EXERCISE BOOK

Student Notes:

CATIA V5 Training
Exercises

Quick Surface Reconstruction

Version 5 Release 19
August 2008

EDU_CAT_EN_QSR_FX_V5R19

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Student Notes:

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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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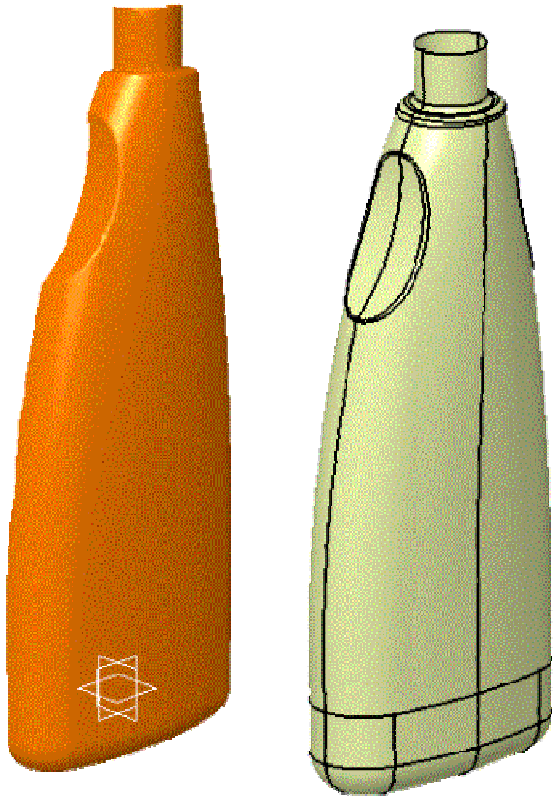
Student Notes:

Design Intent – Plastic Bottle

- The surface must be at 0.5mm max from the point
- Radius for small fillets is 2mm
- Radius for lower fillet is unknown, it has to be measured on the tessellated cloud of points.



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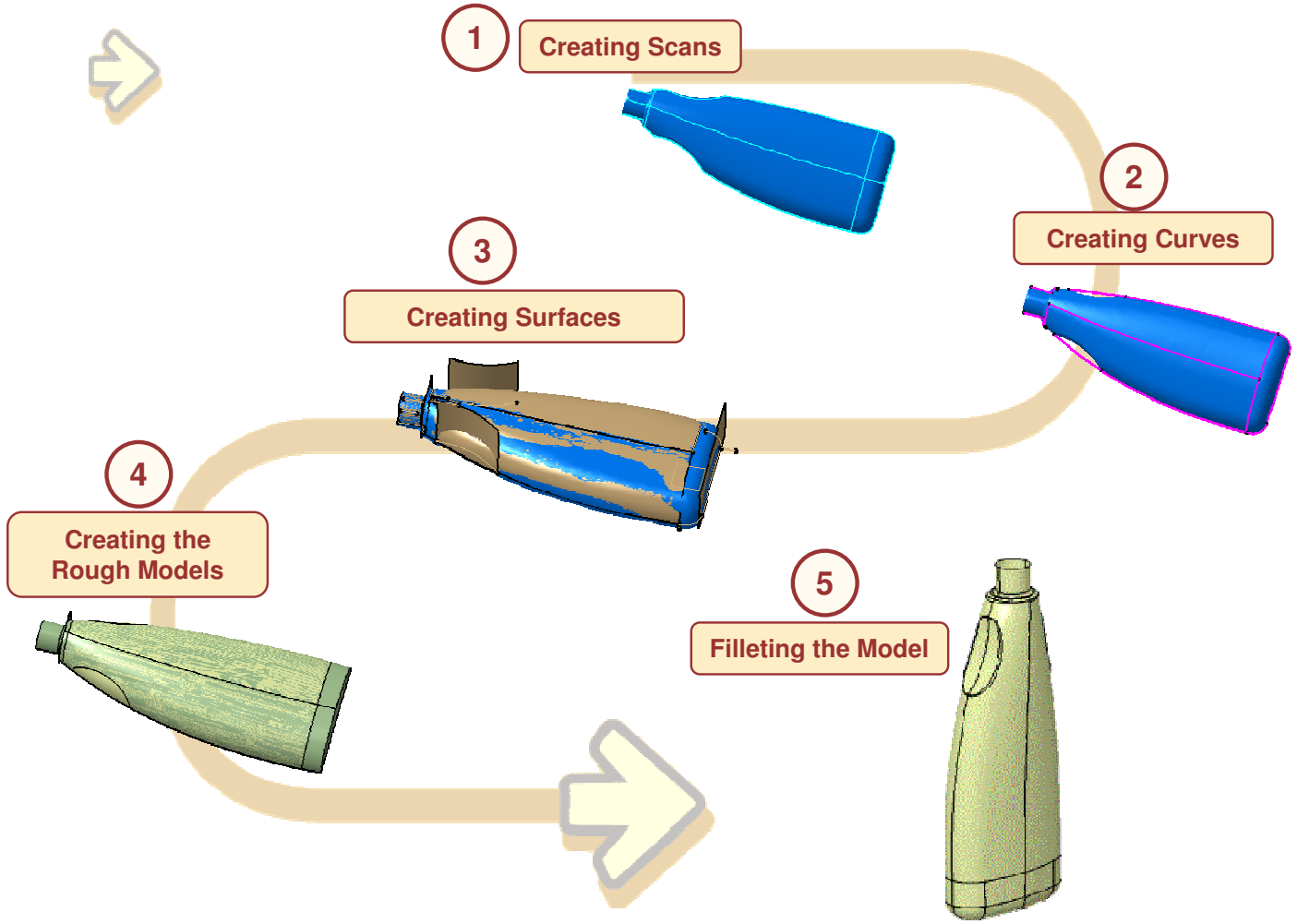
Student Notes:

Design Process – Plastic Bottle



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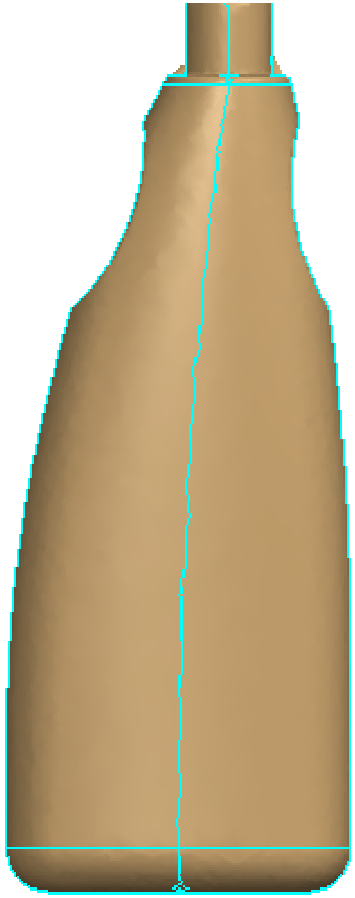
Student Notes:

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.



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Student Notes:

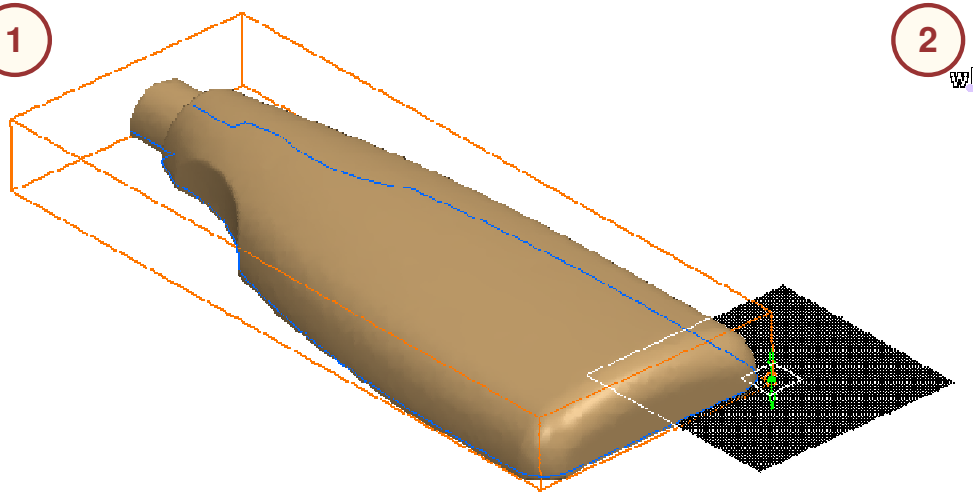
Do It Yourself (1/2)

Part used: Exercise_Plastic_Bottle_step_1_Start.CATPart

1. **Create a scan at the symmetry plane (Y=0).**

2. **Create a scan using the isoslope computation.**
   - **Scan must be the apparent contour of the bottle when looking in the X direction**

1



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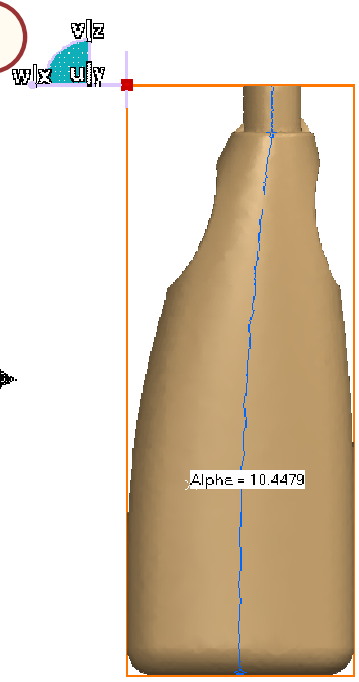

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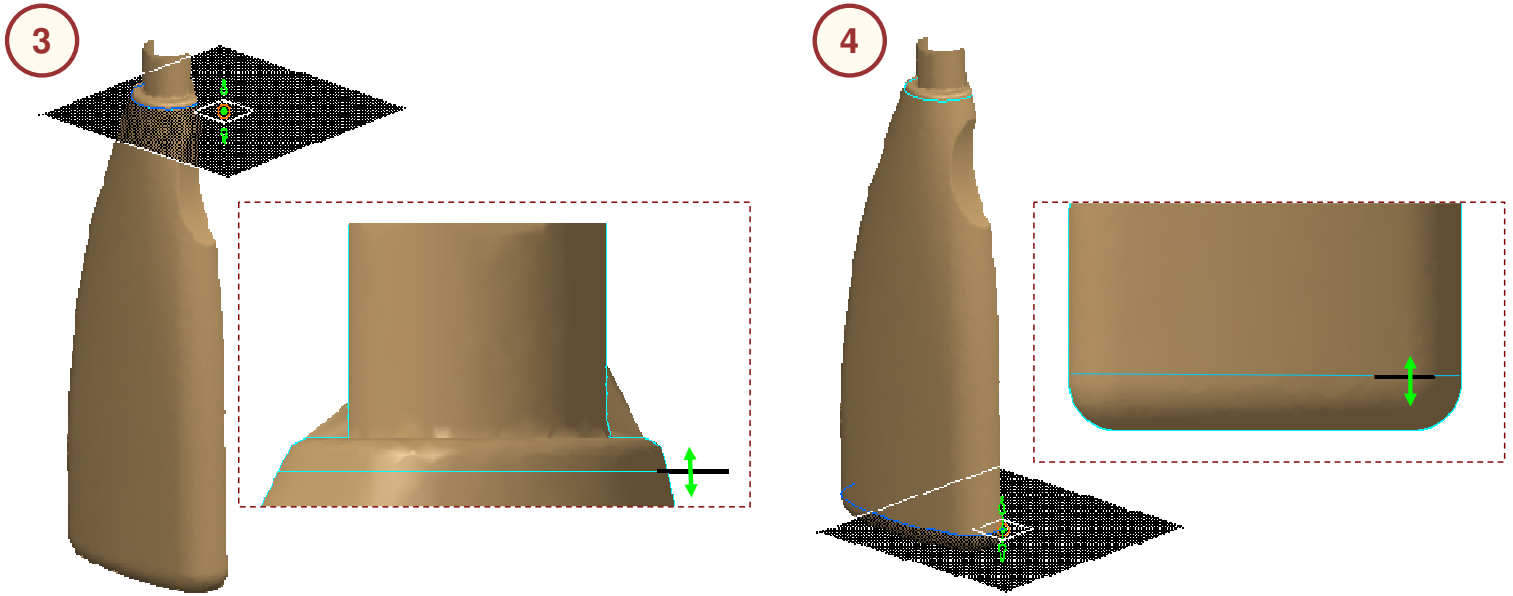
EXERCISE BOOK

Student Notes:

Do It Yourself (2/2)

3. Create a scan below the top fillet

4. Create a scan above the lower fillet



You can compare your results with end Part-Exercise_Plastic_Bottle_step_1_End.CATPart

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Student 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.

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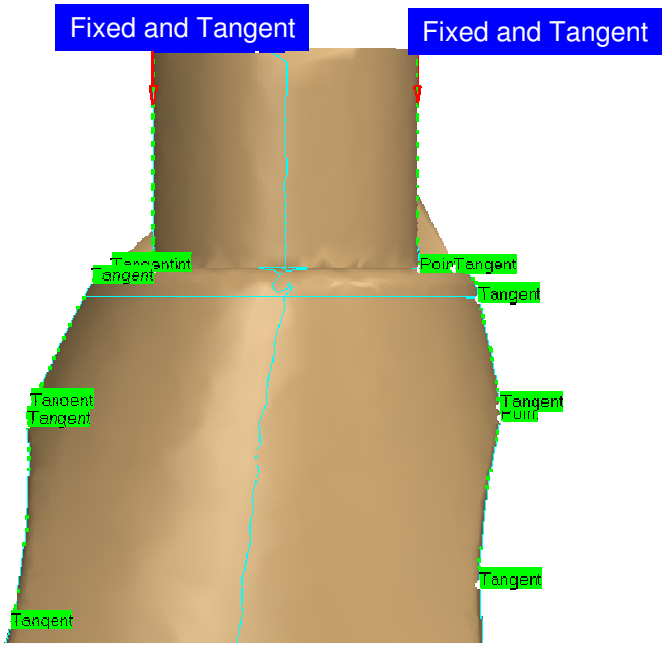
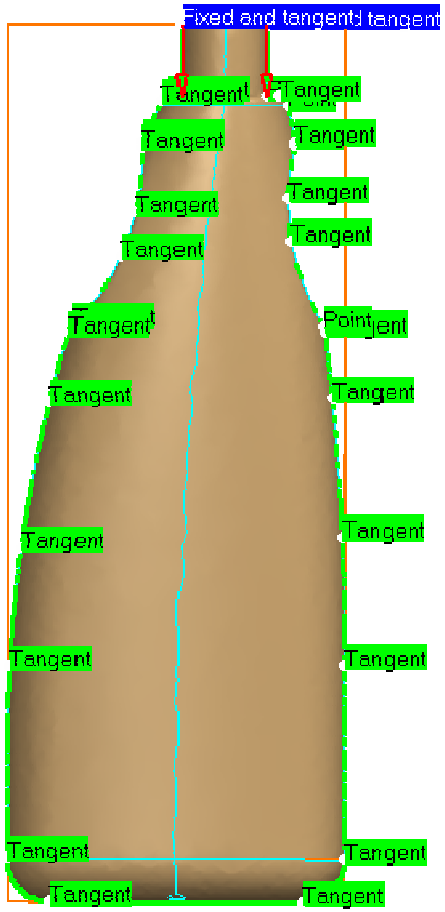
Student Notes:

Do It Yourself (1/3)

Part used: Exercise_Plastic_Bottle_step_2_Start.CATPart

1. **Create curves on the scan in symmetry plane**
   - **Curve must be at 0.5mm max from the points**
   - **Add splitting points as shown**
   - **Set continuities as necessary (point or tangent)**
   - **Impose vertical tangencies at extremities (parallel to Z direction)**





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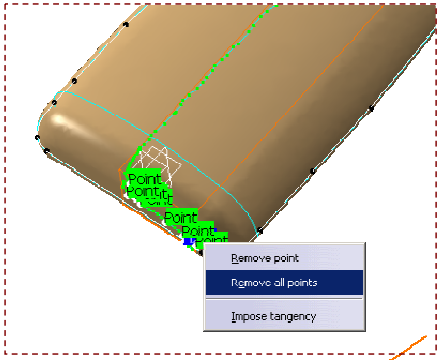
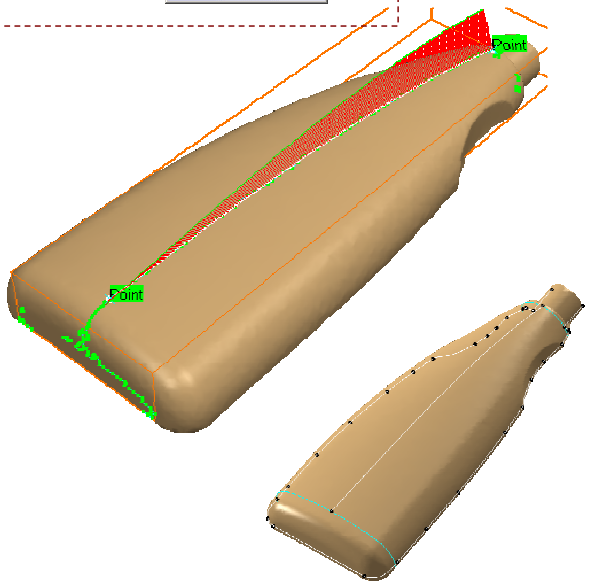
Student Notes:

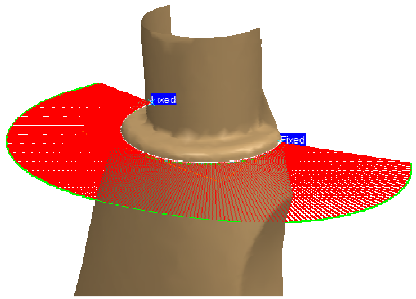
Do It Yourself (2/3)

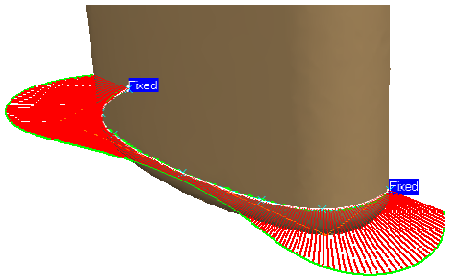
2. Create a curve on the isoslope scan 
   - Curve must be at 1mm max from the points
   - First remove all points and then select two endpoints to create the curve on the body of the bottle
   - Check the curvature evolution





3. Create curves or sketches on the two last scans
   - Curves must be at 0.5mm max from the points





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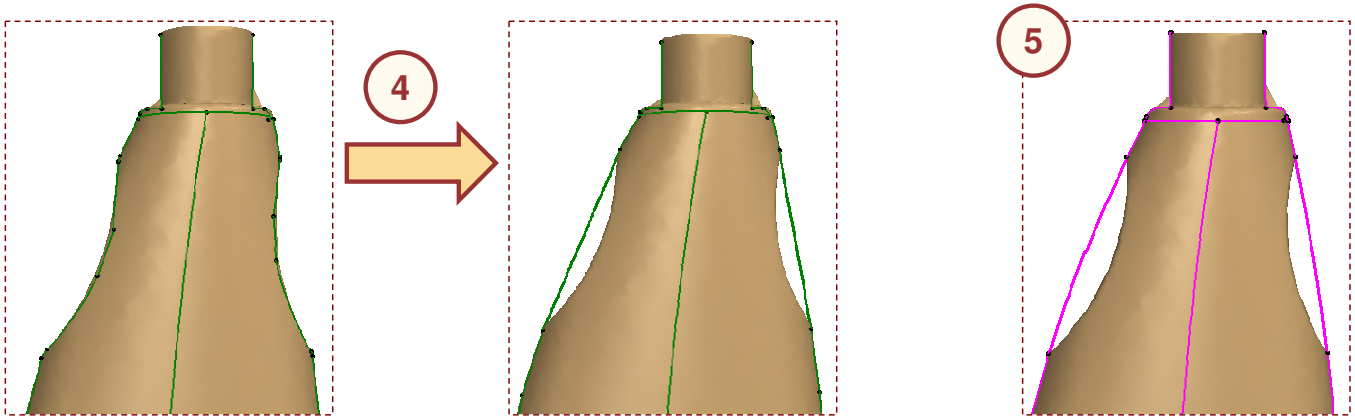
Student Notes:

Do It Yourself (3/3)

4. Replace the curves in the handle areas by blend curves
   - Use 3D Spline or Wireframe and Surfaces connect curve operator.

5. Slice all the curves



You can compare your results with end Part-
Exercise_Plastic_Bottle_step_2_End.CATPart

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EXERCISE BOOK

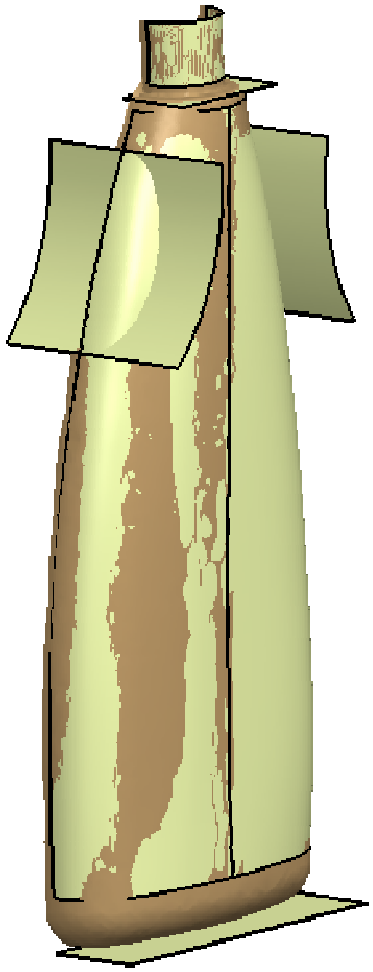
Student Notes:

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.



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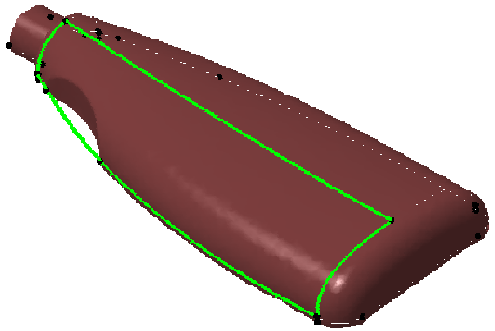
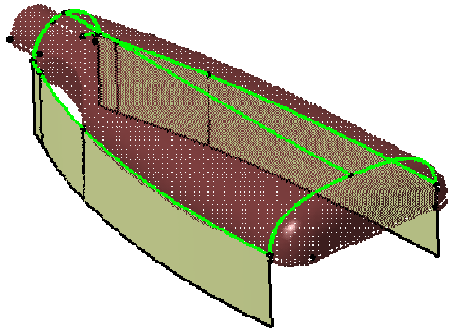
Student Notes:

Do It Yourself (1/4)

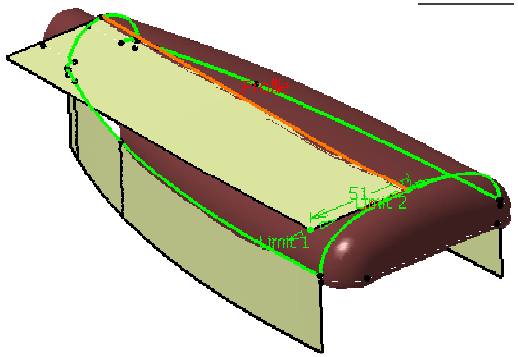
Part used: Exercise_Plastic_Bottle_step_3_Start.CATPart

1. **Create tangency constraints by extruding the curves in the symmetry plane in the Y direction (in a Generative Shape Design workbench).**





2. **Create a tangency constraint along the apparent contour by extruding the curve in the X direction.**



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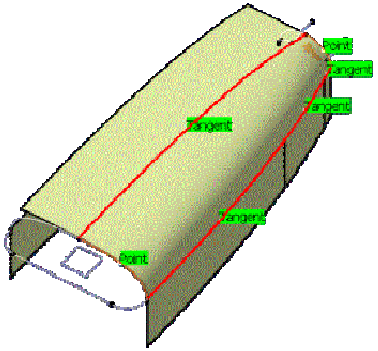
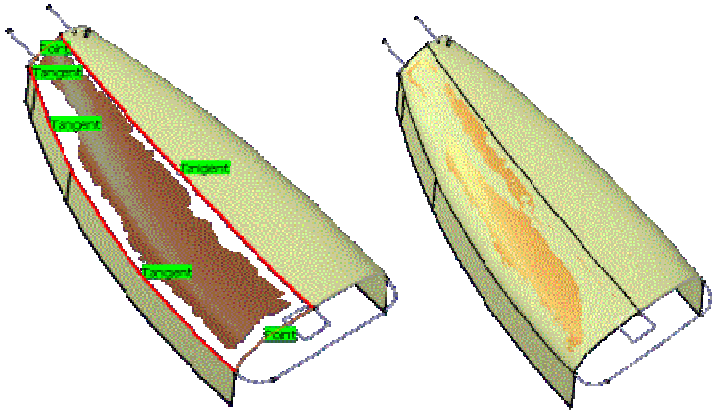
Student Notes:

Do It Yourself (2/4)

3. **Create a first surface on the body** 
   - **Surface must be at 0.5mm max from the points**
   - **Select the curves and the edges of the surfaces as shown.**
   - **Use the extruded surfaces to apply tangent constraints.**





4. **Create a second surface on the body**
   - **Surface must be at 0.5mm max from the points.**

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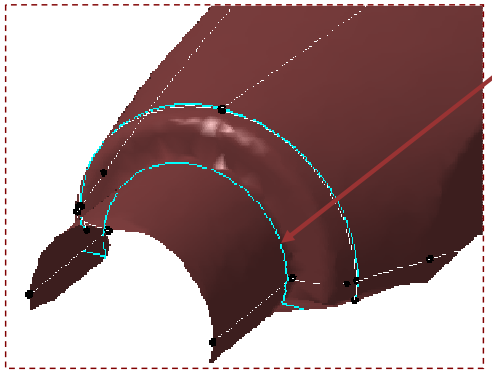
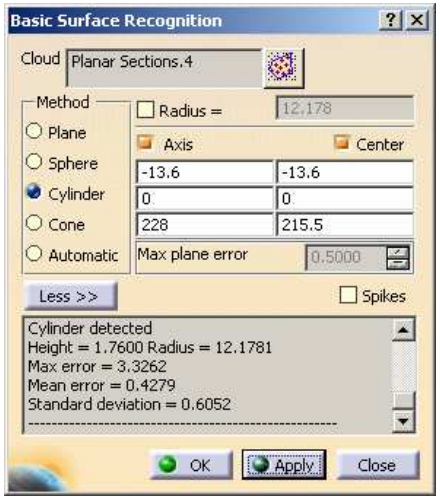
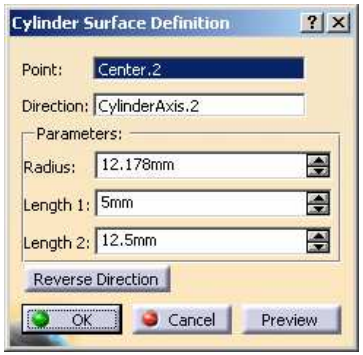
Do It Yourself (3/4)

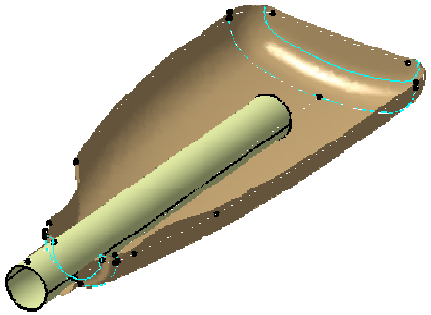
5. **Create a Planar section on the neck area of the Cloud tessellation as shown.**

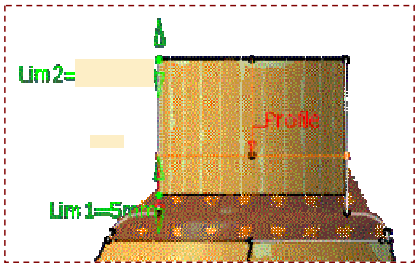




6. **Create a cylinder at the top of the bottle.**
   - **Specify the cylinder parameters as shown in the dialog box**
   - **Change the diameter and length of the cylinder as shown**







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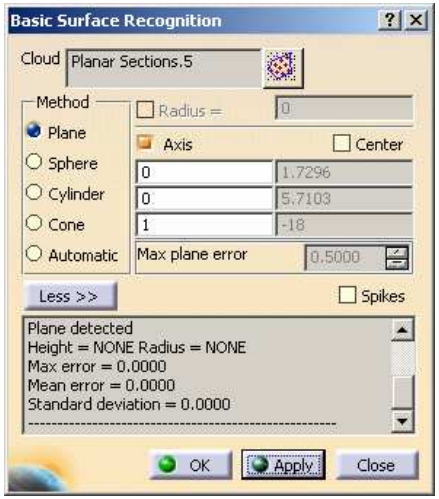
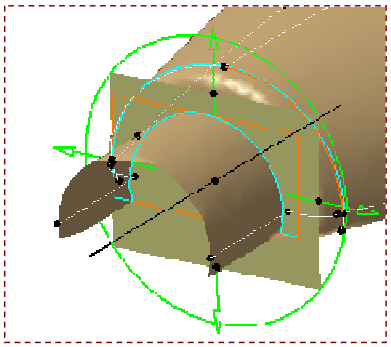
Student Notes:

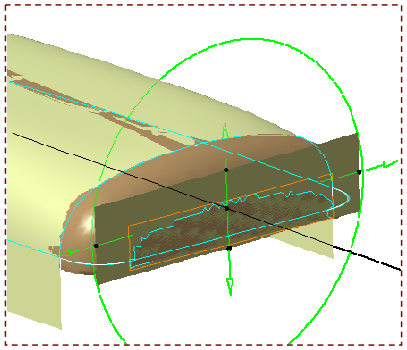
Do It Yourself (4/4)

7. **Create a planar surface between body and top**
   - **Use the previously created Planar Section to create the Planar surface**



8. **Similarly create a planar surface at the lower side of the bottle**
   - **Create a Planar section at the lower of the cloud data to create the planar surface**





9. **Create the surface of the left handle by an extrude in Y direction**

10. **Create the surface of the right handle by an extrude in Y direction**

You can compare your results with end Part-Exercise_Plastic_Bottle_step_3_End.CATPart

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EXERCISE BOOK

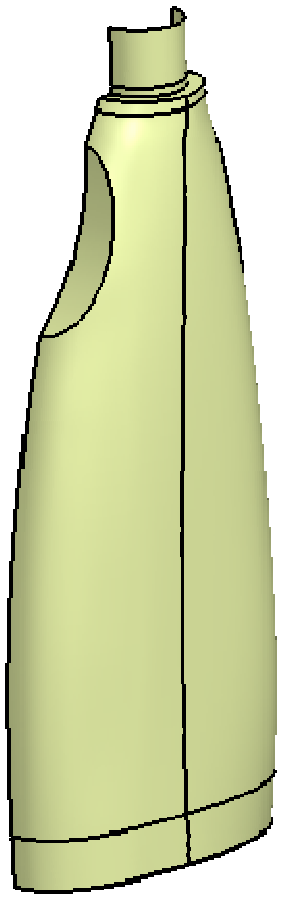
Student Notes:

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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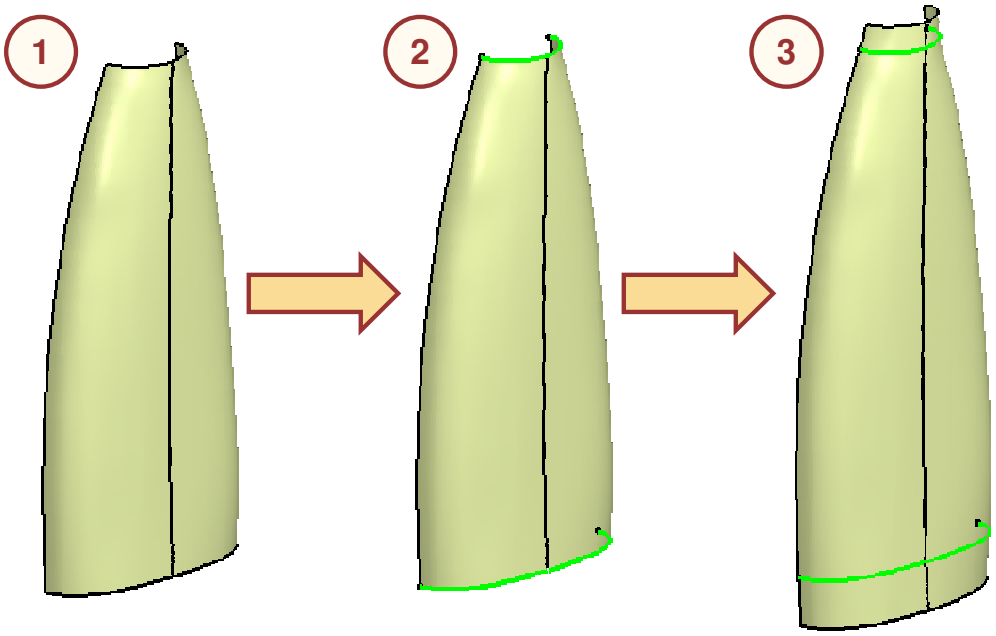
Student Notes:

Do It Yourself (1/2)

Part used: Exercise_Plastic_Bottle_step_4_Start.CATPart

1. Join the two body surfaces 
2. Create top and lower boundaries of the joined surface. 
3. Extrapolate the join surface in +Z and –Z direction to get intersections with the planar surfaces. 



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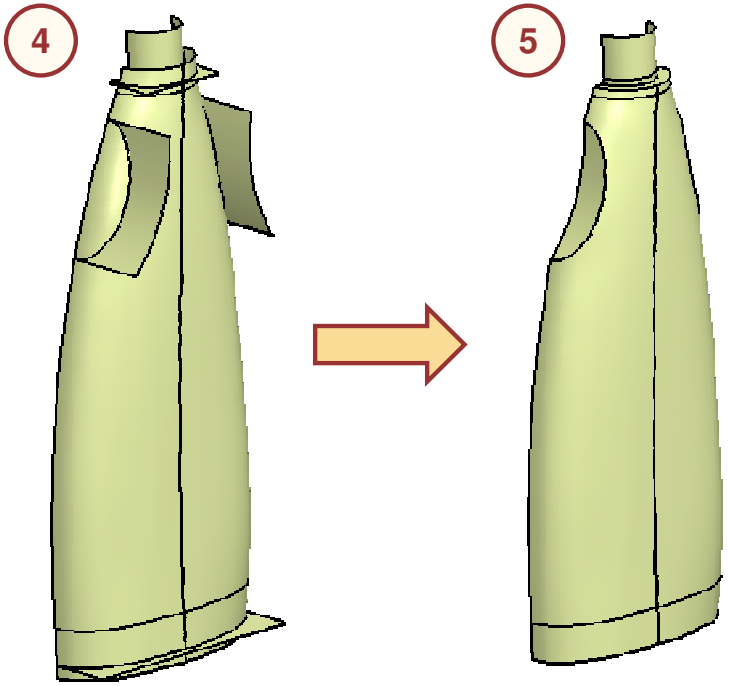
EXERCISE BOOK

Student Notes:

Do It Yourself (2/2)

4. Trim all the elements with each other 

5. Split the final surface by the ZX plane 



You can compare your results with end Part-Exercise_Plastic_Bottle_step_4_End.CATPart

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EXERCISE BOOK

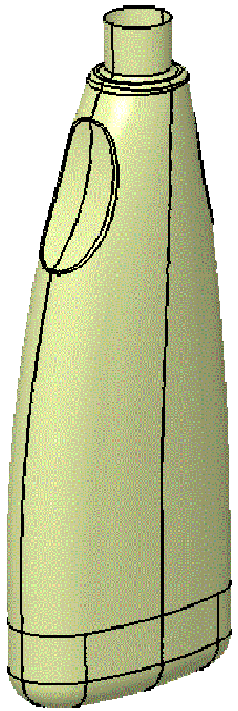
Student Notes:

Plastic Bottle

Step 5: Filleting the Model

20 min

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



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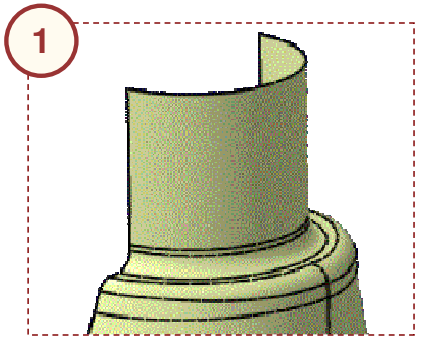
Student Notes:

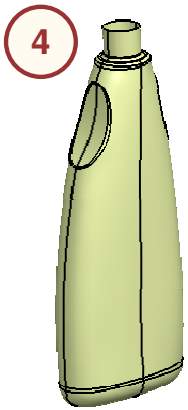
Do It Yourself

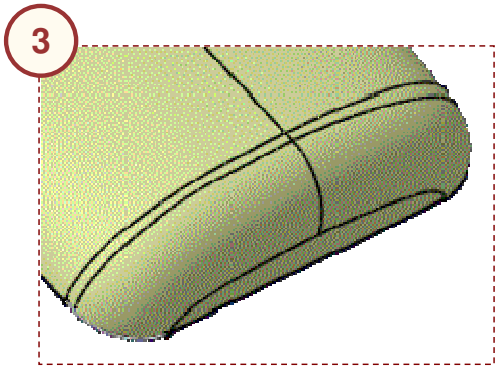
Part used: Exercise_Plastic_Bottle_step_5_Start.CATPart

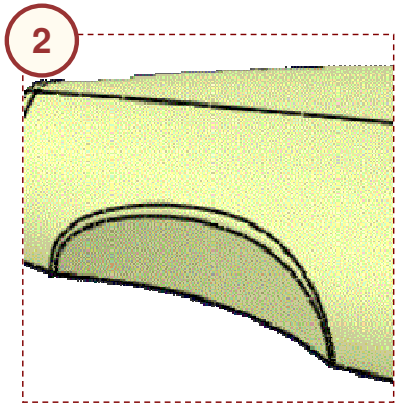
1. Create two 2mm fillets on the top of the bottle in a Generative Shape Design workbench
2. Create two 2mm fillets around the handles
3. Create a 13mm fillet at the bottom.
4. Create a symmetry about ZX plane in a new geometrical set.



You can compare your results with end Part- Exercise_Plastic_Bottle_step_5_End.CATPart







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Student 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

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Student Notes:

Title of First Lesson

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- %tag_child%

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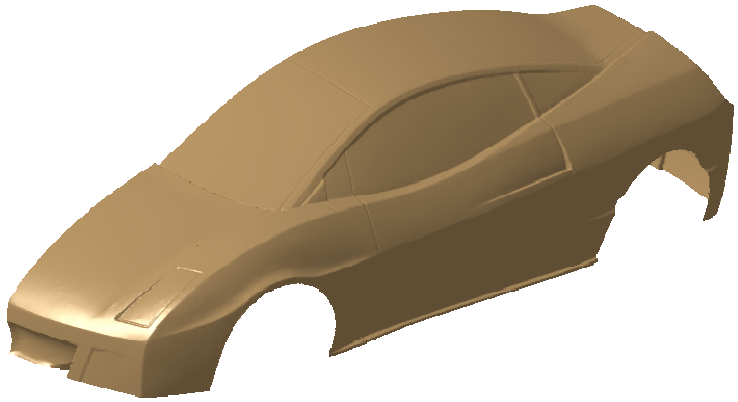
Student Notes:

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.



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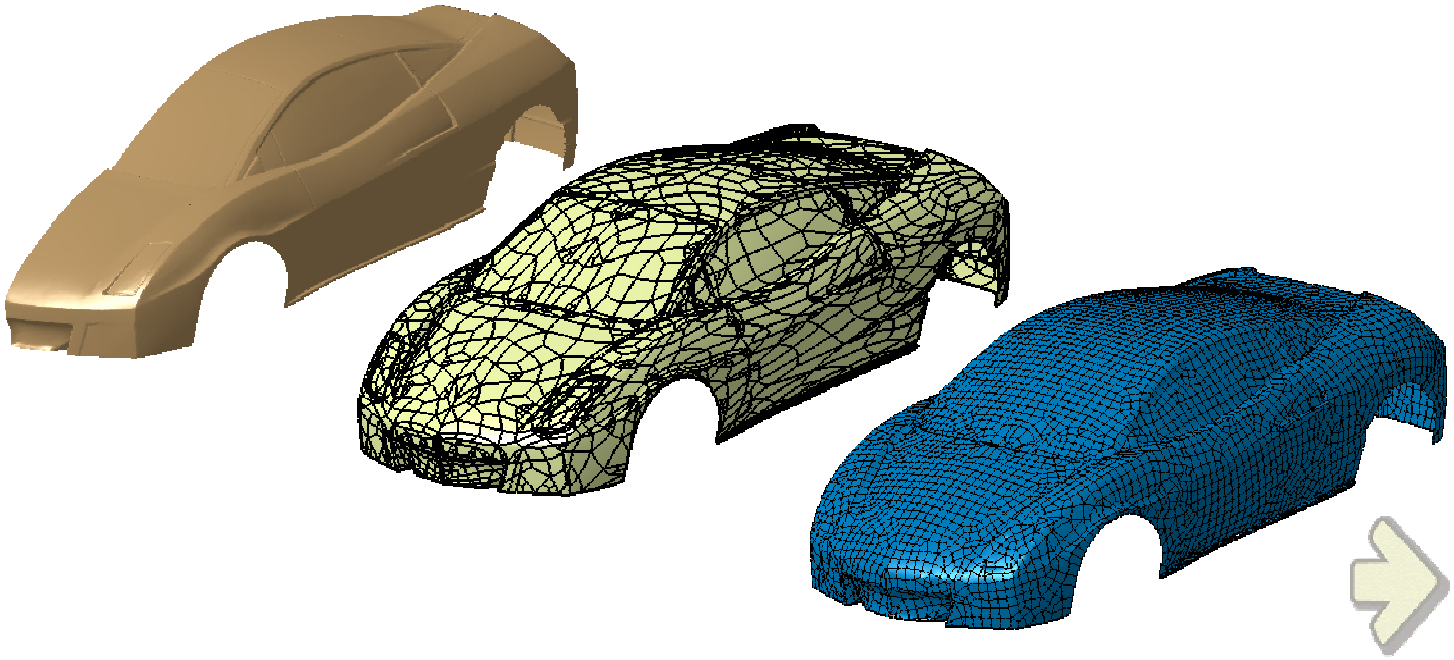
Student Notes:

Design Intent – Car Body

- Mean Surface Deviation must be less than 1mm from the points. Parameter is adaptable depending on the required use of final model.
- Surface quality must be acceptable depending on the required detail and final file size
  - Example: surface for finite element analysis:

1: 5 Scale model



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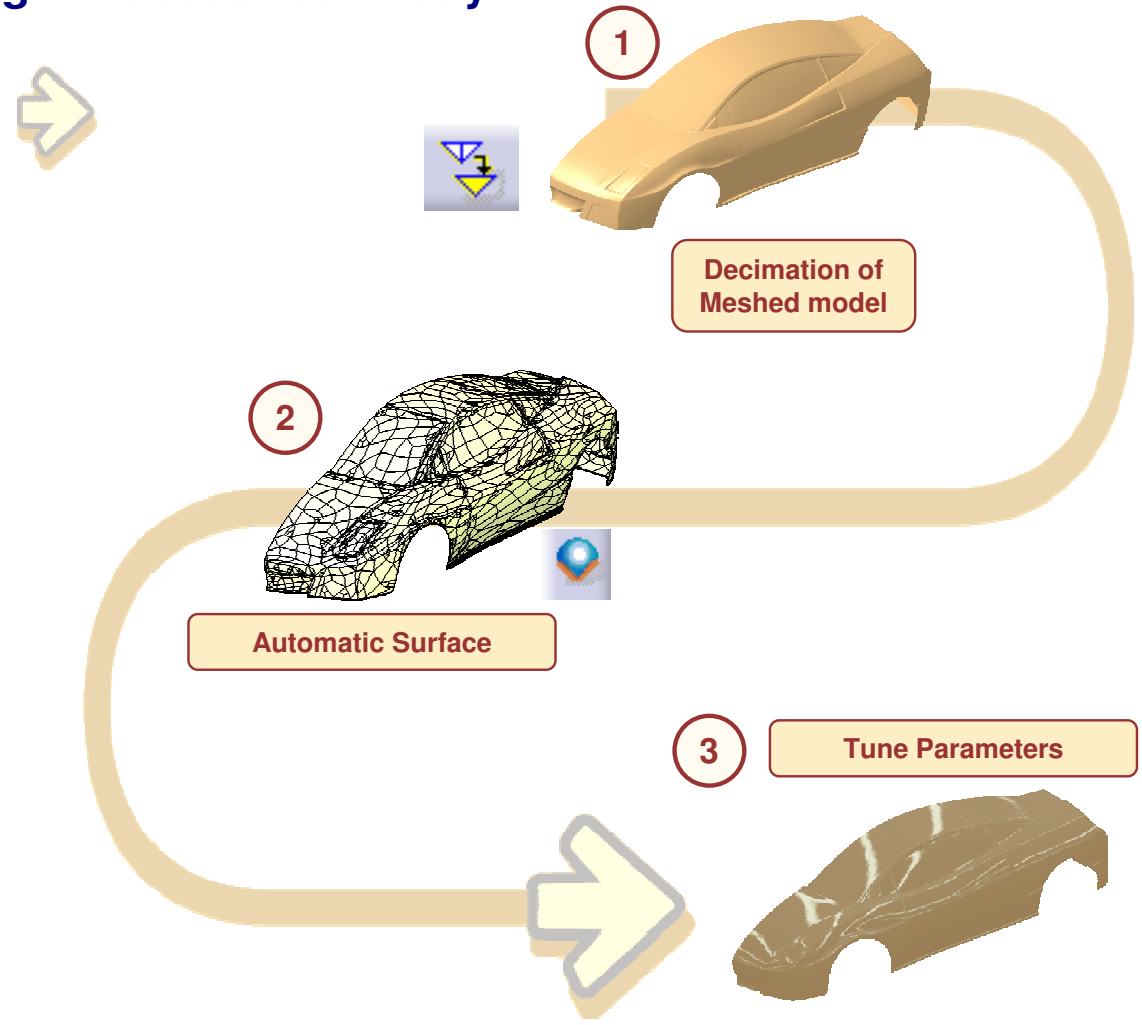
Student Notes:

Design Process- Car Body



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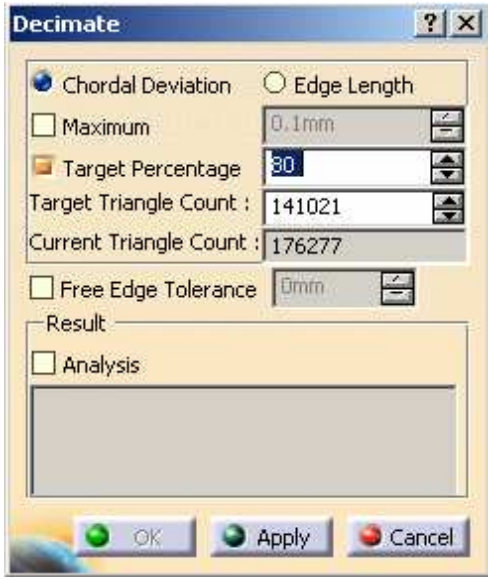
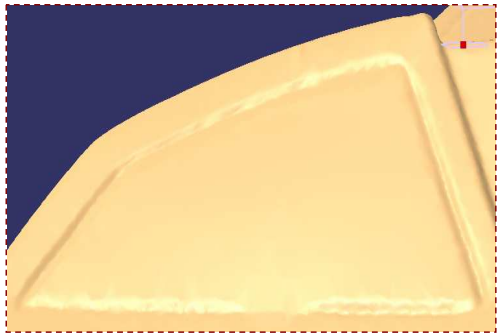
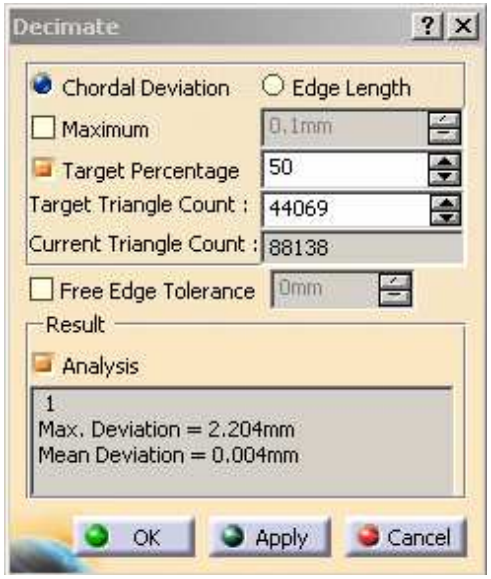
Do It Yourself (1/5)

Part used: Exercise_car_Start.CATPart







In Digitized Shape Editor select Decimation.

1. **Select the meshed model**
2. **Set the Target Percentage to 50%**

Note: advantages of decimating mesh first

- **Processor time**
- **File size**

WARNING: Impossible to reverse the decimation after OK except by Undo.

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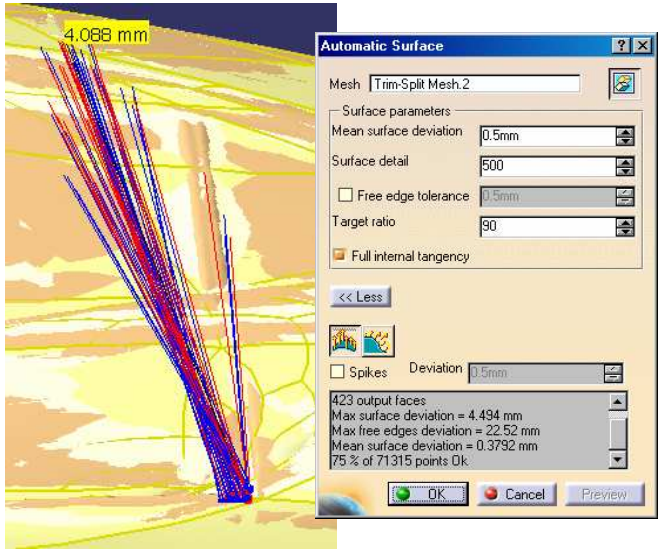
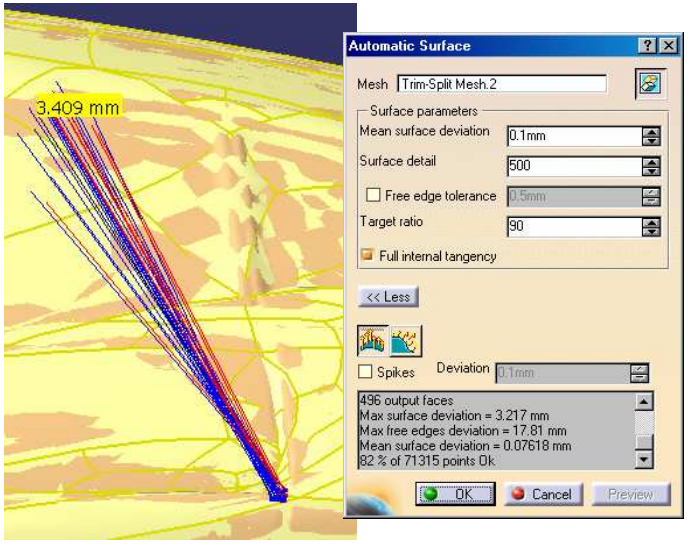
Student Notes:

Do It Yourself (2/5)

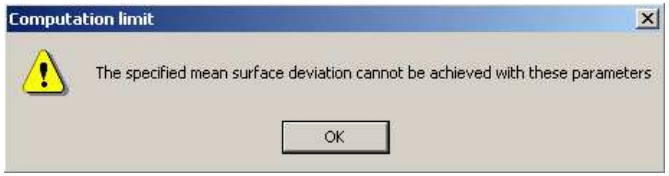
3. Create a Surface

- **Use default setting of Mean Surface Deviation (0.5mm) then adjust to 0.1mm to compare surface tolerance enhancement around small detail objects**
- **Click More to display details of the process and control display of surface deviations.**





Computational Limit dialog box may appear if no surface can be computed with the selected combination of parameters.



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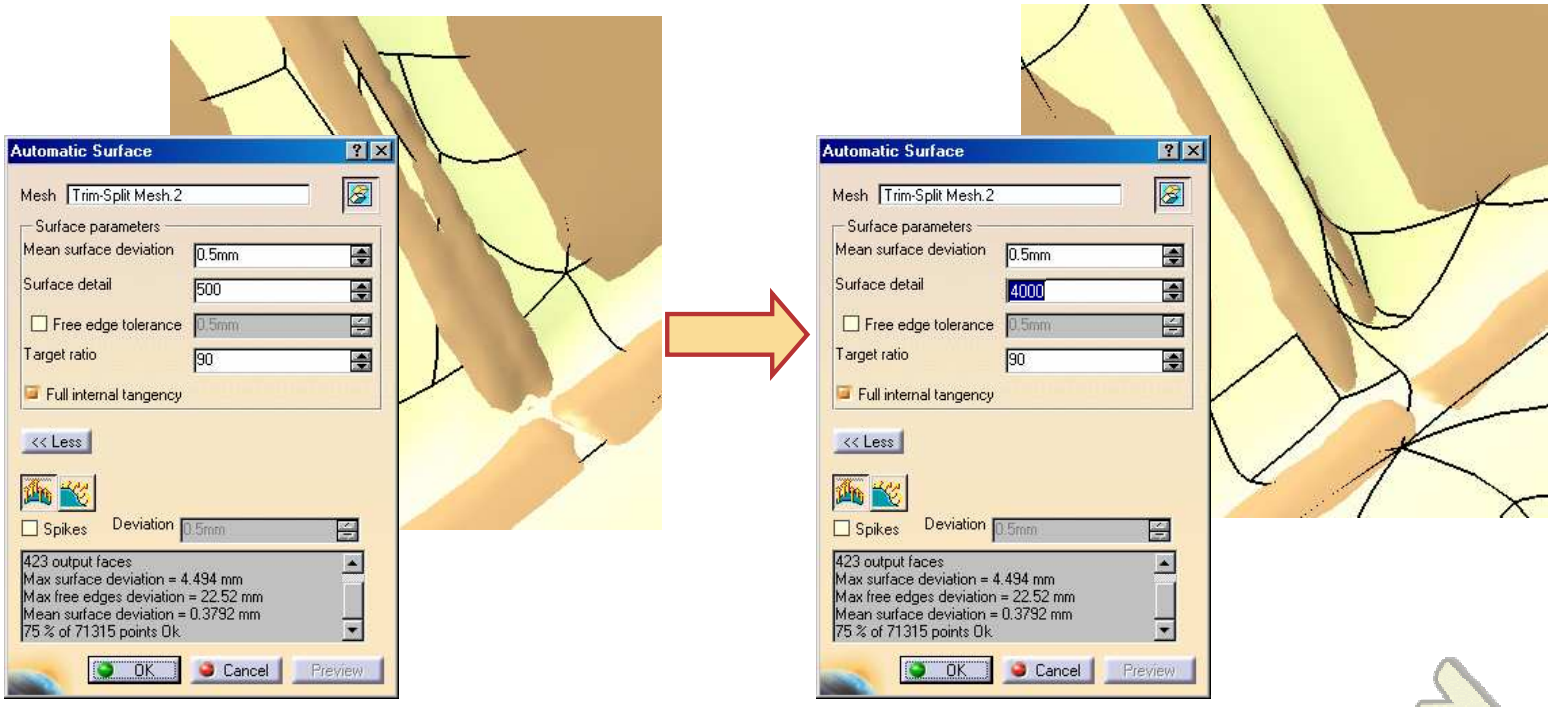
Student Notes:

Do It Yourself (3/5)

4. **Return to a Mean Surface Deviation of 0.5mm.**
5. **Surface Detail first with default setting (500) then adjust to 4000 to compare shape detail enhancement around small objects.**



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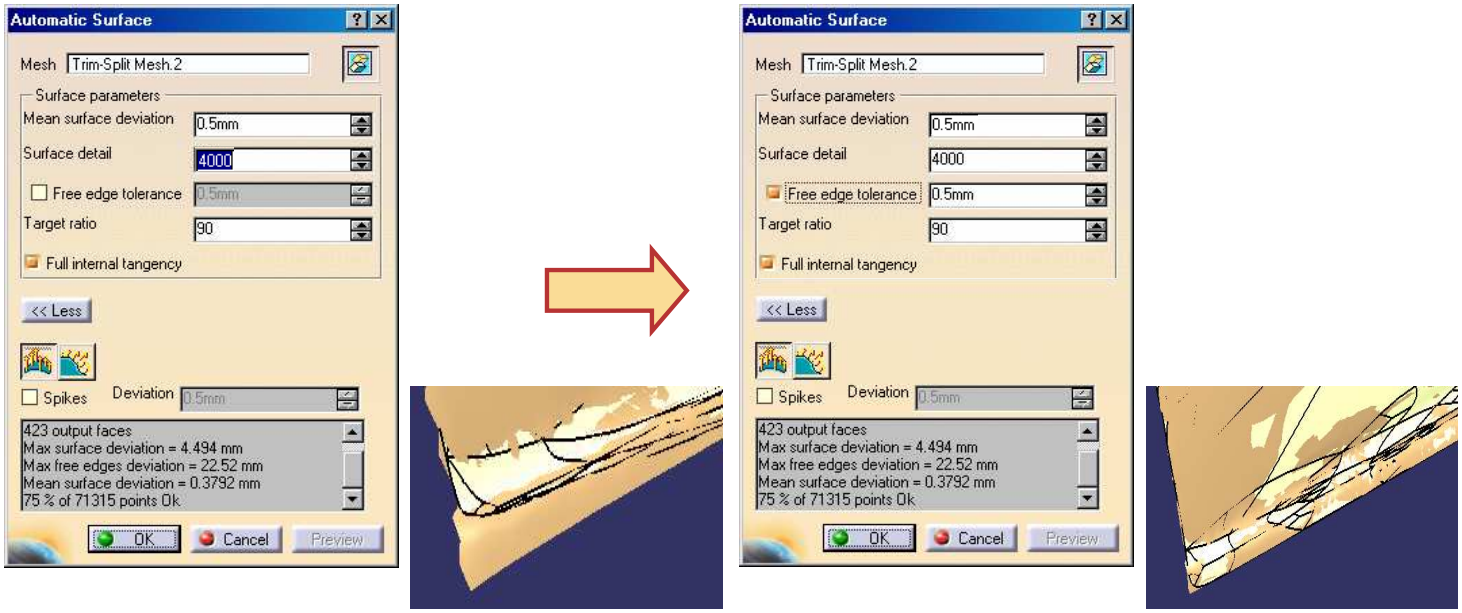
EXERCISE BOOK

Student Notes:

Do It Yourself (4/5)

6. Activate and adjust the value of Free Edge Tolerance to control the chord error on the mesh boundaries
7. Selecting Free Edges Deviations enables you to display the deviation along the free edges of the mesh 



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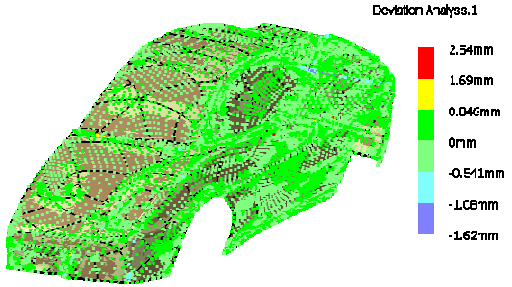
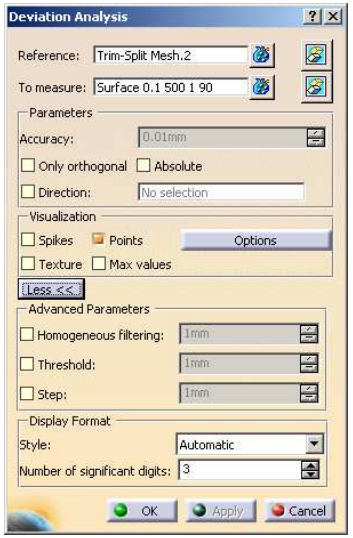
Student Notes:

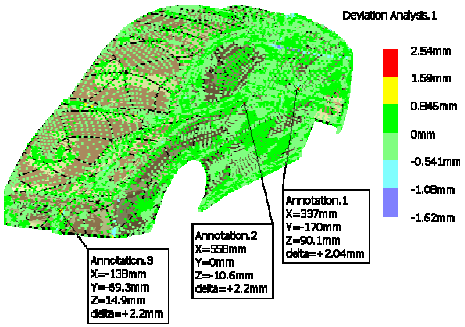
Do It Yourself (5/5)

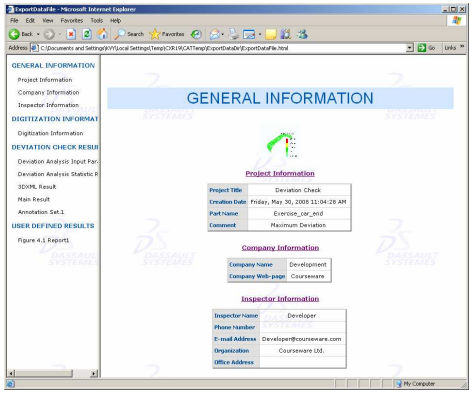
8. **Perform a Deviation Analysis**
   - **Select the Reference cloud and the created surface**
   - **Click OK**





9. **Apply Annotations to show maximum values**
10. **Create the Deviation Report to document the information**





You can compare your results with the end part: Exercise_car_end.CATPart

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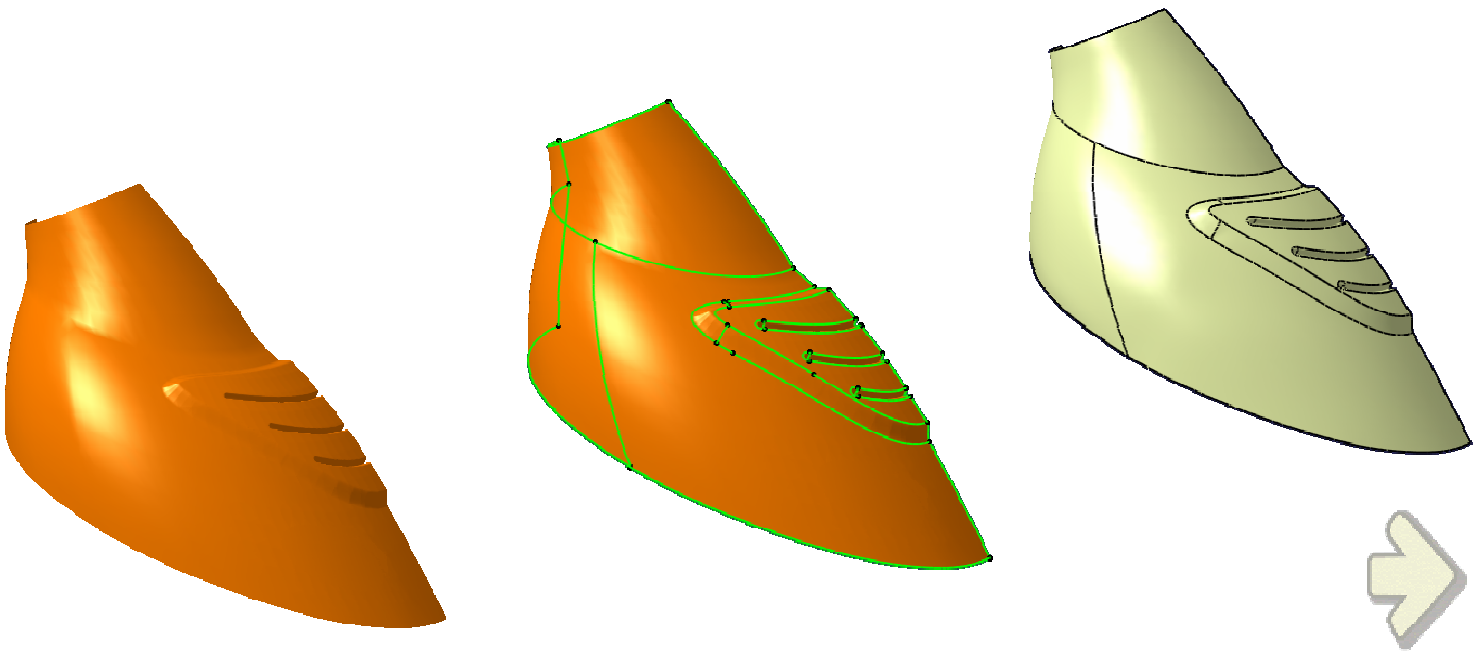
Student Notes:

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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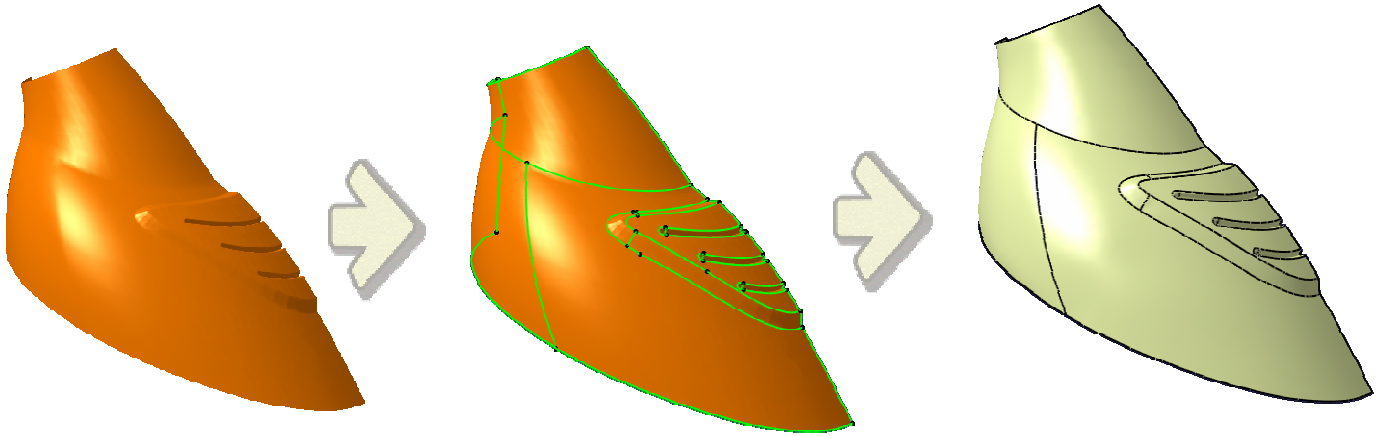
Student Notes:

Design Intent – Toy Plastic Part

- Surfaces must be at less than 1mm from the points
- Surface quality must be acceptable



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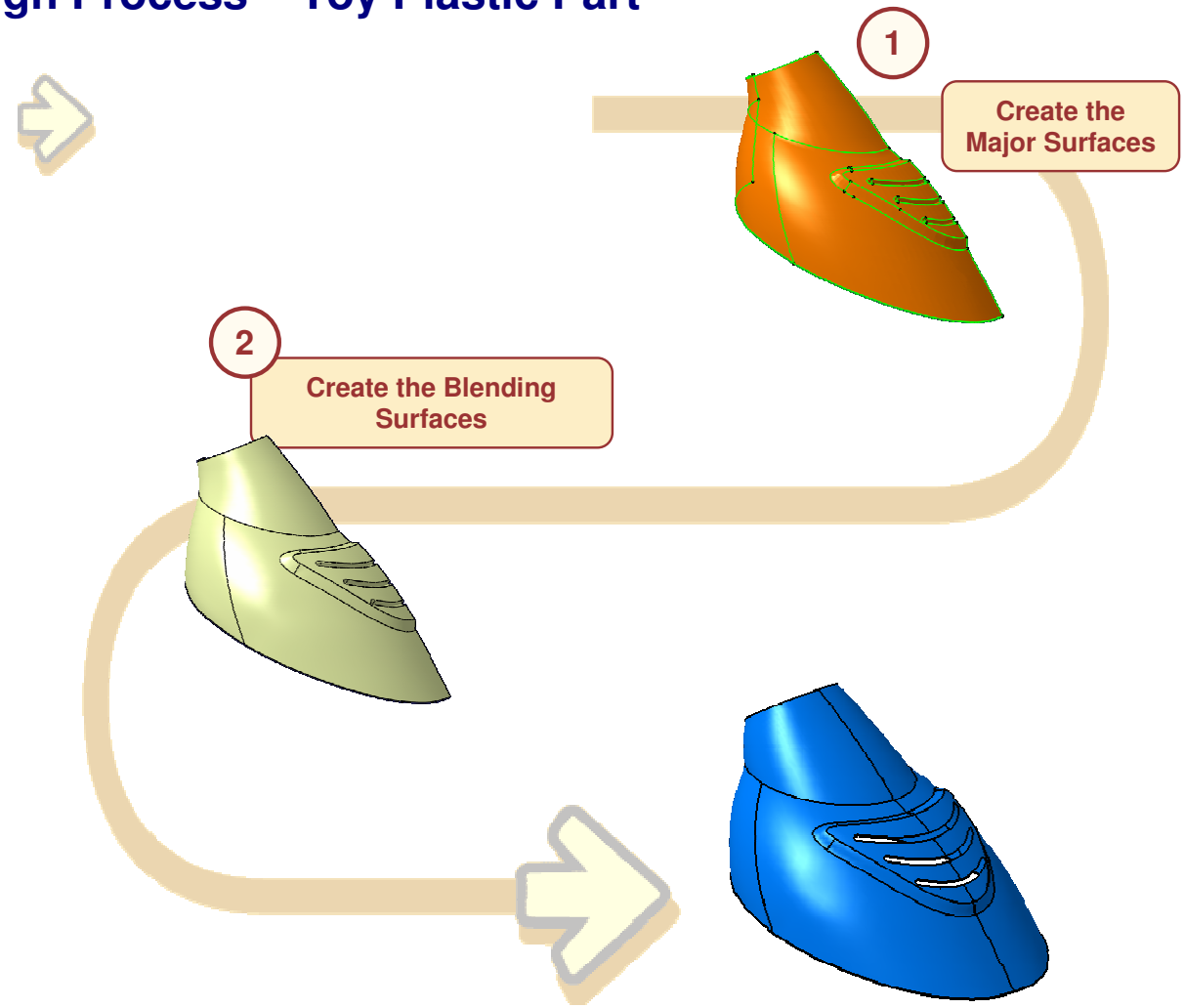
Student Notes:

Design Process – Toy Plastic Part



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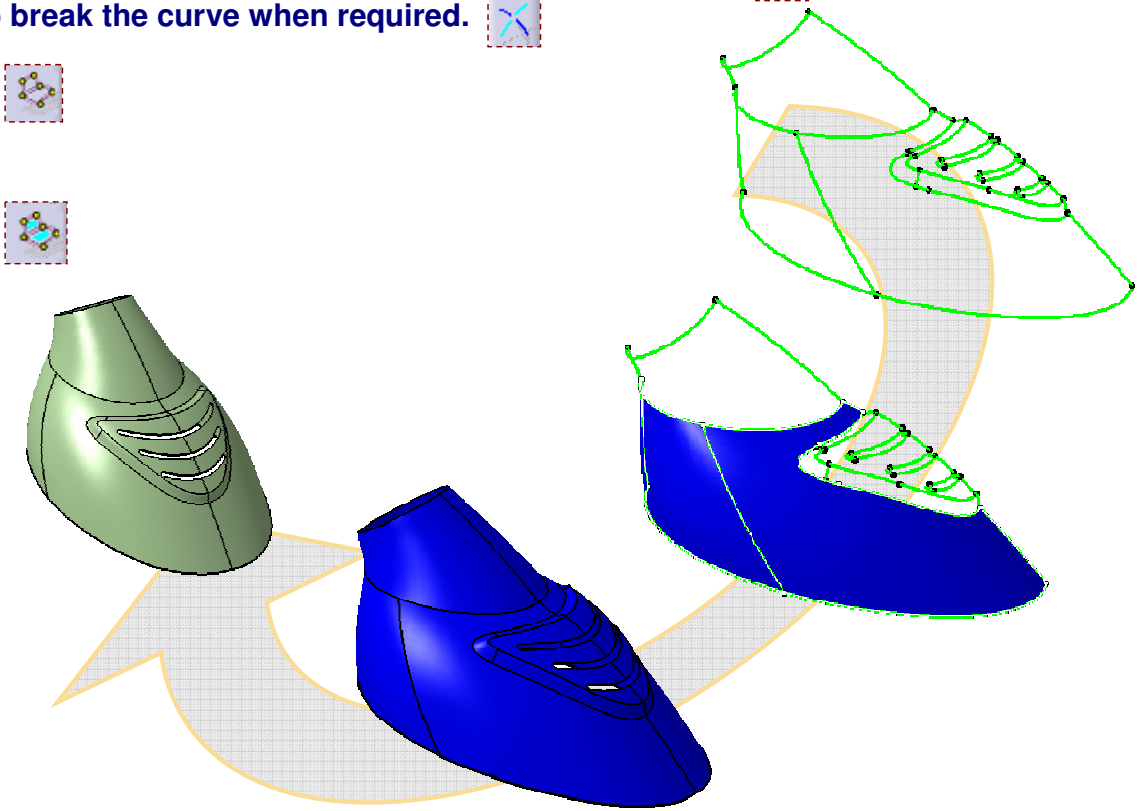
Student Notes:

Do It Yourself (1/3)

Part used: Exercise_toy_Start.CATPart

FAST ROUGH DESIGN:

1. Create curves on the cloud of points (you may use the curves available in body Network data).
   - Use 3D curve to connect the gaps between the curve when required.
   - Use Curve Slice to break the curve when required.
2. Create a network
   - Curves network
3. Create surfaces
   - Surfaces network



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Student Notes:

Do It Yourself (2/3)

FINE DESIGN:

1. **Create tangency constraints along the symmetry plane**
   - **Extrude(in Wireframe and Surfaces or GSD)** 
2. **Create a network with the edges of the extrude surfaces**
   - **Curves network** 
3. **Create surfaces with tangency constraints and strict accuracy**
   - **Surfaces network** 
4. **Create missing surfaces if necessary**
   - **Powerfit** 

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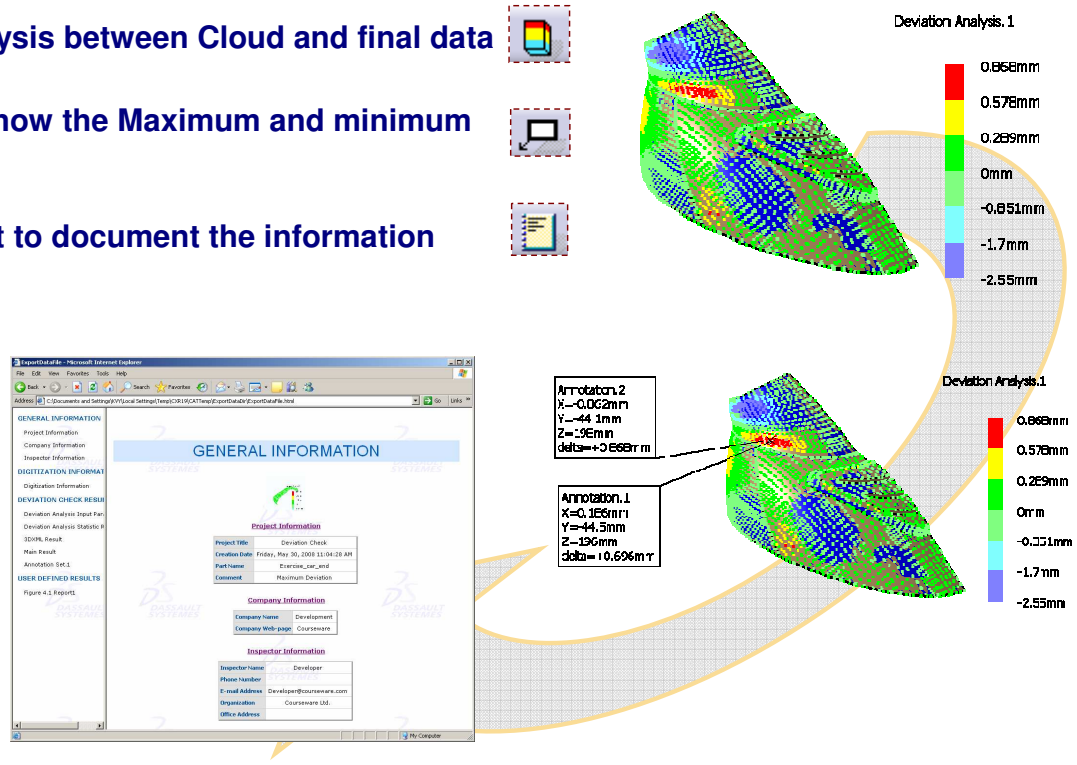
Student Notes:

Do It Yourself (3/3)

Deviation Analysis, Annotations and Deviation Report:

1. **Perform Deviation Analysis between Cloud and final data**
2. **Apply Annotations to show the Maximum and minimum deviation**
3. **Create Deviation Report to document the information**



You can compare your results with the end part:
For results of Fast Rough Design (Method 1): Exercise_toy_End_Fast_Rough_Design.CATPartt
For results of Fine Design (Method 2): Exercise_toy_End_Fine_Design.CATPart

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EXERCISE BOOK

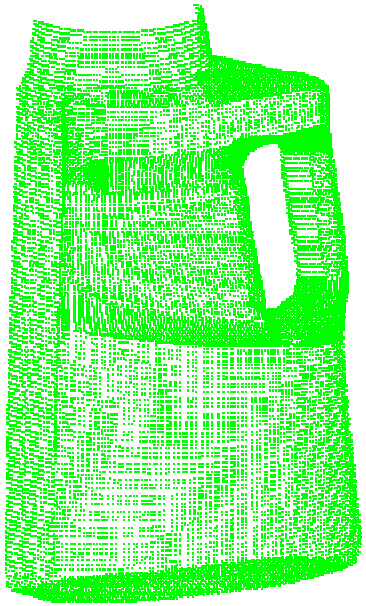
Student Notes:

Washing Powder Bottle

Exercise

2 hrs

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



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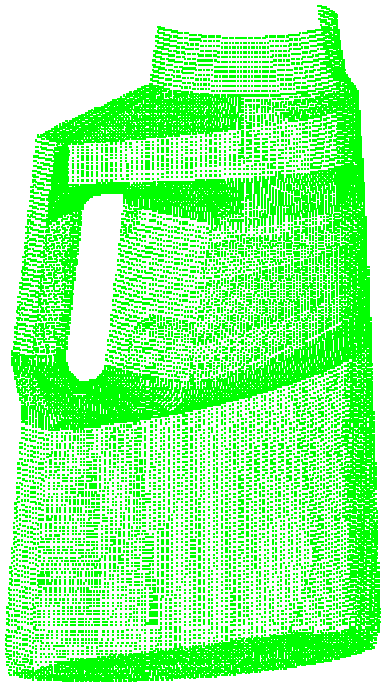
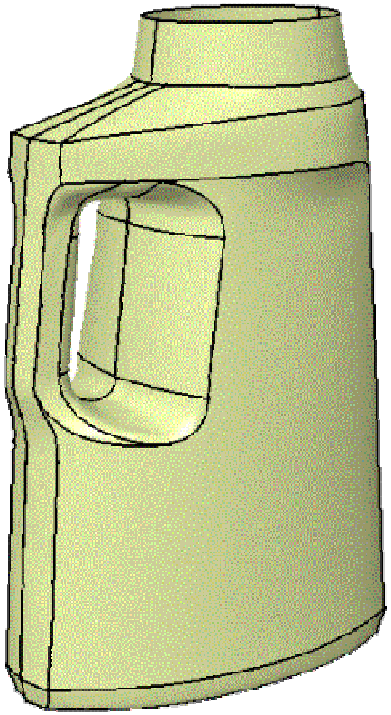
Student Notes:

Design Intent – Washing Powder Bottle

- Surfaces must be at 0.5mm max from the points.





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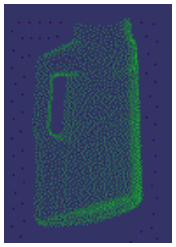
Student Notes:

Design Process- Washing Powder Bottle

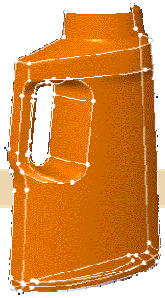


1

Import and filter the cloud of points

2

Tessellate the cloud of points



3

Create a network of clouds

4

Fill the network of Clouds

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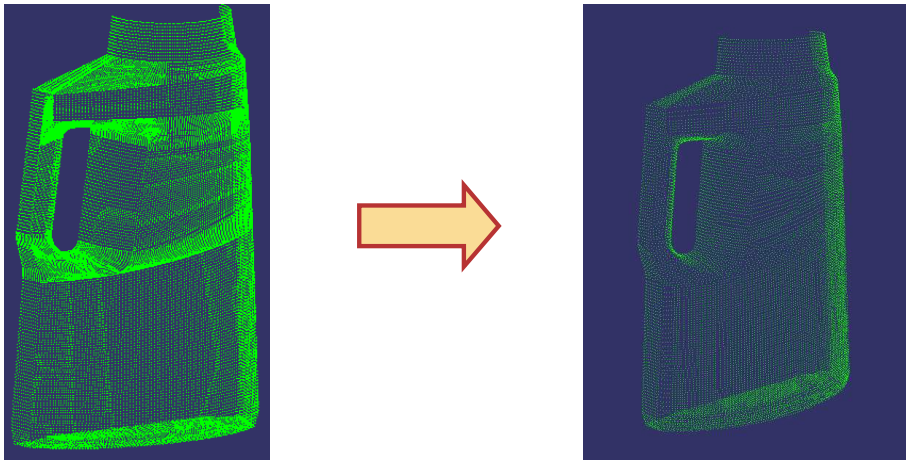
EXERCISE BOOK

Student Notes:

Do It Yourself (1/5)

Part used: Exercise_washing_powder_Bottle_Start.asc



1. Import the cloud of points  in Digitized Shape Editor workbench
   - File to import is “Exercise_washing_powder_Bottle_Start.asc”
2. Filter the cloud of points  in Digitized Shape Editor workbench
   - Use an adaptative filter for the body
   - Refine filtering on the bottom using an homogeneous filter

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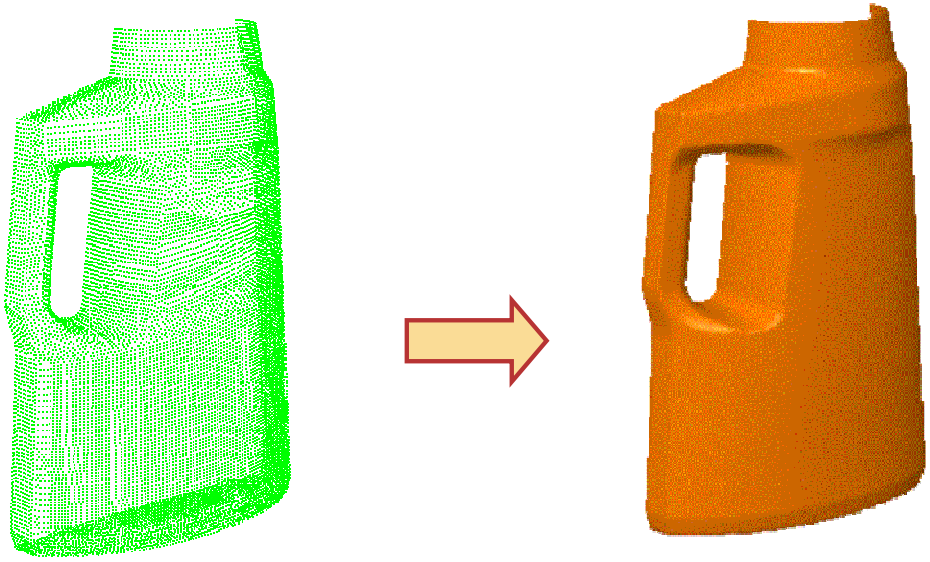
Student Notes:

Do It Yourself (2/5)

3. Tessellate the cloud of points 



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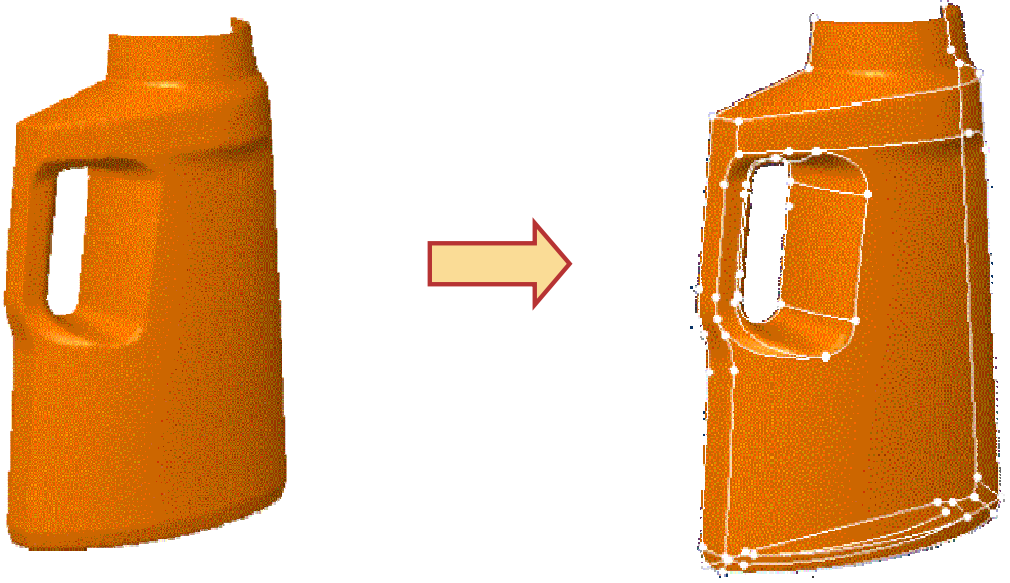
Student Notes:

Do It Yourself (3/5)

4. Create scans on the tessellation 

5. Create curves on the cloud 



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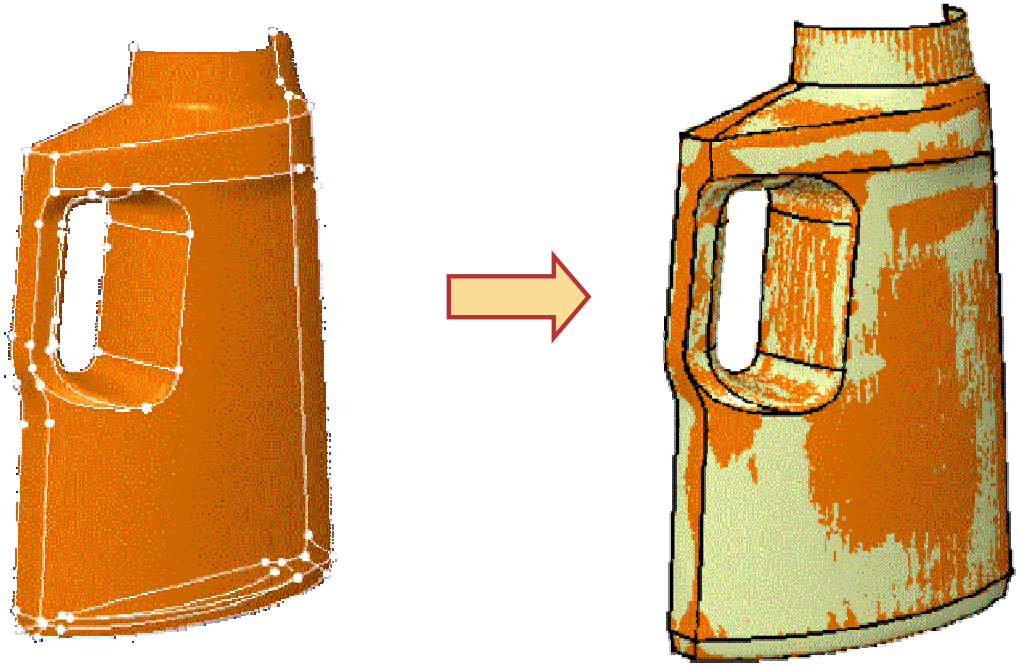
EXERCISE BOOK

Student Notes:

Do It Yourself (4/5)

6. Create surfaces using the curves 
7. Create canonical surfaces where needed 



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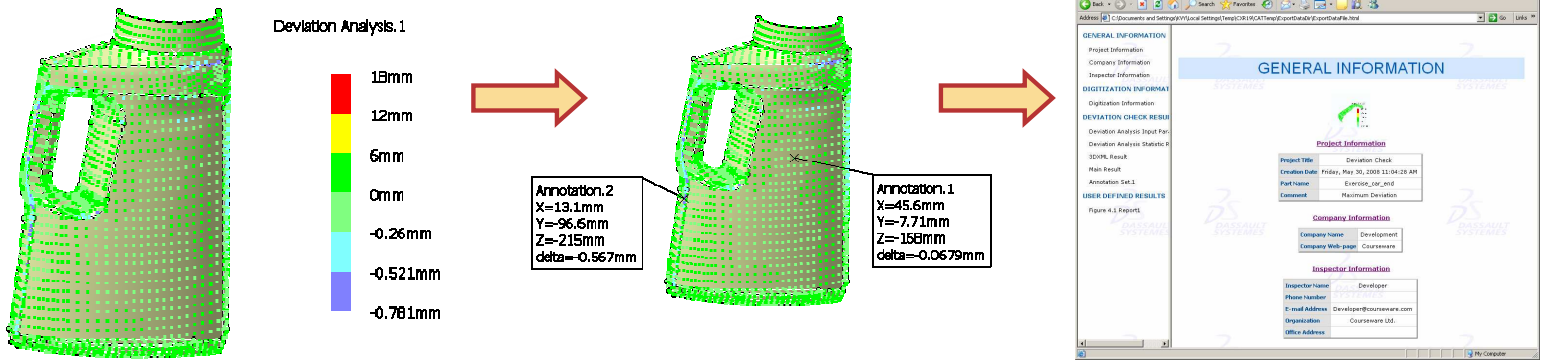
Student Notes:

Do It Yourself (5/5)

1. **Perform Deviation Analysis between Cloud and final data**
2. **Apply Annotations to show the Maximum and minimum deviation**
3. **Create Deviation Report to document the information**



You can compare your results with the end part:
Exercise_Washing_powder_Bottle_End.CATPart

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