysis Report is associative to the Deviation Analysis and the annotations.

HTML File

Instructor Notes:

Creating a Curvature Mapping

This command is able to display a curvature mapping on selecting a mesh. For each vertex, the influent radius (explained below) defines a sphere. All vertices and edges inside this sphere influence the resulting curvature value at this vertex.

The curvature mapping dialog box consists of the following options:

A. **Element:** It is a mesh (cloud data).

B. **Influent Radius:** By default, it is 1/100 of the diagonal of the bounding box or else you can specify it.

C. **Type:** It is the type of curvature to apply from the drop-down list.

- **Maximum and Minimum:** A plane normal to the surface cuts the surface along a curve that has a given curvature in this point.
- **Absolute:** It detects the surface areas where the surface is locally almost flat.
- **Mean:** It is used to detect irregularities and warping on the surface.
- **Gauss:** It describes the local shape of a surface in one point.

Bounding box of the mesh
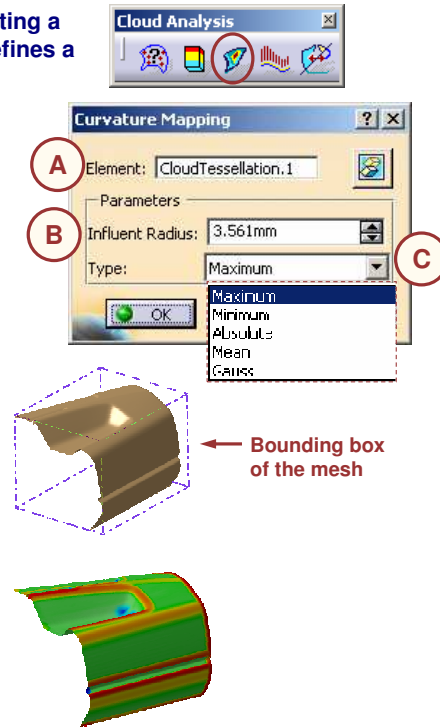
Instructor Notes:

Automatic Processes

In this lesson you will learn the tools like Curve network and Surface network, which helps you to construct the surface more sophisticatedly using Automatic processes.
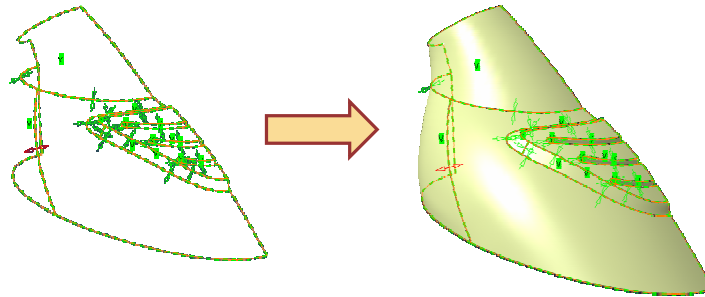
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Instructor Notes:

Creating a Network (1/5)

A network is a set of curves lying on a cloud of points and that divides the cloud into areas which can be filled by a Power Fit.

A. **Add/Remove Curve: List of curves to process. Curves are usually selected by a trap.**

B. **Support: Support cloud: a cloud is necessary for the computation of a network. Only meshes can be used.**

C. **Parameters: Same parameters as in Slice operator for the detection of intersections.**
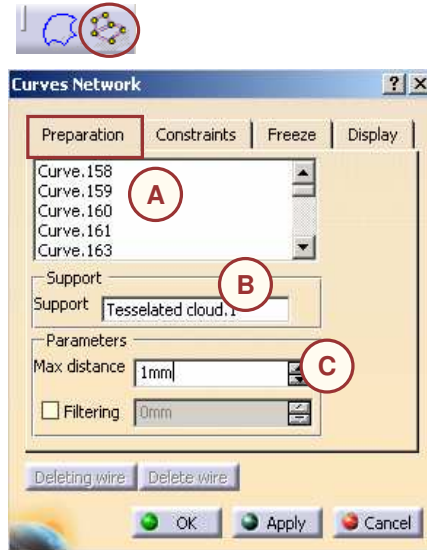
Instructor Notes:

Creating a Network (2/5)

On clicking the Apply button, the following results can be observed:

1. **The detected intersections are shown by green dots.**
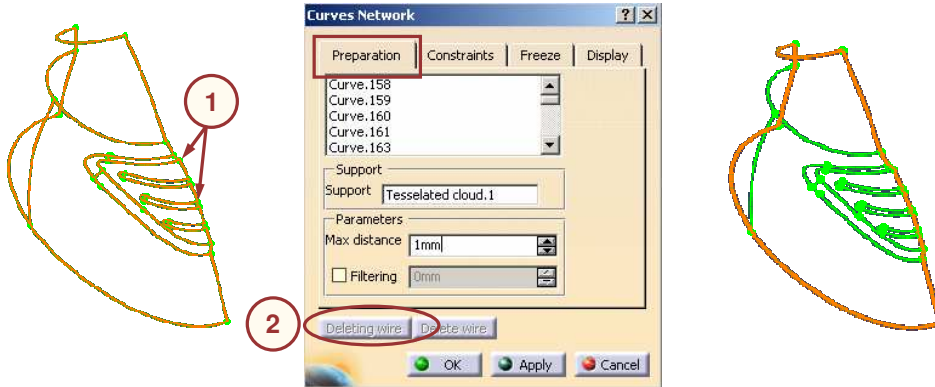
2. **A new button 'Deleting wire' appears. It must be used when the network to create is not closed (i.e. the surface to create is not closed). Click it to access the delete wire mode, the greatest cell of the network is highlighted. Select other curves if you want to delete another cell. Click it once again, the cell to delete is defined.**

Instructor Notes:

Creating a Network (3/5)

A. **Node tolerance: Usually same as Max distance.**

B. **Automatic tangency: Detects tangent curves up to the given threshold value and preserves detected tangency during network creation. The detected tangencies are shown by cyan lines. If all the expected tangencies have not been detected, you can increase the value of the threshold angle.**

C. **Projection on support: When activated, all the network curves are projected (normal projection) onto the support cloud within the specified tolerance.**

D. **Global Deformation: With the Global deformation option you can change the shape of the adjusted curves.**
   - **Local: The deformation is distributed on 1/3 of the curve.**
   - **Global: The deformation is spread all along the curve.**

E. **Default constraints: Reset all parameters to their default values.**
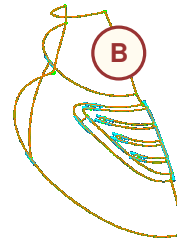
Instructor Notes:

Creating a Network (4/5)

List of Curves to freeze: Curves are usually selected one by one with this option. The frozen curves will remain the same after the creation of the network

A. **Distance at Nodes:** Display of gap between each couple of input curves, at the nodes.

B. **Curve- Curve Deviation:** Expected number of points within tolerance = the subdivision process stops when the value in % is reached.

C. **Curve-Mesh Deviation:** Display of the deviation between the mesh support and curve network.

D. **Curvature:** Display of the curvature along curve network's edges.

E. **Max. Deviation:** For Ⓑ and Ⓒ, possibility to display the Max deviation

F. **Spike Density:** You can modify the spikes scale and/or density for a better visualization.

G. **Display of deviation statistics with the percentage of the network's points which are at a lower distance than the distance set above.**
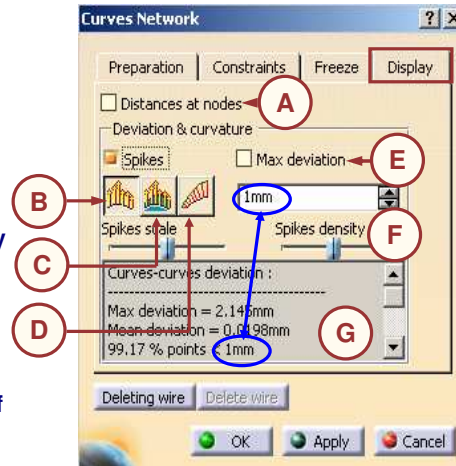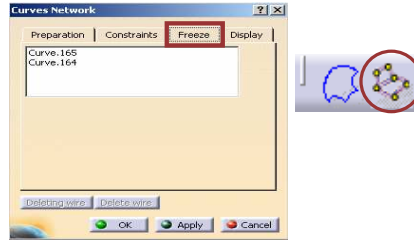
Instructor Notes:

Creating a Network (5/5)

- Avoid situations where a selected curve have two or more intersections with another selected curve (cell with only 2 boundary curves).
  Only one intersection can be taken as a connection.
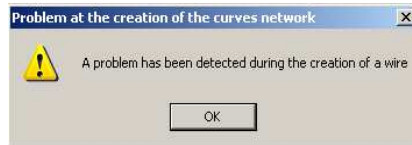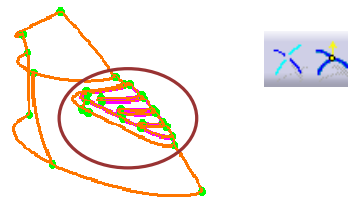 In this case split one of the curves into two curves before creating the network.

- Check the connections marked with a green dot before creating the network.
  - ◆ If an expected connection is not found: increase the value of Max. Distance
  - ◆ If an unexpected connection is found: decrease the value of Max. Distance
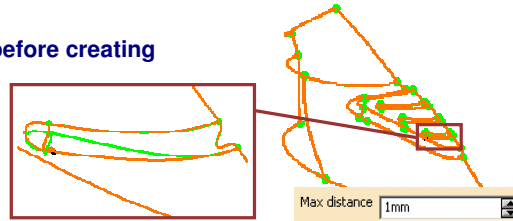
- Sometimes the network cannot be created and an error message is displayed. The curves which cause the failure are highlighted on the model.

  In this case, check the highlighted curves and use Slice and Adjust node to process them manually before creating the network

Max distance 1mm

Problem at the creation of the curves network

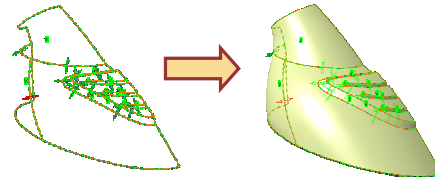A problem has been detected during the creation of a wire

OK

Instructor Notes:

Creating Surface on a Network (1/3)

Once a network has been created, all cells can be filled automatically by surfaces using the Surfaces Network command.

A. **Curve Network: Name of network to fill**

B. **Cloud: Name of support cloud. You may deactivate the option to ignore the cloud.**

C. **Parameters: Same parameters as in Power Fit operator.**

D. **Compute with Ribbons: Compute ribbons: possibility to choose between two possible algorithms.**
   - **If not active: each surface is made tangent to the already computed surfaces. The result depends on the filling order.**
   - **If active: all tangency constraints are computed first, then surfaces are computed using the tangency constraints. The filling order has no impact on the result.**

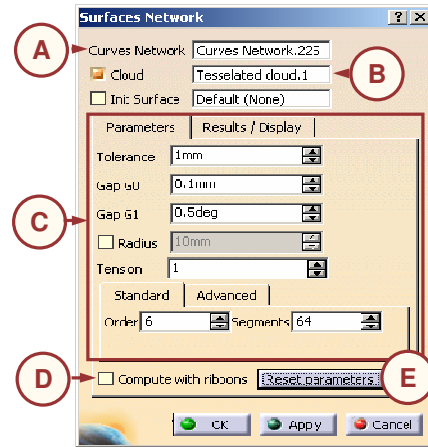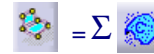**E.** **Reset Parameters: Reset all parameters to their default values**

Instructor Notes:

Creating Surface on a Network (2/3)

Once a network has been created, all cells can be filled automatically by surfaces using the Surfaces Network command.
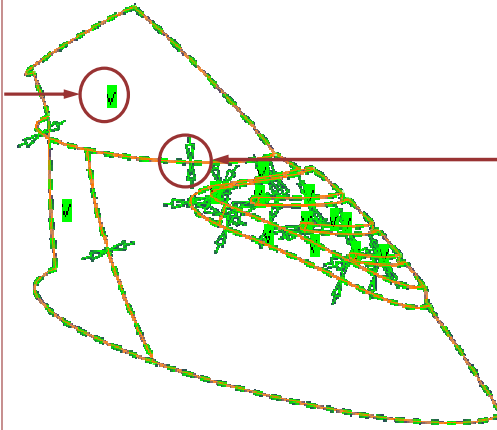
Flags show for each cell of the network if it is selected or not. Only selected cells are filled by surfaces.

You can select or unselect a cell by clicking the flag

selected   *not selected*

A right-click on the flag lets you access more possibilities to select cells of the network

Selected
Not selected
Select all
De-Select all
Swap Selection
Remove Surface

Arrows show the requested level of continuity between neighboring cells.

You change the continuity from point to tangent by clicking the arrow.

point   tangent

A right-click the arrow lets you choose the continuity for the curve or the whole network.

Point Continuity
Tangent Continuity
All Point Continuity
All Tangent Continuity

Instructor Notes:

Creating Surface on a Network (3/3)

- When a surface is created in a cell, it becomes a constraint for the creation of the next surfaces. As a result the filling order has an impact on the result.
  - ◆ You may reduce the impact of the order by checking Compute with ribbons. Then surfaces are no longer used as tangency constraints for following surfaces.
  - ◆ You may also activate only one cell, usually an easy one located near the middle of the model, and compute the surface.Then when you swap the selection, the filling starts from the computed surface. `Compute with ribbons`
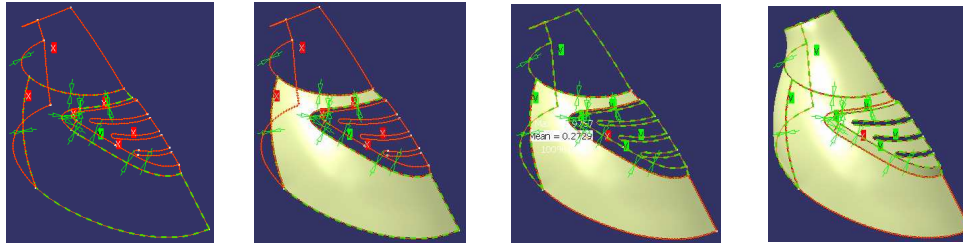
- If the result is OK except for some cells, it may be convenient to remove the bad surfaces and create only the good ones.

  The removed surfaces can be recreated afterwards with PowerFit.
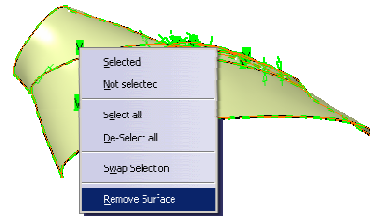
Instructor Notes:

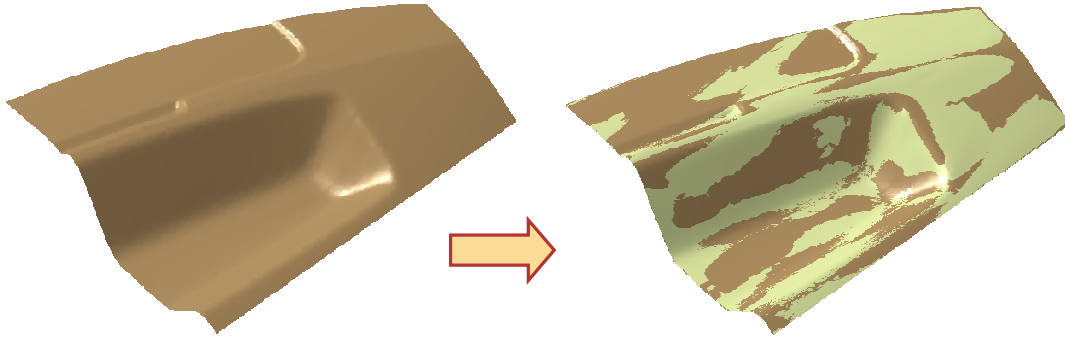# Creating Automatic Surfaces (1/4)

Automatic Surface creates surfaces in one shot on any mesh. It approximates a surface using a subdivision technology.

The resulting surface is made of G1 faces. If the mesh is closed (no free edge) the surface is also closed and can be used directly to create a solid.
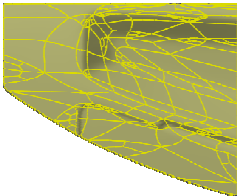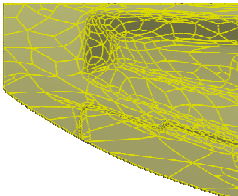
Select a mesh…

A single multi-face surface is created

Instructor Notes:
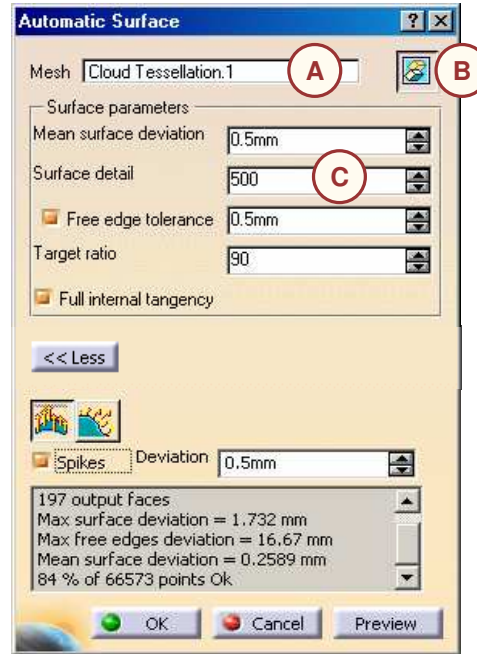
Creating Automatic Surfaces (2/4)

A. **Mesh:** Select the mesh.

B. **Hide/Show mesh to process.**

C. **Surface Detail: Surface detail to increase for tiny shape details.**

Surface detail; to increase for tiny shape details

Surface detail 200   **Surface detail 1000**

Number of facets in subdivision base mesh: increase the value to better reproduce small shape details, but the number of faces also increases (data size increased)

Automatic Surface

Mesh Cloud Tessellation.1 (A) (B)

Surface parameters
Mean surface deviation 0.5mm
Surface detail 500 (C)
Free edge tolerance 0.5mm
Target ratio 90
Full internal tangency

<< Less

Spikes Deviation 0.5mm

197 output faces
Max surface deviation = 1.732 mm
Max free edges deviation = 16.67 mm
Mean surface deviation = 0.2589 mm
84 % of 66573 points Ok

OK   Cancel   Preview

Instructor Notes:

Creating Automatic Surfaces (3/4)

D. Free Edge Tolerance:

Chord error on mesh boundaries; must be activated for open surfaces

Not active   **Active with 1mm**
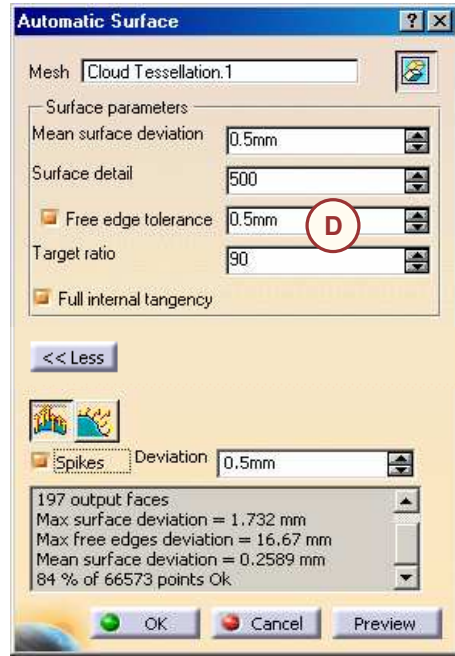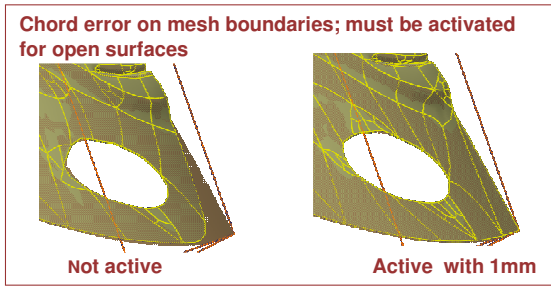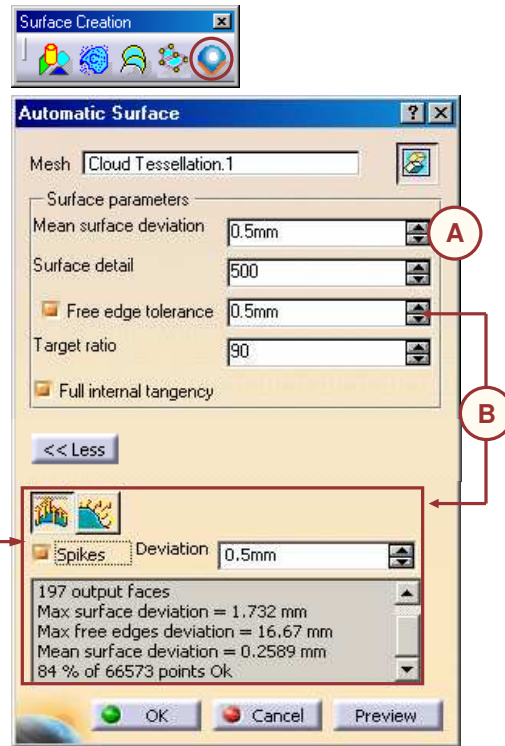

Instructor Notes:

Creating Automatic Surfaces (4/4)

A. **Mean Surface Deviation: Expected tolerance on mesh points given as mean distance between surface and mesh (not max. distance).**

B. **Free Edge Tolerance: Expected number of points within tolerance = the subdivision process stops when the value in % is reached.**

Display options to validate result: you can display deviation as spikes

• **Mesh deviation**

• **Free edge deviation**

Surface Creation

Automatic Surface

Mesh Cloud Tessellation.1

Surface parameters
Mean surface deviation 0.5mm **A**

Surface detail 500

Free edge tolerance 0.5mm **B**

Target ratio 90

Full internal tangency

<< Less

Spikes Deviation 0.5mm

197 output faces
Max surface deviation = 1.732 mm
Max free edges deviation = 16.67 mm
Mean surface deviation = 0.2589 mm
84 % of 66573 points Ok

OK Cancel Preview

Instructor Notes:

Additional Exercises

In this lesson, you will be presented with additional exercices for practice.

- **Exercise: Car Body**
- **Exercise: Toy Plastic Part**
- **Exercise:Washing Powder Bottle**
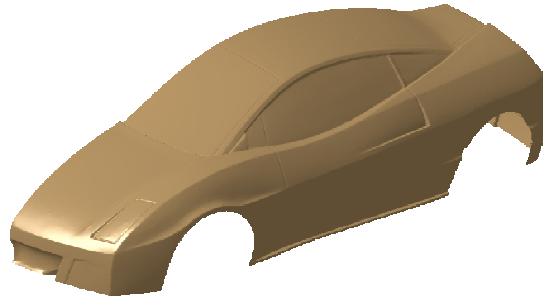
Copyright DASSAULT SYSTEMES

Instructor Notes:

Car Body

Exercise

2 hrs

Starting from a cloud of points, use the Automatic Surface process to rapidly make your model adapted to required precision.
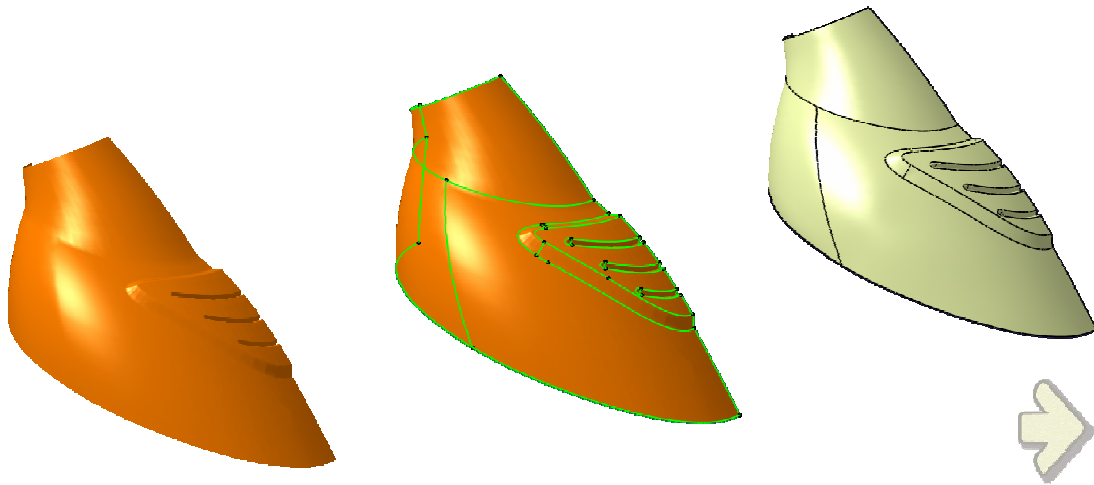
Instructor Notes:

Toy Plastic Part

Exercise

2 hrs

Starting from a cloud of points, rebuild the full model using a full network approach
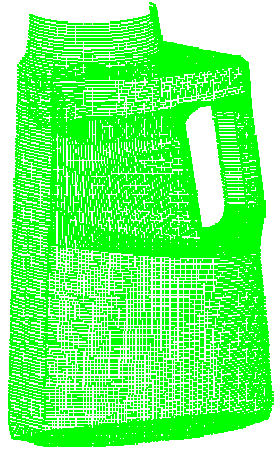

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Instructor Notes:

Washing Powder Bottle

Exercise

2 hrs

Starting from the cloud of points, rebuild the full model using a manual network approach

Instructor Notes:

To Sum Up

In this course you have seen:

- **How to construct a surface using Point Cloud data**

- **How to create Scans using Curvature Analysis and Isoslope Computation**

- **How to create Sketches,Curves from a Scan**

- **How to create Canonical Surfaces and Free Form Surfaces**

- **How to create Curves on network and Surfaces on network**

- **How to create Automatic Surfaces.**

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Instructor Notes: