

CATIA V5 Surface-modeling (Tutorial 6-Glasses)

Not For Commercial Use



A- 1

Surface-modeling

Solid-modeling

Assembly Design

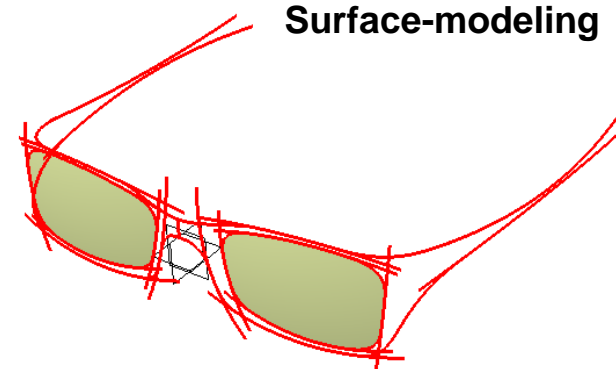
Design with a Master Model

Design in Context

Surface-modeling

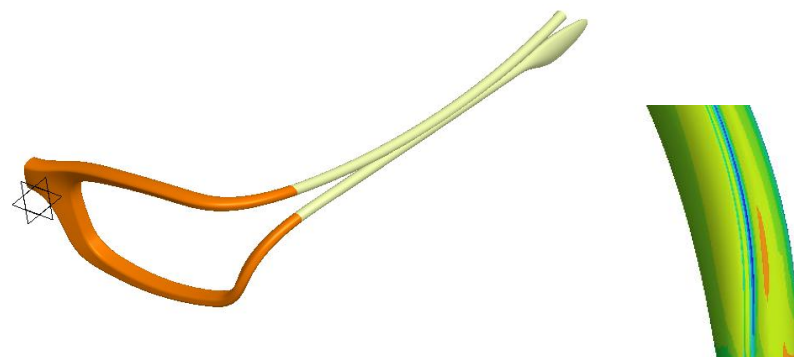
Tutorial 6A

- Create 2D Reference Lines (to control the overall size)
- Build a rough wireframe model by 3D (freeform) curves



Tutorial 6B

- Build a HALF surface model (on right hand side)
- Do “curvature analysis” to check surface smoothness
- Do “connect check” to check tangency continuity
- Do “draft analysis” to check any undercut portion



Tutorial 6C

- Convert the surfaces into a solid
- Build the parting surface
- Split the finished (master) model into separate parts
- Re-assemble the parts into a product
- Part Design in Assembly (Design in Context)
- Capture/Render Images for marketing purposes.

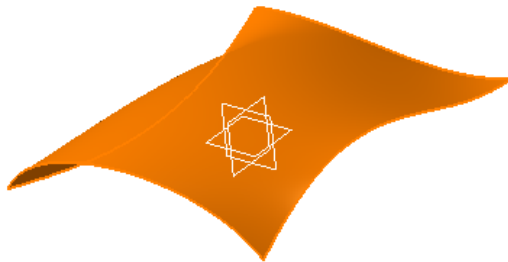


Please be reminded that this series of tutorials is designed to demonstrate a design approach with CATIA, rather than the command itself.

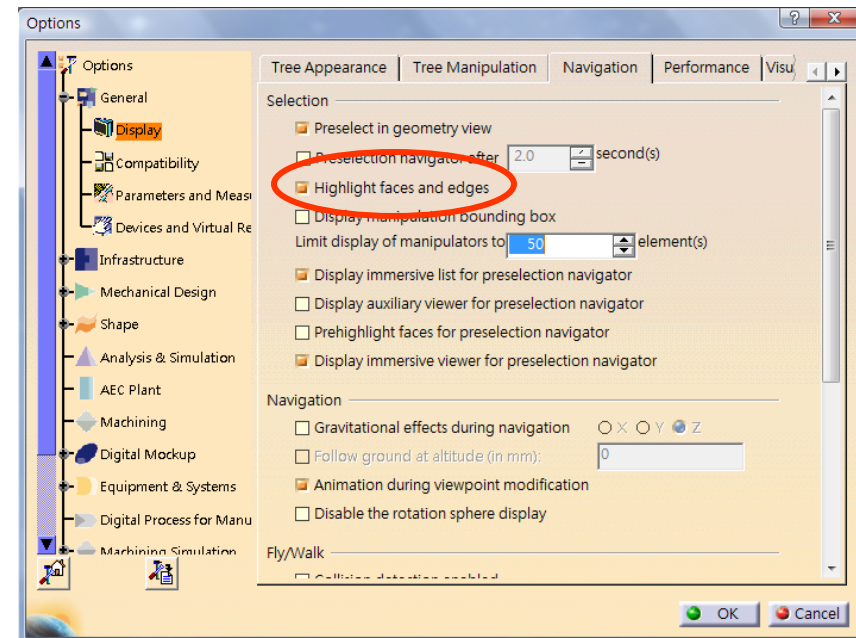
Tutorial 6A

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- Create a new project folder
(e.g. C:\project_glasses)
- Download (nose_pad_right.stp) on web
<http://myweb.polyu.edu.hk/~mmdsham/Ex6.htm>
- Enter CATIA V5 by double-clicking its icon on the desktop.
- File /Close (close the default product file)
- Select “**Tools/Options**” on the top menu
- Select Tab-page “Navigation”
- Select the option” Highlight Faces & edges”



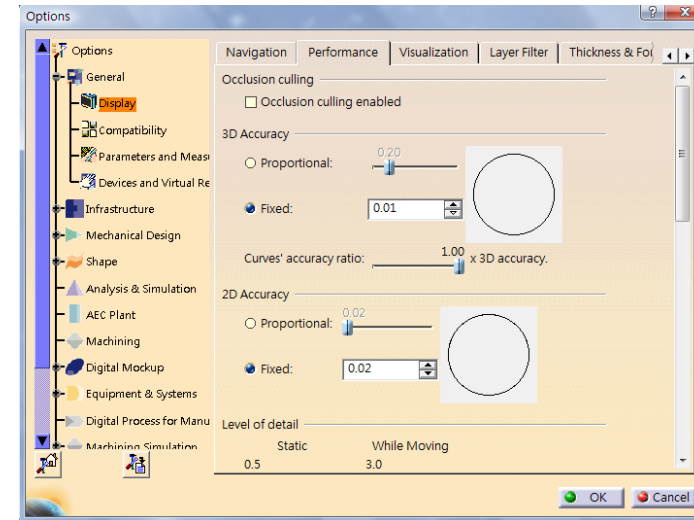
The selected face will be displayed like this.
(whole face will be highlighted in Orange)



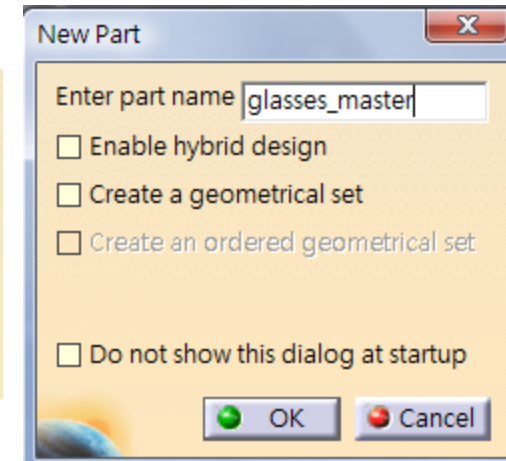
A- 3

Tutorial 6A

- Select Tab-page “**General/ Display/ Performance**”
- Change “**3D accuracy**” Fixed to 0.01 (this makes curves “look” smooth. But if the performance of your computer drops a lot after this change, increase the value)
- On the same Tab-page, select the option “**Enable OpenGL shader**” (if disabled, the draft /curvature color results may not display correctly)
- Click ok.
- Close & Restart CATIA (if the option “enable openGL shader” does not change, CATIA needn’t restart)



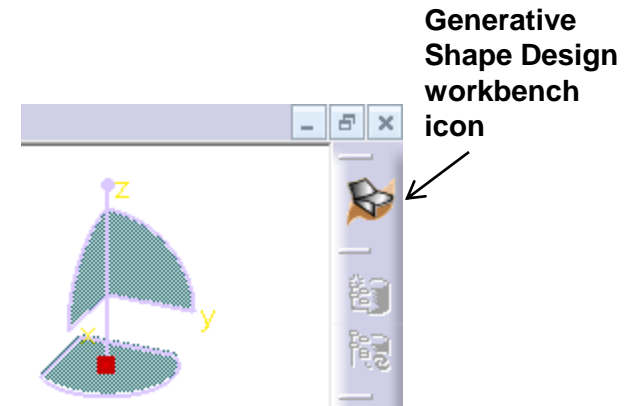
- “**File/New**”
- Select “Part” as Type
- Click ok
- Enter “glasses_master”
- DO NOT SELECT “Enable hybrid design”
- Click ok



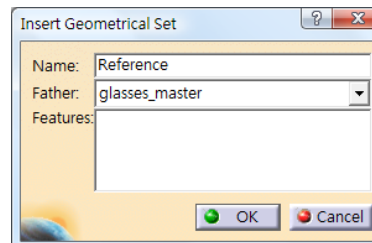
A- 4

Tutorial 6A

- Check if the current workbench is “Generative Shape Design”. If not, select “**Start/ Shape/ Generative Shape Design**” on the top menu



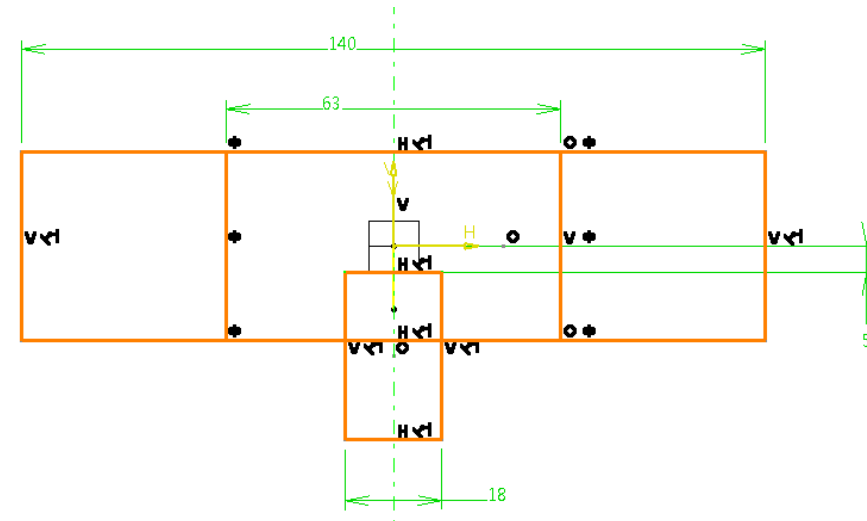
- “**Insert/Geometrical set...**”
- Enter “**Reference**” as Name
- Click ok



- (Default setting)
- (Default XY plane = Top plane)
- (Default YZ plane = Front plane)
- (Default ZX plane = Right plane)

(To create Sketch.1)

- Click icon “**Sketch**”
- Select **YZ plane**
- Draw a profile (10 lines)
- Add dimensional & geometrical constraints
- Click icon “Exit Workbench”
- Click on open area to deselect “Sketch.1”

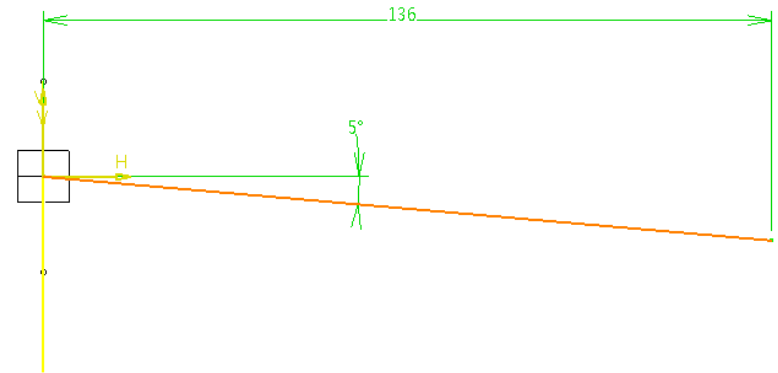


A- 5

Tutorial 6A

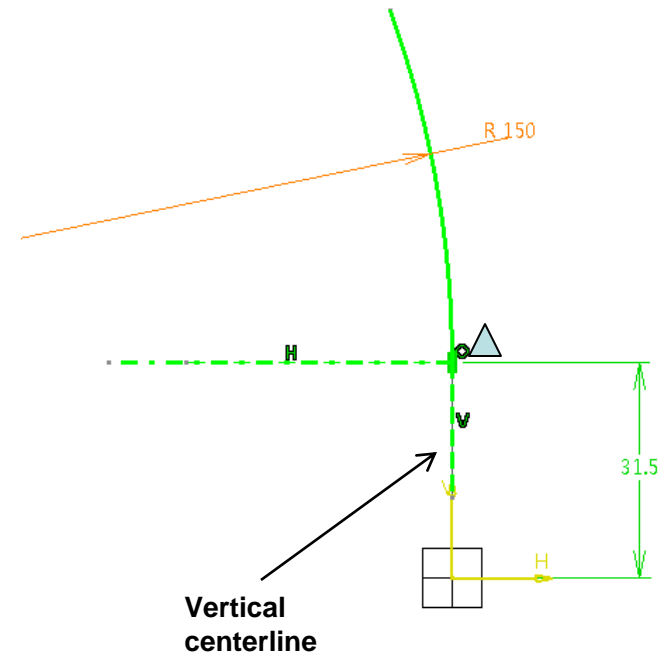
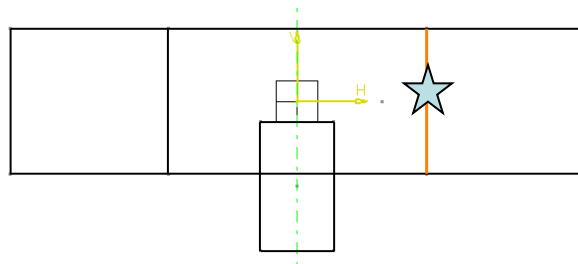
(To create Sketch.2)

- Click icon “**Sketch**”
- Select **ZX plane**
- Draw a Line
- Add dimensional constraints
- Click icon “Exit Workbench”



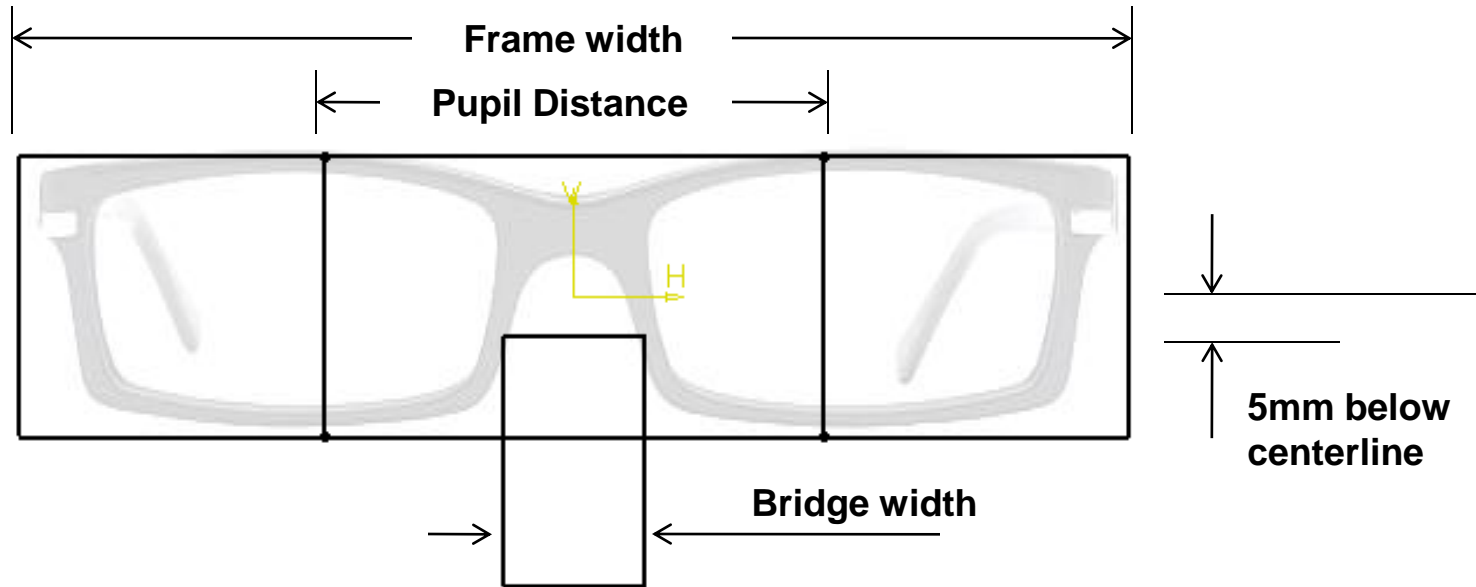
(To create Sketch.3)

- Click icon “**Sketch**”
- Select **XY plane**
- Draw a vertical centerline (an endpoint \triangle aligned to the line \star of Sketch.1)
- Draw an arc (tangent to the line)
- Draw a horizontal centerline
- Click “Exit Workbench”

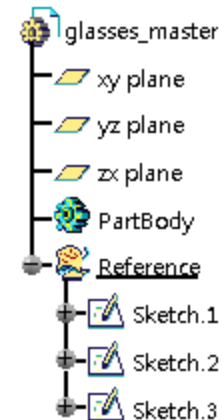


A- 6

Tutorial 6A



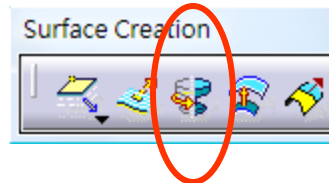
- Multi-select all 3 Sketches on tree
- Right-click on them, then select “**Properties**” on the pop-up menu
- Select Tab-page “Graphic”
- Change “Lines & Curves” Color to yellow, thickness to 0.35mm
- **Deselect** option “Pickable”
- Click ok
- (Now we can see the yellow references on screen, but cannot pick them directly)



Tutorial 6A

- Switch Workbench to Freestyle (“**Start/ Shape/ Freestyle**”)
- Select “**Insert /Geometrical Set...**” on the top menu
- Enter “Control_curve” as name
- Click ok

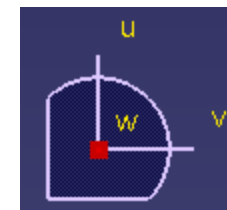
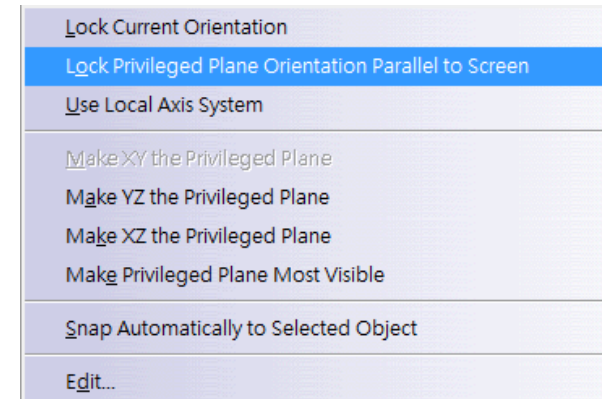
- Click icon “**Revolute**”
- Select Sketch.3 on tree
- Enter 360 deg as Angle1
- (you needn't define the revolution axis; the last centreline in the sketch will be selected as default axis)
- Click ok



- **Hide** “Sketch.3”

(Now Start to draw 3d curves)

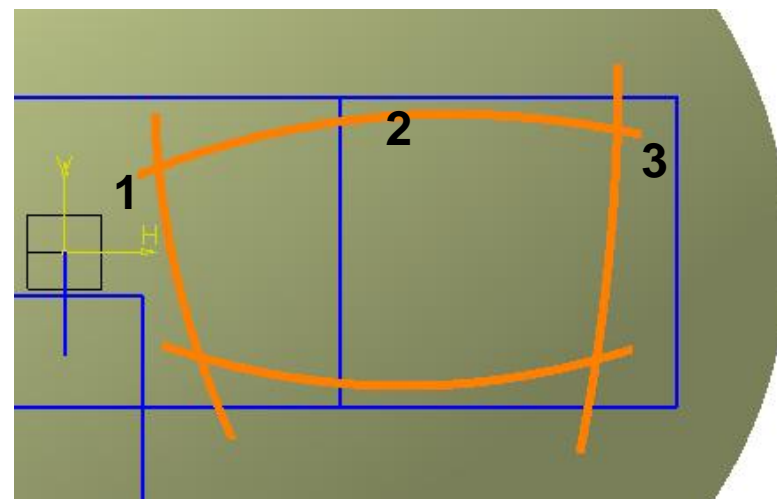
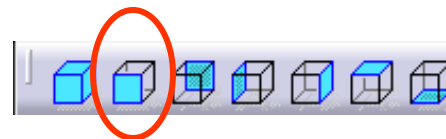
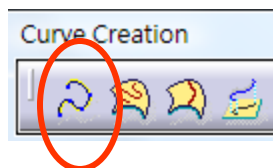
- Right-Click on **the red dot** of the compass at right upper corner of the window
- Select “**Lock Privileged plane orientation parallel to screen**”



Working local uv plane
always parallel to the screen

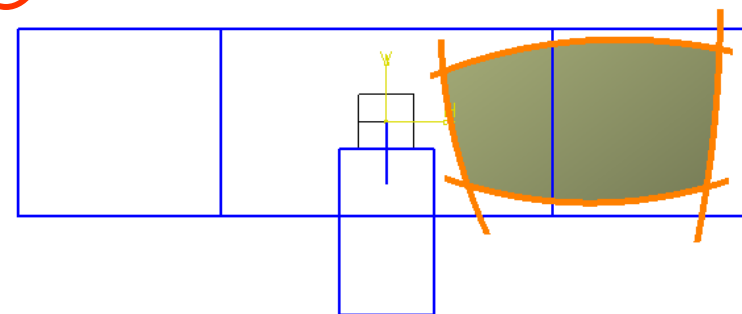
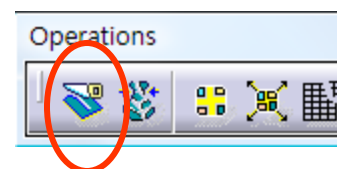
Tutorial 6A

- Click icon “**3D curve**”
- Select type “Through points”
- **Switch to Front View**
- Pick 3 points on the surface to create a curve
- Drag **the green arrow** to adjust the curvature
- Click ok to complete
- Repeat the above steps to **create 3 more curves**



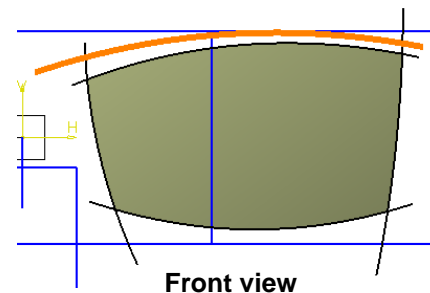
(Trim surface by 3D curves)

- Click icon “**Break surface or curve**”
- Select “Break surface” as type
- Select the revolute surface as Element
- Multi-select the four curves as Limitation
- Switch View to Front View
- Select “along compass” as Projection
- Click “Apply”
- Click the middle portion to keep
- Click ok

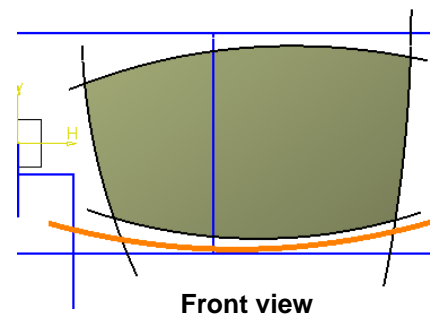


Tutorial 6A

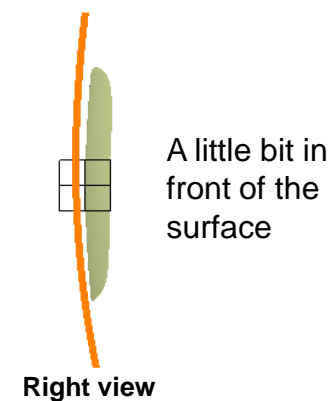
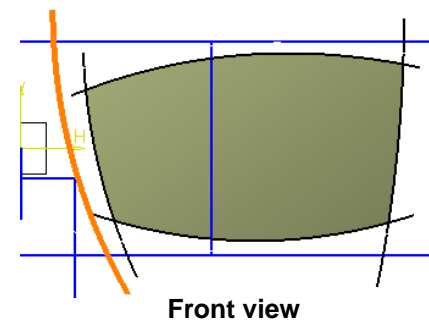
- Switch View to Front View
- Draw a “**3D curve**” (for upper bound)
- Adjust point positions & curvature in **Front View**
- Adjust point positions & curvature in **Top View**



- Draw a “**3D curve**” (for lower bound)
- Adjust point positions & curvature in **Front View**
- Adjust point positions & curvature in **Top View**

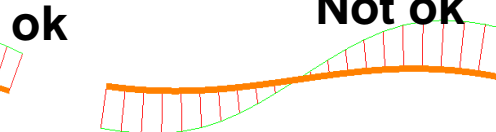
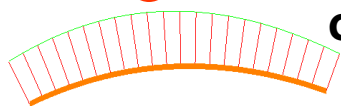
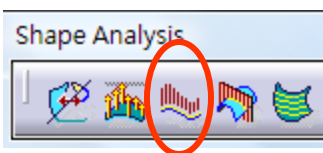


- Draw a “**3D curve**” (for left bound)
- Adjust point positions & curvature in **Front View**
- Adjust point positions & curvature in **Right View**

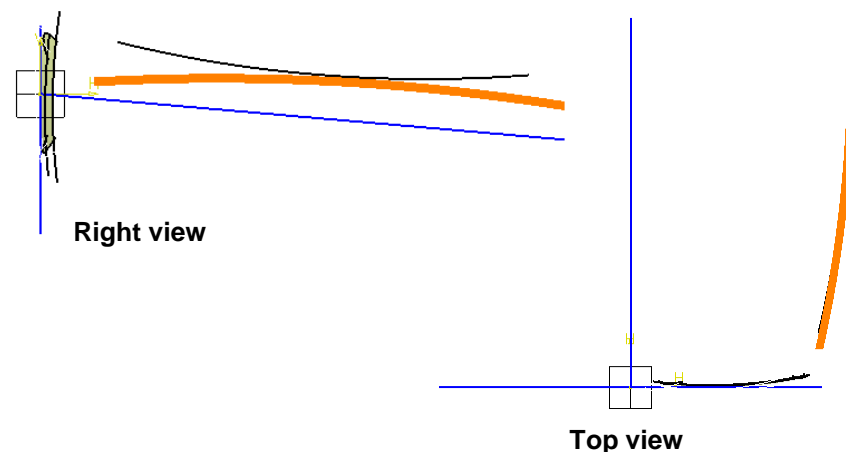
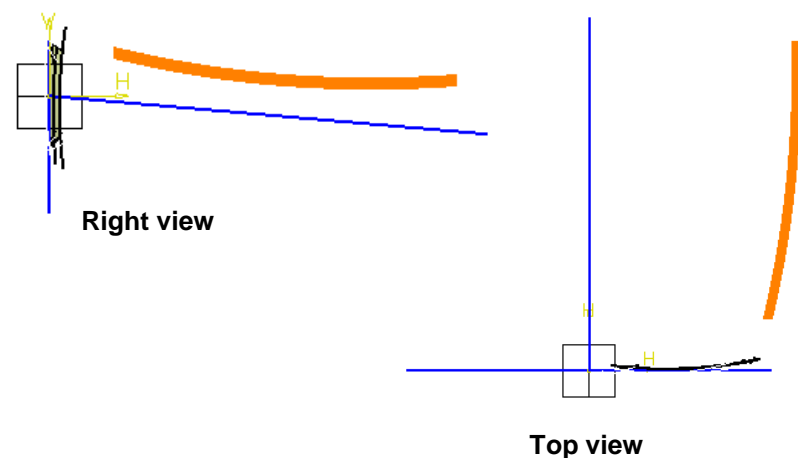


Tutorial 6A

- Switch View to Right View
- Draw a “**3D curve**” (for upper arm)
- Adjust point positions & curvature in **Right View**
- Adjust point positions & curvature in **Top View**
- Click icon “Porcupine Curvature Analysis” (make sure the curve is not S-shaped in Top View)

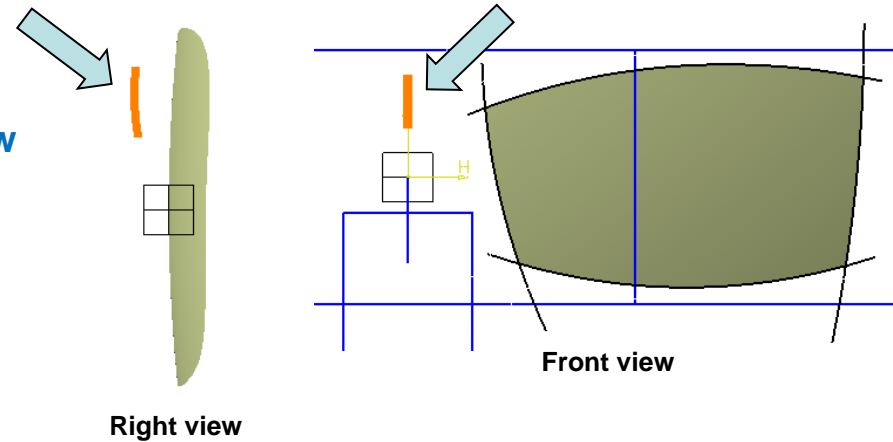


- Draw a “**3D curve**” (for lower arm)
- Adjust point positions & curvature in **Right View**
- Adjust point positions & curvature in **Top View**
- Click icon “Porcupine Curvature Analysis” (make sure the curve is not S-shaped in Top View)



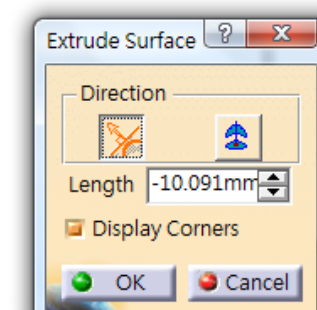
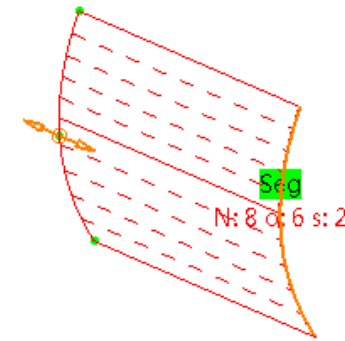
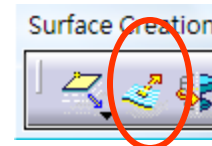
Tutorial 6A

- Draw a “**3D curve**” (for the bridge)
- Adjust point positions & curvature in **Right View**
- Adjust point positions in **Front View**



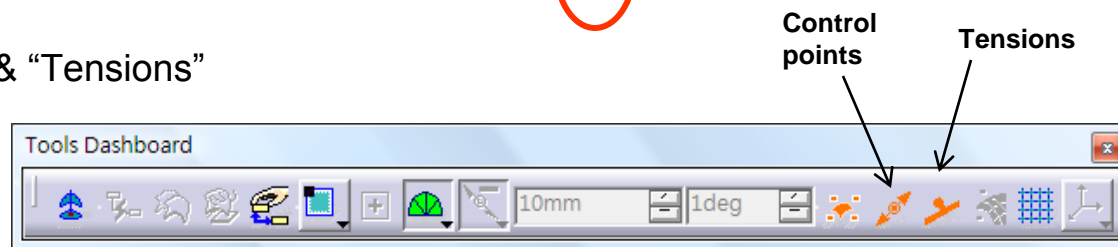
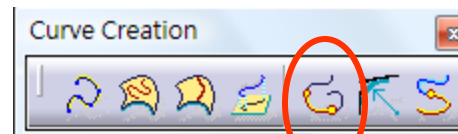
- **Hide** Geometrical Set “Reference”

- Click icon “**Extrude**”
- Select “Normal to the Curve” as Direction
- Drag the green dot to increase the length to ~10mm
- Click ok



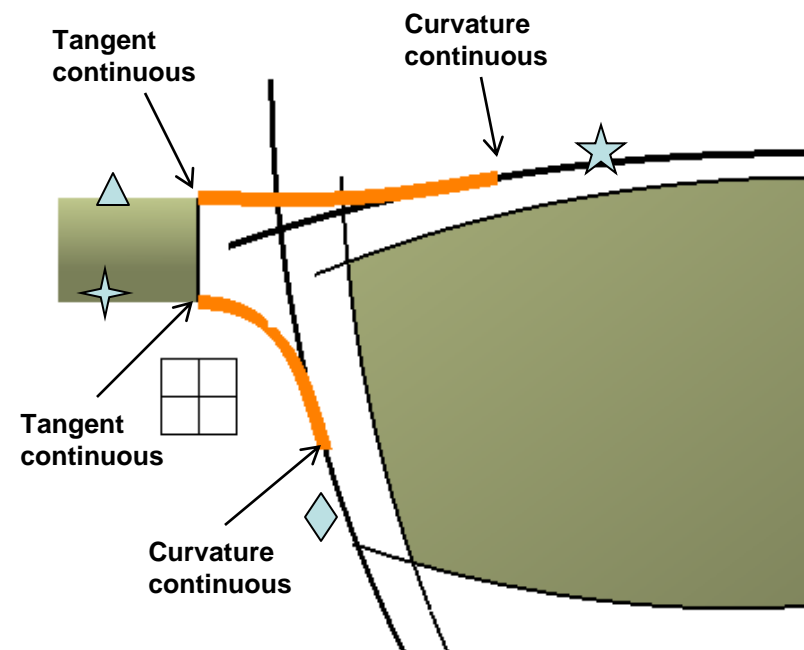
Tutorial 6A

- Click icon “**Freestyle Blend Curve**”
- Select the surface edge (straight) \triangle
- Select the 3d curve \star
- Highlight options “Control Points” & “Tensions”
- (Invert Direction if needed)
- Switch to Front View
- Drag to modify its shape, then ok





(Create another Blend Curve)

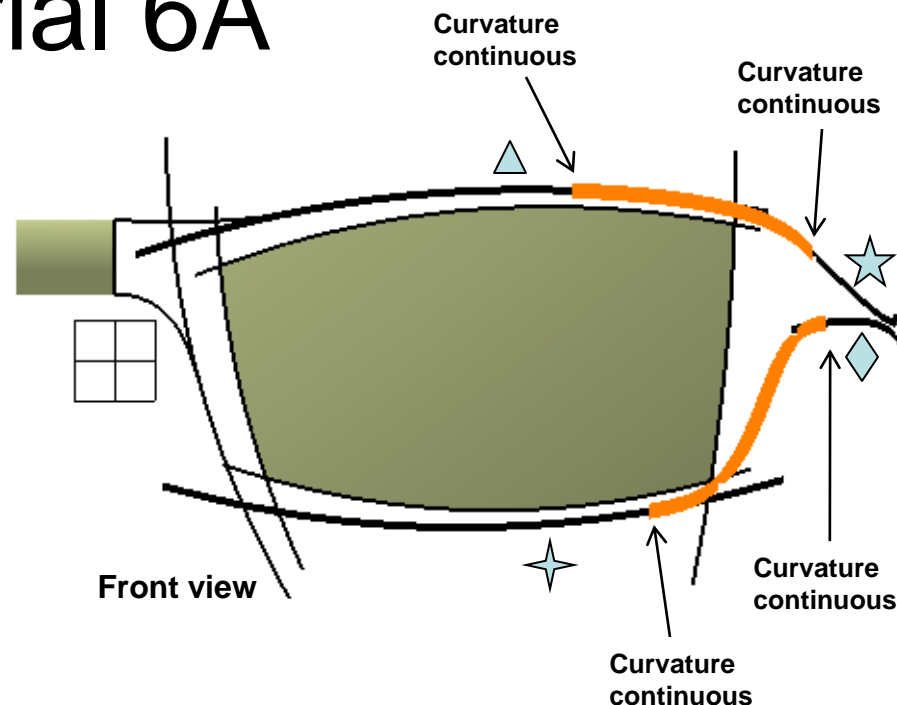
- Click icon “**Freestyle Blend Curve**” again
- Select the surface edge (straight) \star
- Select the 3d curve \diamond
- Switch to Front View
- Drag to modify its shape, then ok
- **DELETE** the extrude surface
- (history-free, it can be deleted)





Tutorial 6A

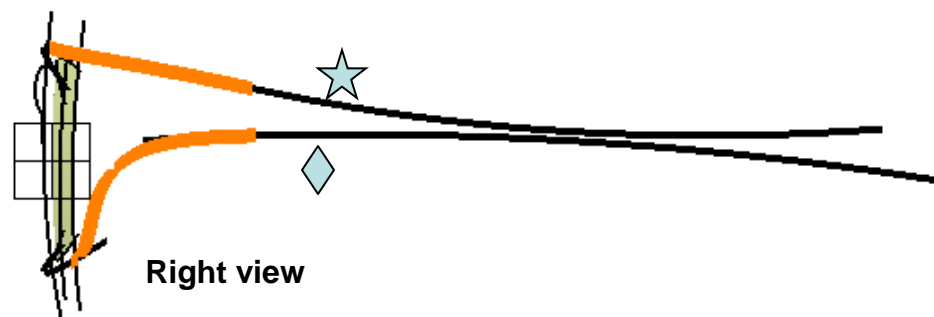
(Create 3rd Blend Curve)

- Click icon “**Freestyle Blend Curve**”
- Select the 3d curve 
- Select the 3d curve 
- *Curvature Continuous* for both ends
- Switch to Right View or Front View or Top View
- Drag to modify its shape, then ok



(Create 4th Blend Curve)

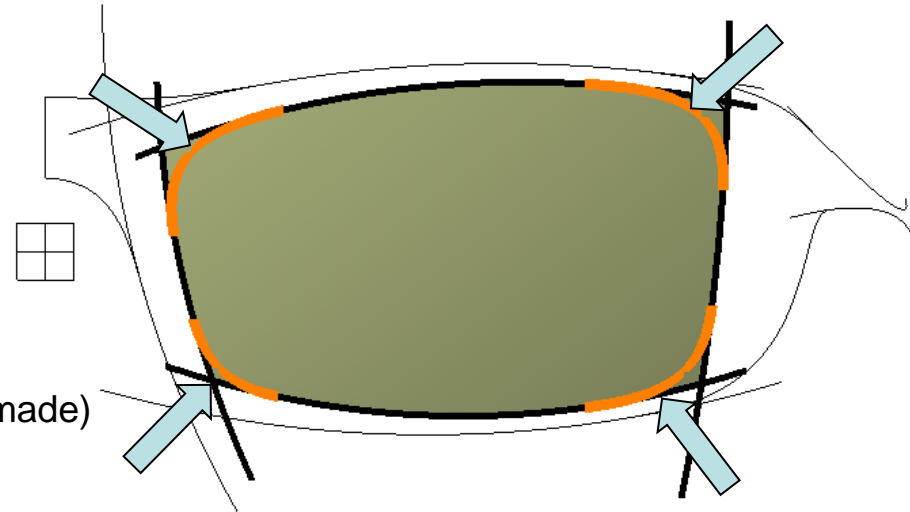
- Click icon “**Freestyle Blend Curve**”
- Select the 3d curve 
- Select the 3d curve 
- *Curvature Continuous* for both ends
- Switch to Right view or Front View
- Drag to modify its shape, then ok



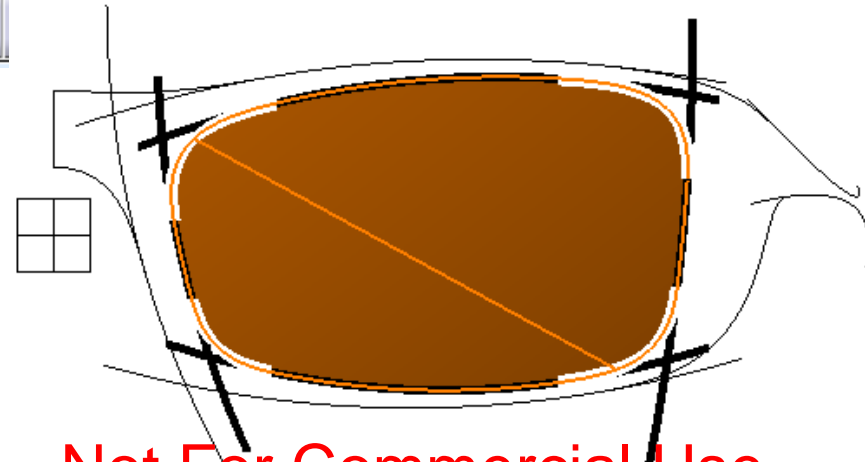
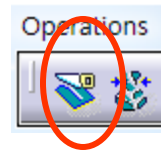
Tutorial 6A

(Create 4 blend Curves on Surface)

- Click icon “**Freestyle Blend Curve**”
- Select a 3d curve
- Select another 3d curve
- (Invert (tangential) directions)
- Switch to Front View (for better view)
- Drag to modify its shape, then ok
- (repeat the above steps until 4 blend curves are made)



- Click icon “**Break surface or curve**”
- Select “Break surface” as type
- Select the Surface.1 as Element
- Multi-select these four curves as Limitation
- Switch View to Front View
- Select “along compass” as Projection
- Click “Apply”
- Click the middle portion to keep
- Click ok





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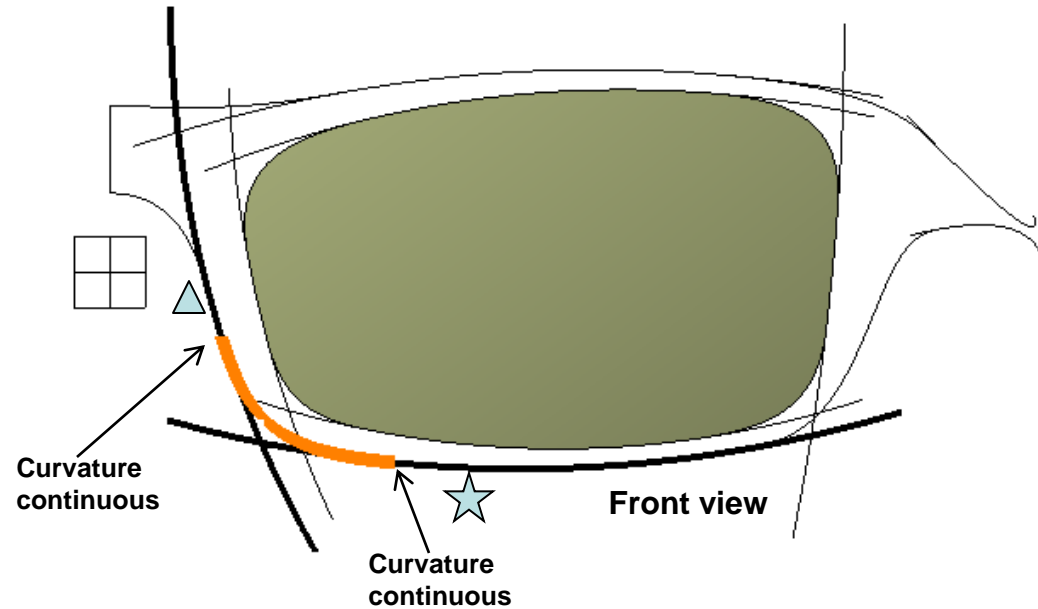
- **RENAME** the surface as “**LENS**”

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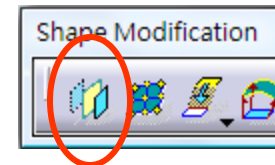
Tutorial 6A

(Create another Blend Curve)

- Click icon “**Freestyle Blend Curve**”
- Select the 3d curve 
- Select the 3d curve 
- *Curvature Continuous* for both ends
- Switch to Front View
- Drag to modify its shape, then ok

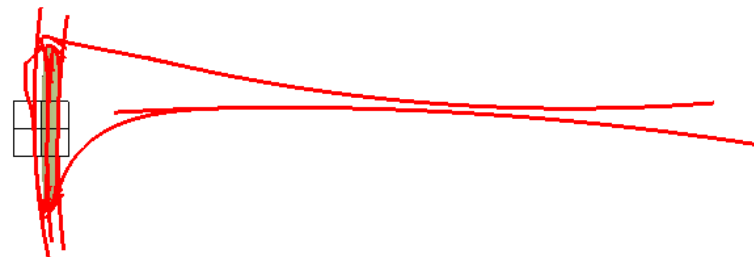
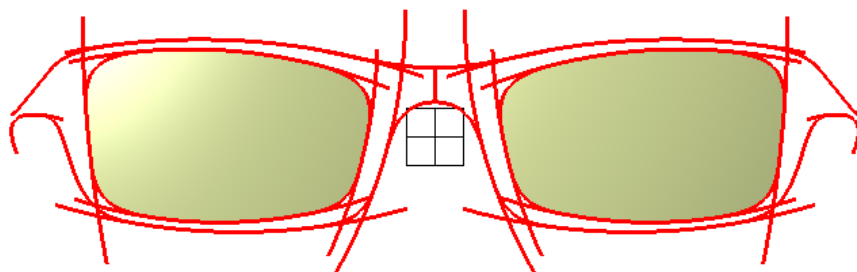
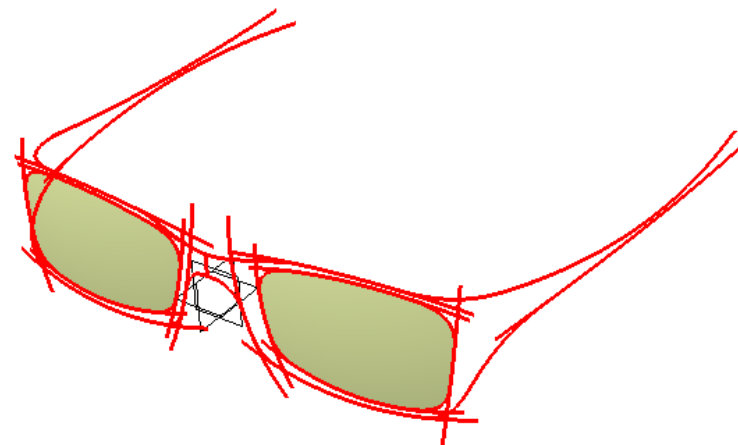


- Click icon “**Symmetry**”
- Select **all entities** on screen (except 3 datum planes) as Element
- Select ZX plane as Reference (mirror plane)
- Click ok



Tutorial 6A

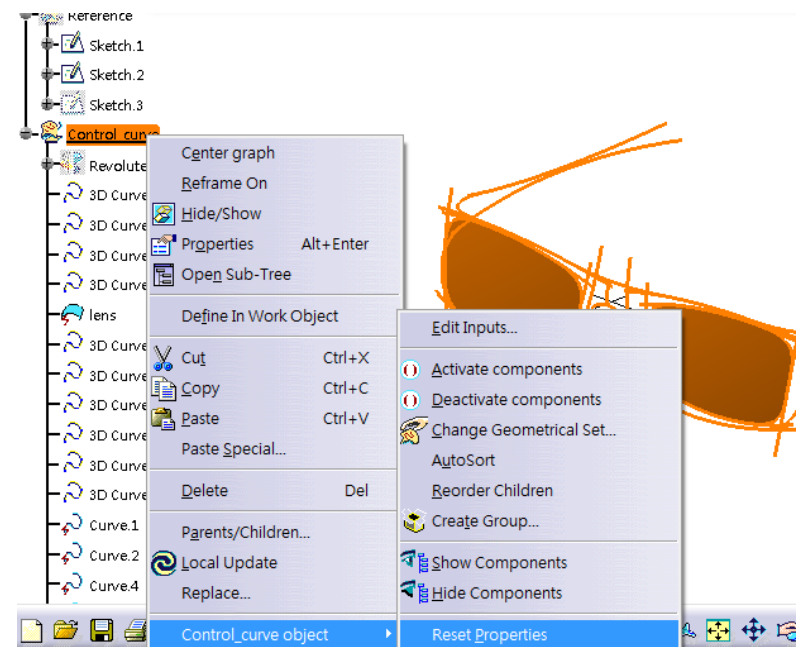
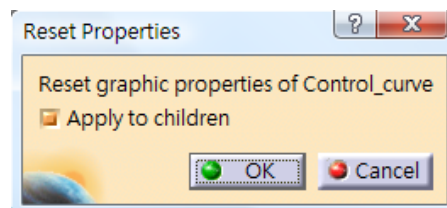
- **Right-Click** on the geometrical set “**Control_Curve**”
- Select Tab-page “**Graphic**”
- Change “**Lines & Curves**” color to Red
- Change “**Lines & Curves**” thickness to 0.7mm
- Click ok
- (We now have a rough idea of the outlook; Modify curves if necessary. Building a wireframe model is always quicker and easier to modify than building a surface model)
- Select “**View/ Render Style/ Perspective**” on the top menu (to increase 3d feeling)



A- 17

Tutorial 6A

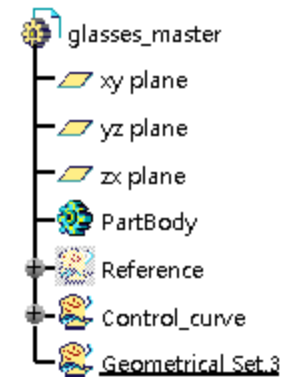
- **Delete** the feature “Symmetry” on tree
- Select “**View/Render Style/Parallel**” on the top menu(This should be always selected when modeling; otherwise parallel faces doesn't look parallel)
- **File Save**
- Enter “glass_master_a” as file name
- **Right-Click** on “Control_Curve” on tree
- Select “Control_Curve object”/ **Reset properties**”
- Select “Apply to children”
- Click ok
- (All colors & line thickness are reset to default values)



A- 18

Tutorial 6A

- Switch workbench to “**Generative Shape Design**”

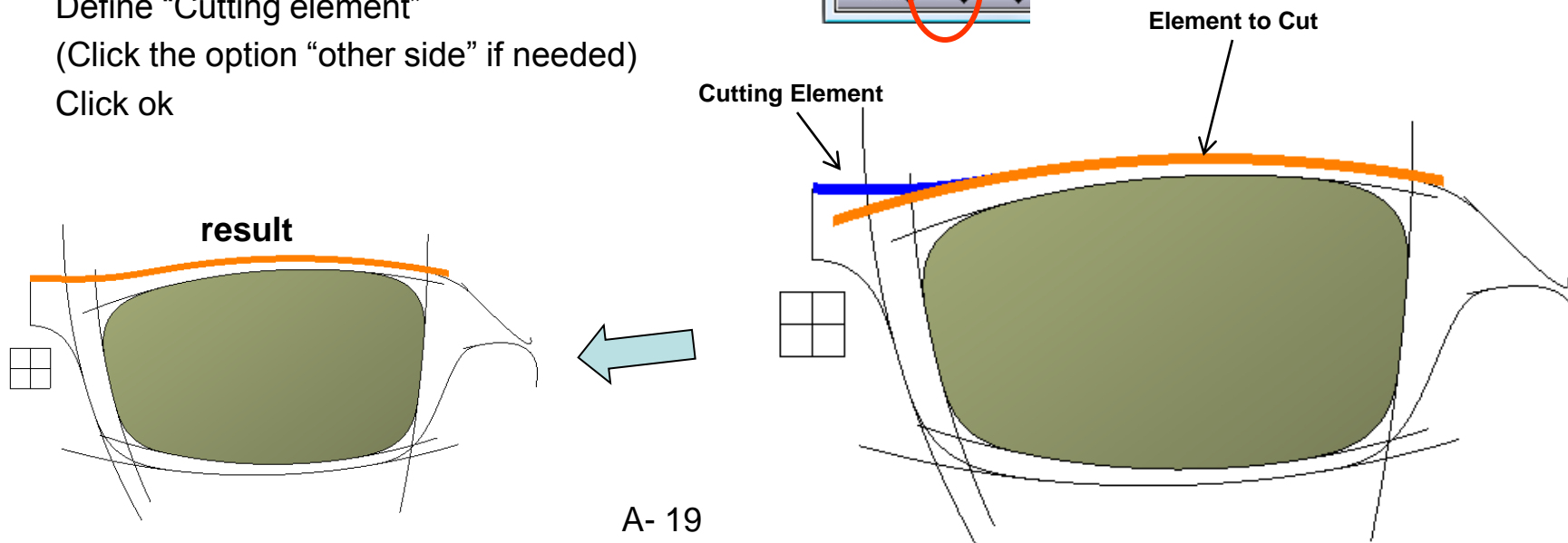
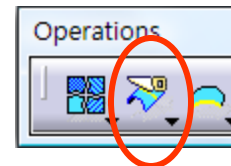


(Create a new geometrical set)

- Select “**Insert /Geometrical Set...**” on the top menu
- Click ok
- (this new set is now active (underlined))

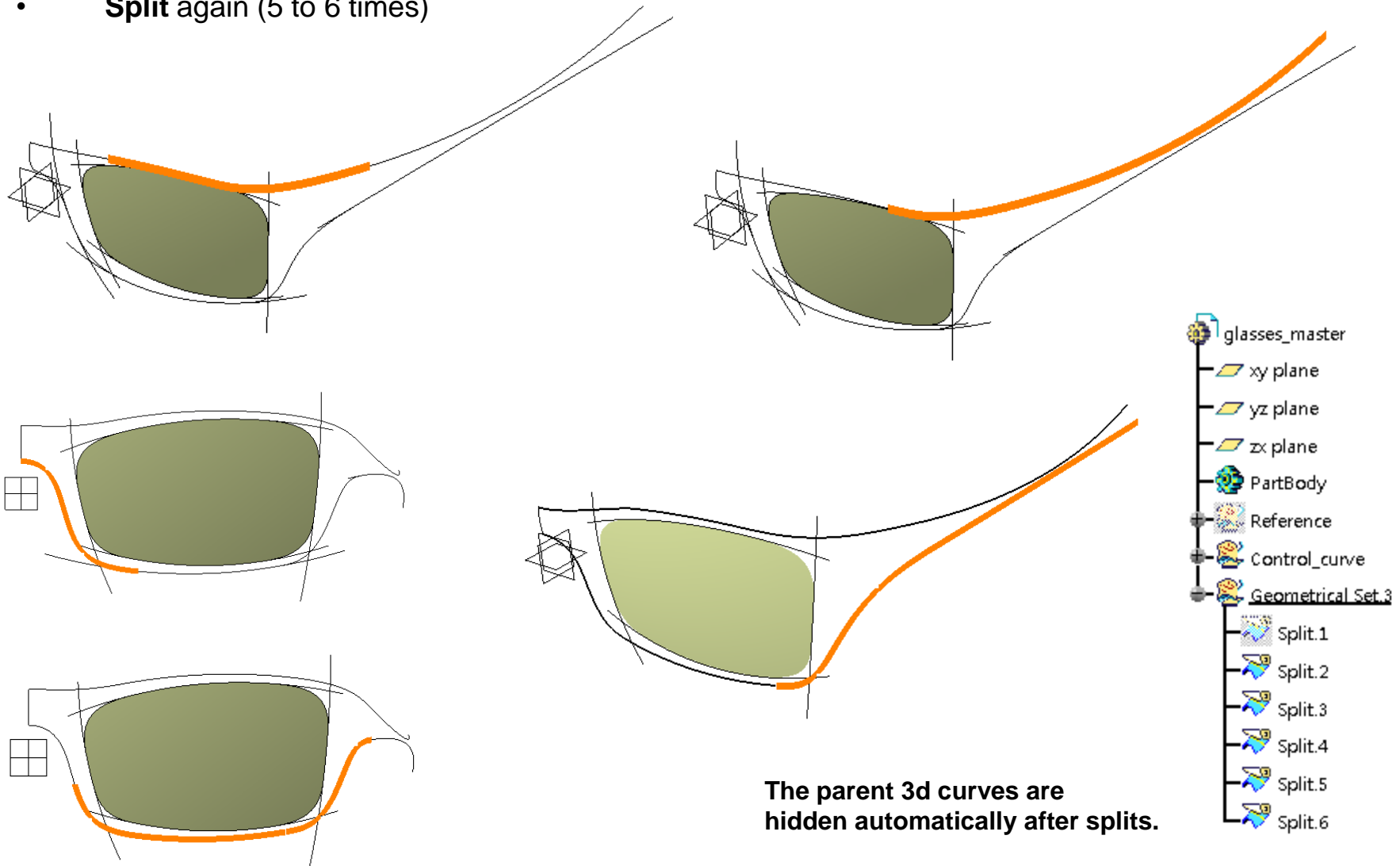
(Trim Curves – removing unnecessary portions)

- Click icon “**Split**”
- Define “Element to cut”
- Define “Cutting element”
- (Click the option “other side” if needed)
- Click ok



Tutorial 6A

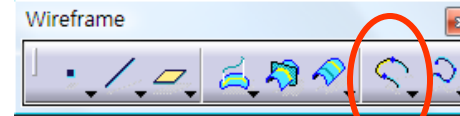
- **Split** again (5 to 6 times)



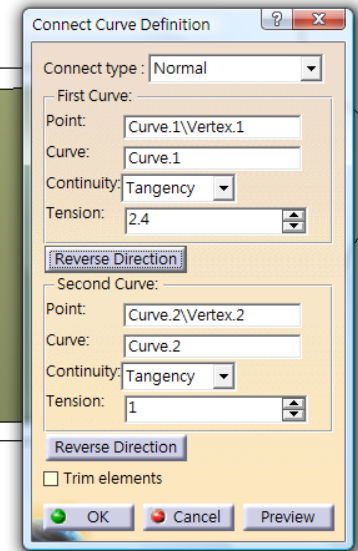
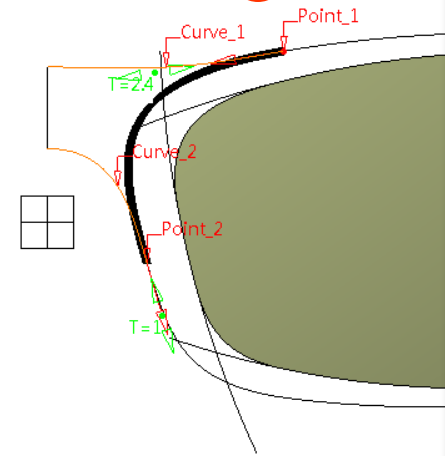
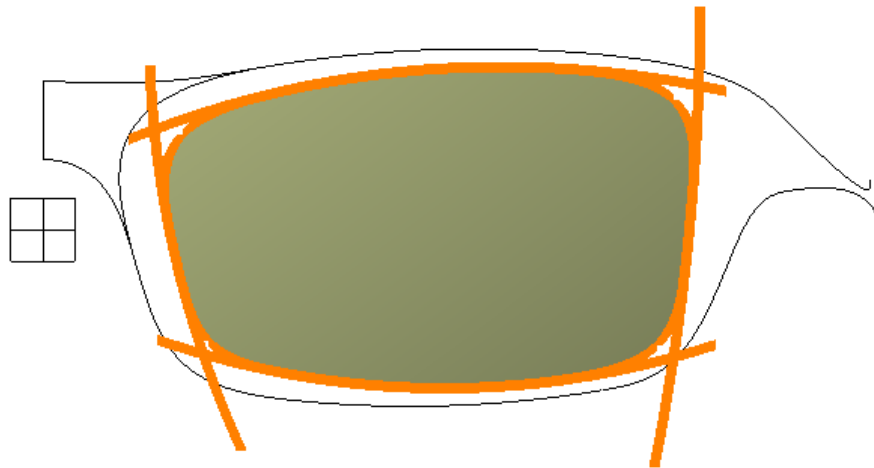
The parent 3d curves are hidden automatically after splits.

Tutorial 6A

- Click icon “**Connect Curve**”
- Define First Point & First Curve
- Define Second Point & Second Curve
- Reverse Direction if needed
- Drag on the green arrow to adjust Tension value
- Click ok

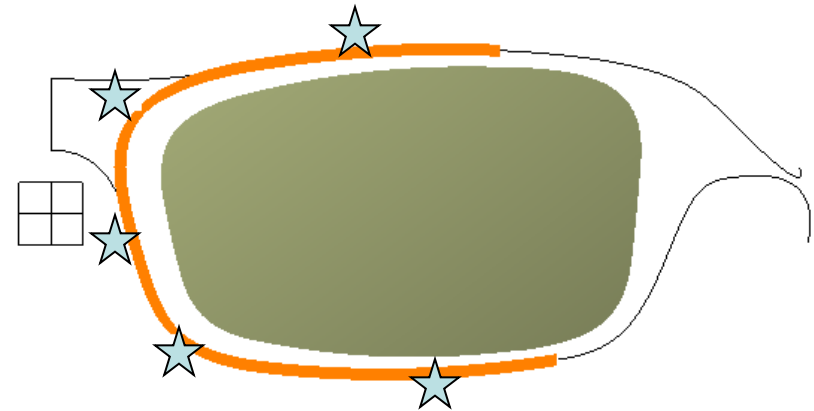
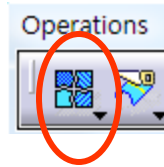


- **Hide** all Curves around the lens

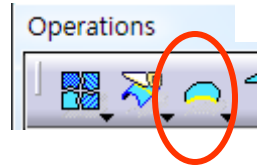


Tutorial 6A

- Click icon “**Join**”
- Select these 5 curves ★
- Click ok

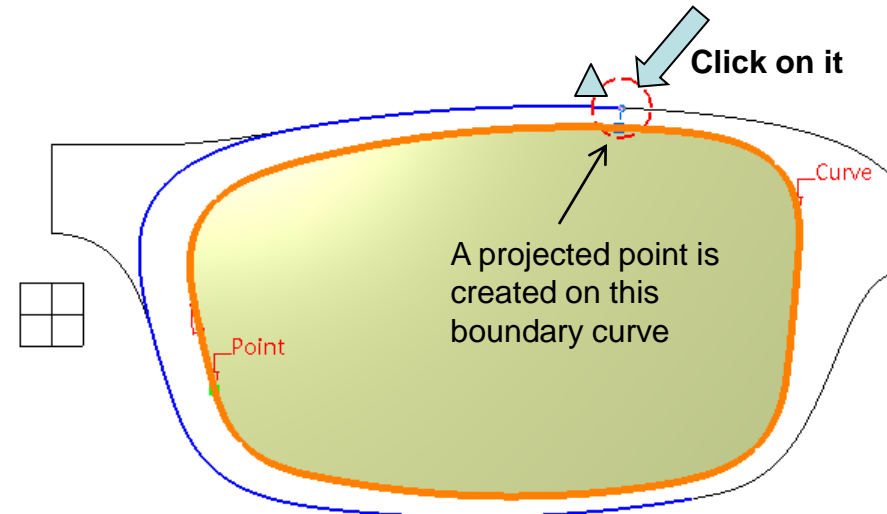
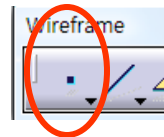


- Click icon “**Boundary**”
- Select Surface “Lens”
- (all surface edges are selected)
- Click ok




(Create a point on a curve)

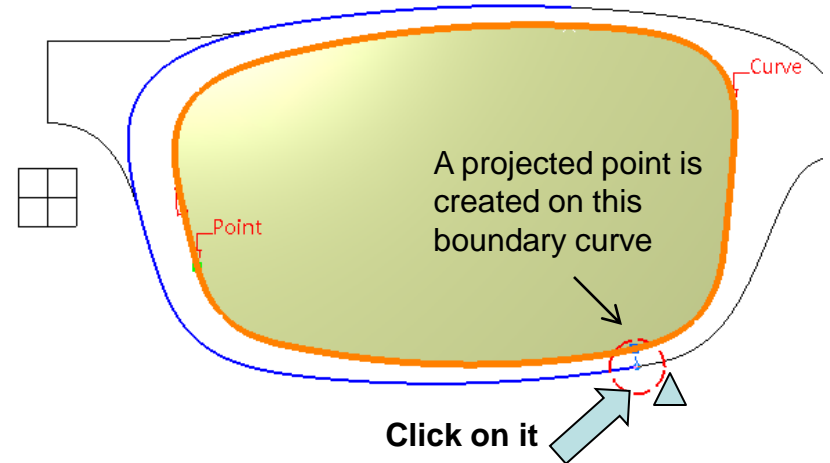
- Click icon “**Point**”
- Select the Boundary Curve
- Select the endpoint ▲ of Join Curve
- (When the mouse cursor moves on the endpoint, a red dotted circle will appear. Click on it, then a “Projected point” will be created on the boundary curve)
- Click ok



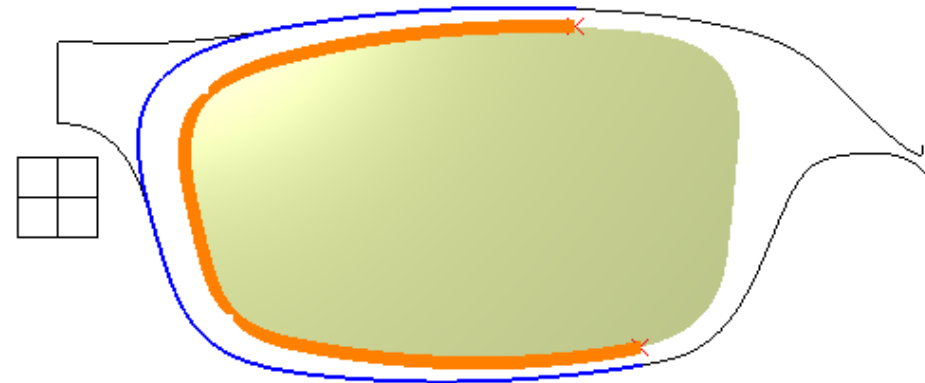
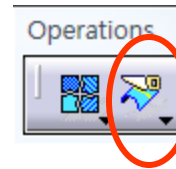
Tutorial 6A

(Similarly, Create another point on a curve)

- Click icon “**Point**”
- Select the Boundary Curve
- Select the endpoint  of Join Curve
- Click ok

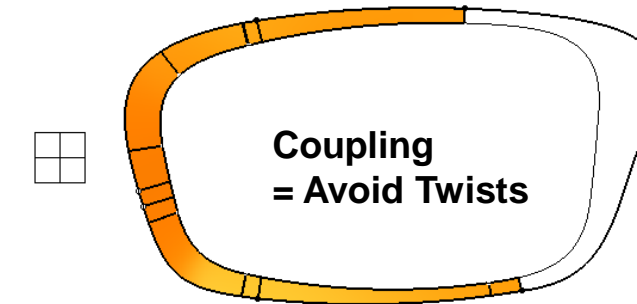
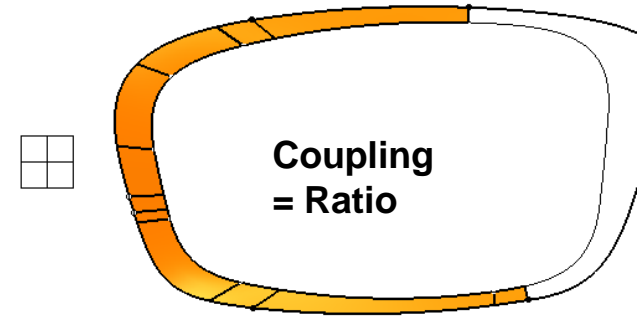
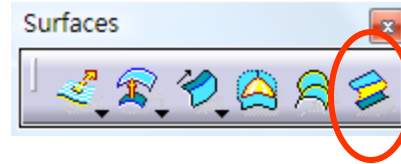



- Click icon “**Split**”
- Select the Boundary Curve
- Select the two points
- (Click “Other Side” if needed)
- Click ok

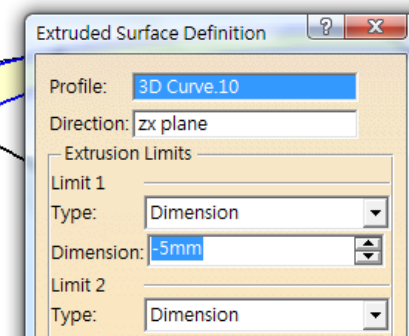
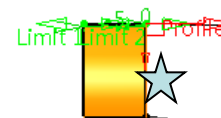
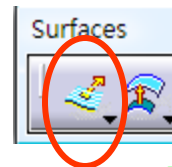


Tutorial 6A

- Click icon “**Blend (Surface)**”
- Define the First Curve
- Define the Second Curve
- (No selection for First Support & Second Support)
- Select Tab-page “Coupling/Spine”
- Select “**Avoid Twists**”
- (we can see the difference between default “Ratio” and “Avoid Twists”)
- Click ok

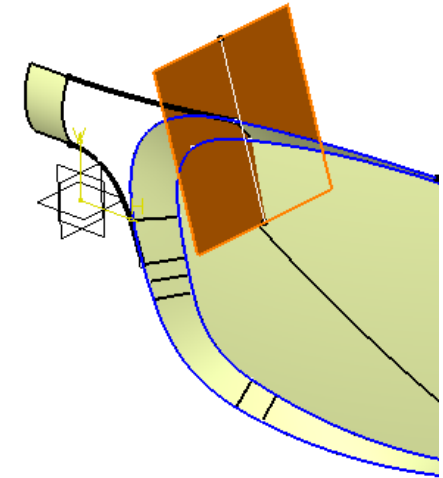
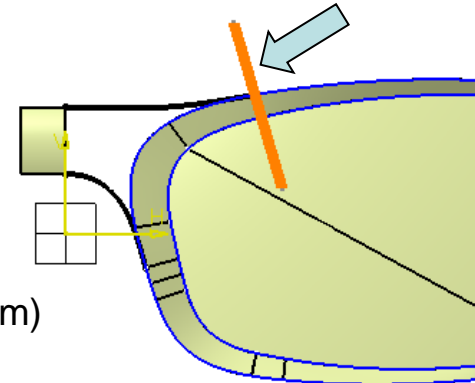


- **Hide the two points**
- Click icon “**Extrude**”
- Select the 3d Curve  as Profile
- Select ZX plane as Direction
- Drag the green arrow “Limit 1” to -5mm
- Click ok

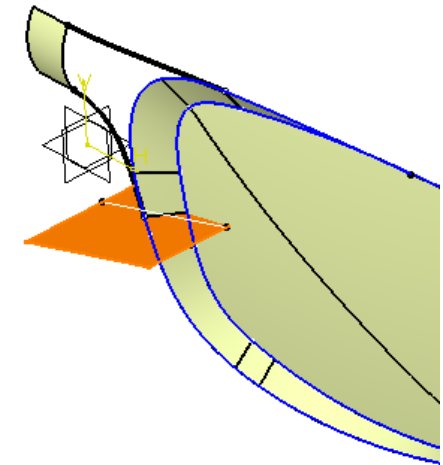
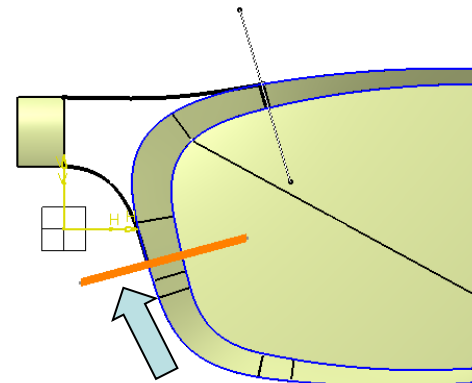


Tutorial 6A

- Click icon “**Sketch**”
- Select Yz plane
- Draw a straight line
- Click “Exit workbench”
- Click icon “**Extrude**”
- Drag green arrows (Limit 1 & 2 ~10mm)
- Click ok



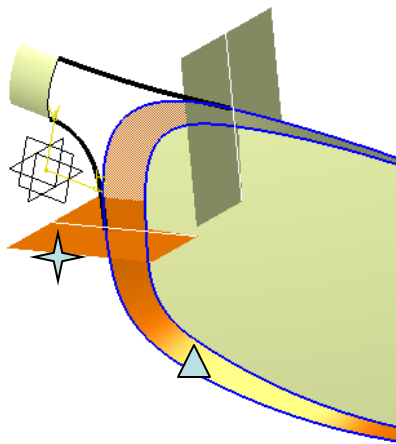
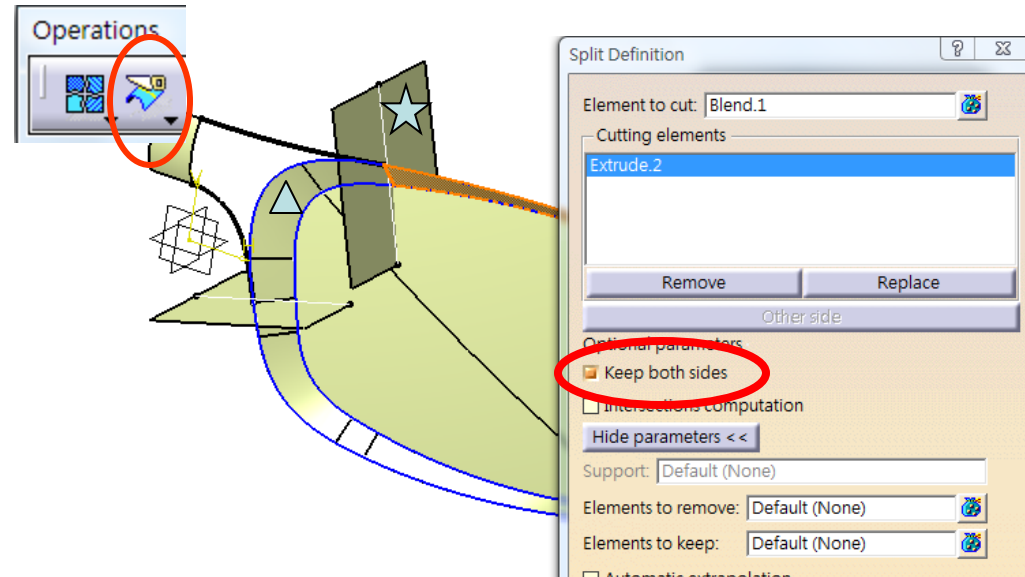
- Similarly, Click icon “**Sketch**”
- Select Yz plane
- Draw a straight line
- Click “Exit workbench”
- Click icon “**Extrude**”
- Drag green arrows (Limit 1 & 2 ~10mm)
- Click ok



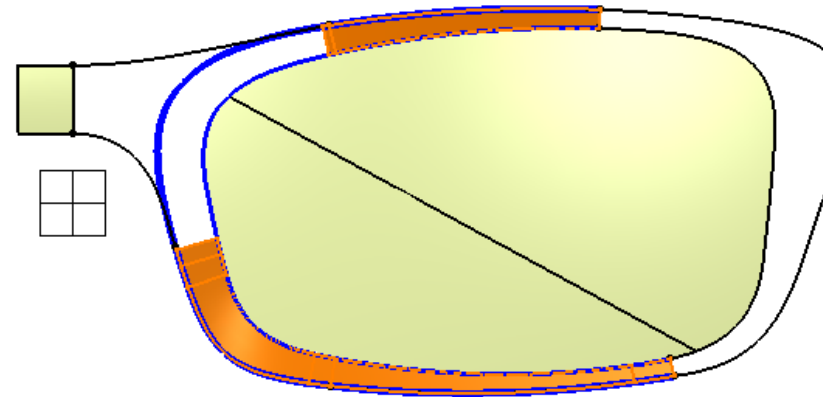
Tutorial 6A

- Click icon “**Split**”
- Select Surface ▲ as “Element to Cut”
- Select Surface ☆ as “Cutting Element”
- Highlight option “**Keep both sides**”
- Click ok

- Click icon “**Split**” again
- Select Surface ▲ as “Element to Cut”
- Select Surface ☆ as “Cutting Element”
- (Click “Other side” if needed)
- Click ok



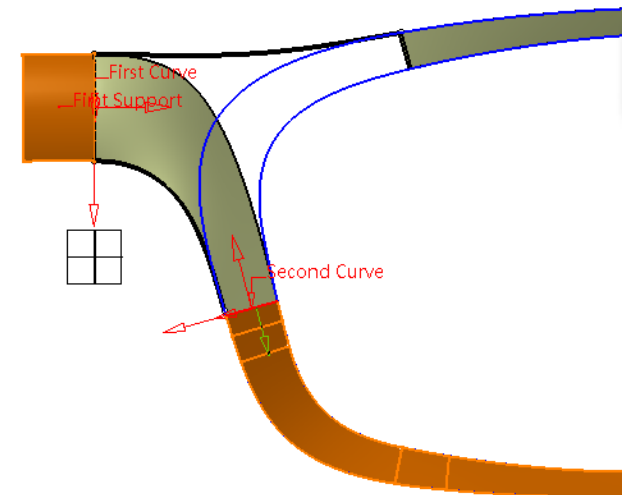
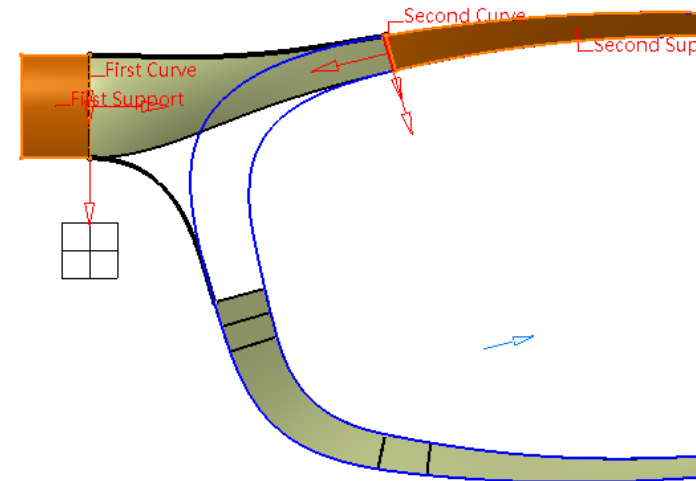
A- 26



Result after two splits

Tutorial 6A

- **Hide Previous Two Sketches & Two Extruded Surfaces**
 - Click icon “**Blend (surface)**”
 - Define First Curve & First Support
 - Define Second Curve & Second Support
 - Select “**Tangency**” as First Continuity (**Extruded surface**)
 - Select “**Curvature**” as Second Continuity
 - Adjust Tension on both sides (ref to existing 3D curve)
 - Click ok
-
- Click icon “**Blend (surface)**”
 - Define First Curve & First Support
 - Define Second Curve & Second Support
 - Select “**Tangency**” as First Continuity (**Extruded surface**)
 - Select “**Curvature**” as Second Continuity
 - Adjust Tension on both sides (close to existing 3D curve)
 - Click ok



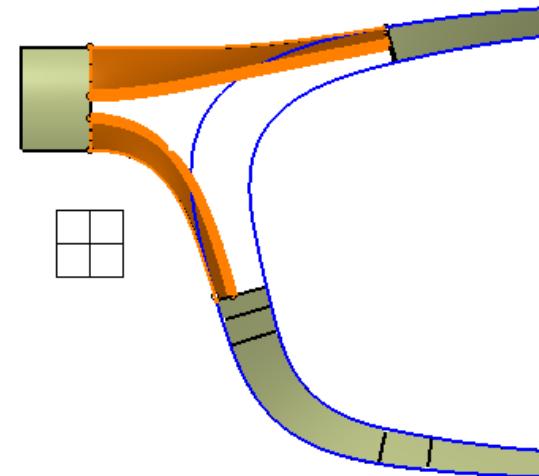
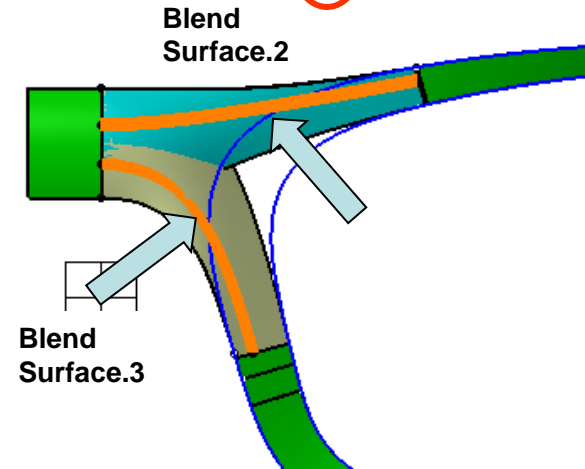
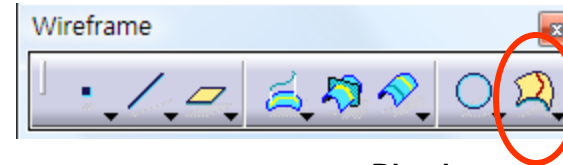
Tutorial 6A

- Click icon “**Isoparametric Curve**”
- Select Surface “Blend.2”
- Click on the surface
- Click “Swap Curve Direction” if needed
- Click ok

- Click icon “**Isoparametric Curve**”
- Select Surface “Blend.3”
- Click on the surface
- Click “Swap Curve Direction” if needed
- Click ok

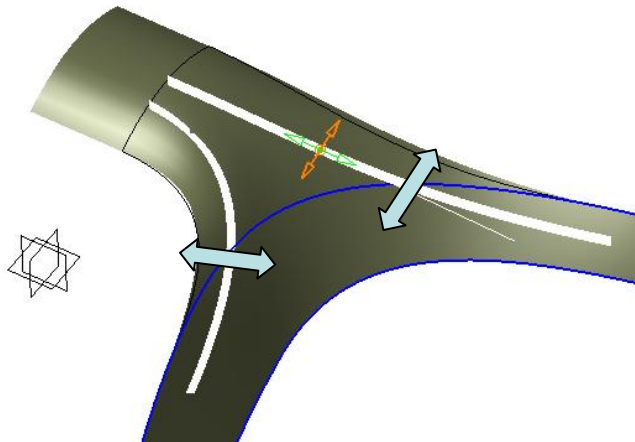
- Click icon “**Split**”
- Select “Blend.2” as “Element to cut”
- Select “Isoparametric Curve.1” as “Cutting Element”
- Click ok

- Click icon “**Split**”
- Select “Blend.3” as “Element to cut”
- Select “Isoparametric Curve.2” as “Cutting Element”
- Click ok

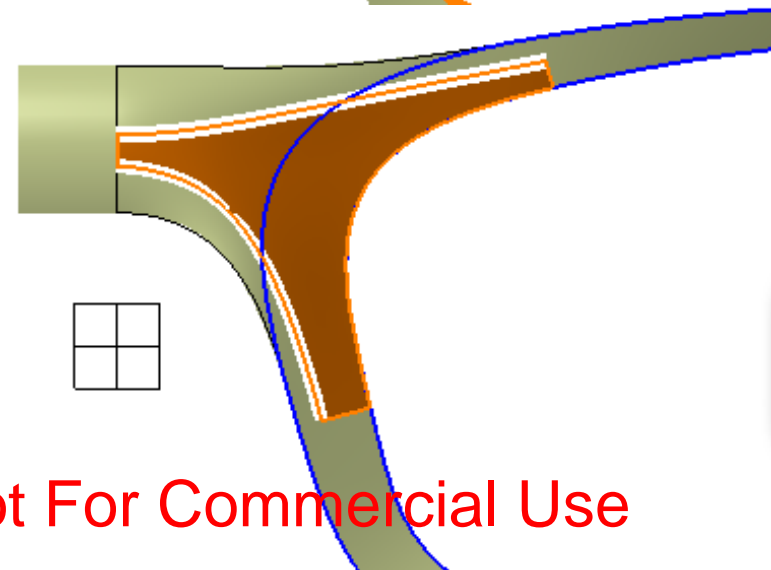
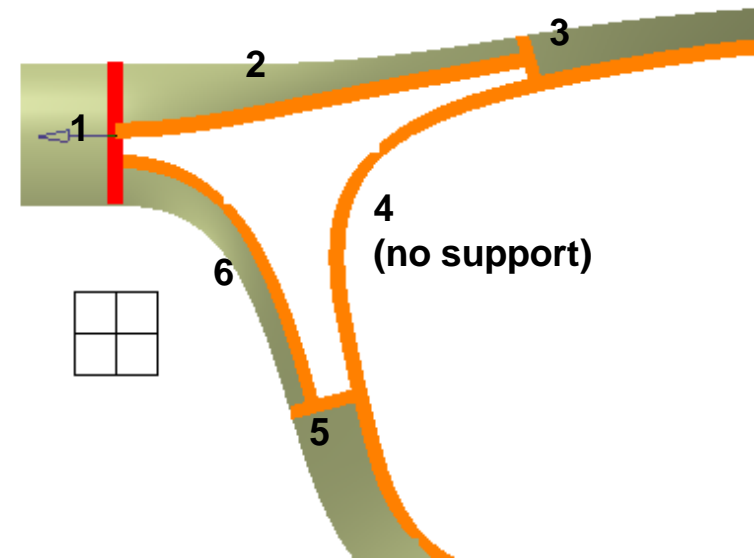


Tutorial 6A

- Click icon “**Fill**”
- Select curves & support surfaces as shown
- (we don’t need to trim crossing curves before the command “Fill”; we just need to ensure that there is no gap among them)
- Select “**Curvature**” as Continuity
- Click ok
- (if you find the resultant surface is not smooth, double-click the isoparametric curve and drag the green arrow on the surface to change another uv position)
- (if your computer is too slow, you can select “manual update mode”; Modify the curve, then click icon “update” to update all surfaces)



Manual
update

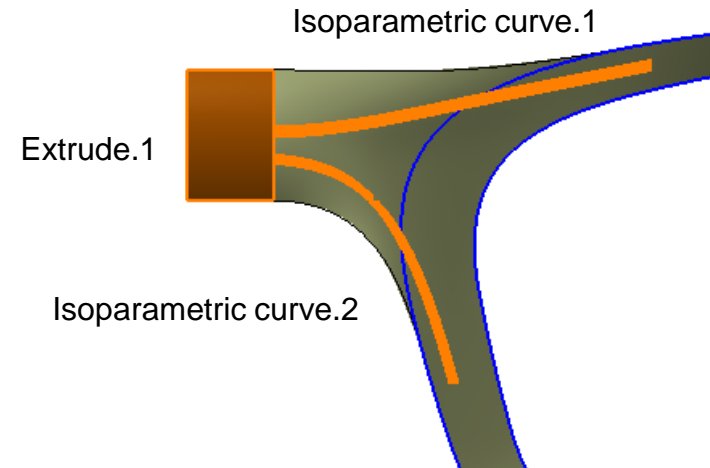


Not For Commercial Use

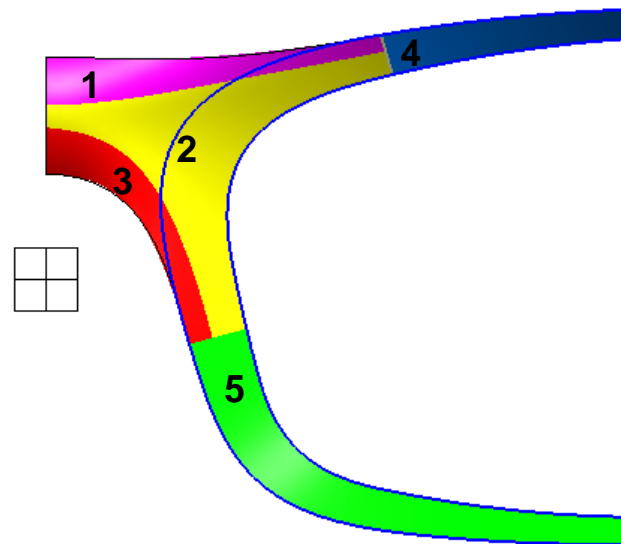
A- 29

Tutorial 6A

- Hide “Extrude.1” Surface
- Hide “Isoparametric Curve.1”
- Hide “Isoparametric Curve.2”



- Click icon “Join”
- Select these 5 surfaces
(selection sequence is NOT IMPORTANT)
- Click ok



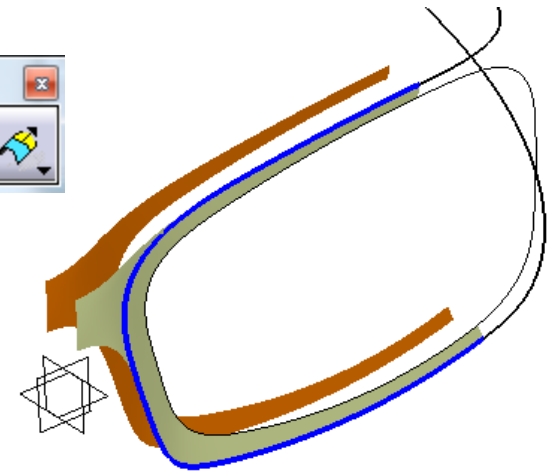
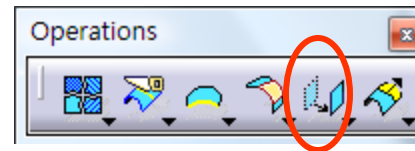
- File Save Again

**End of Tutorial 6A
- Take a Rest**

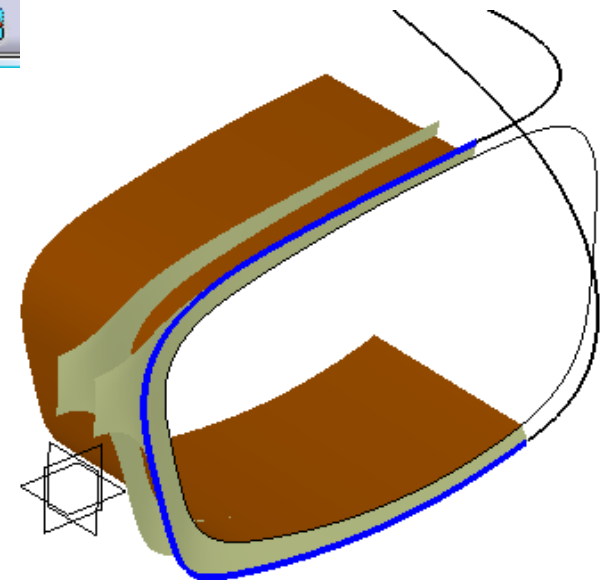
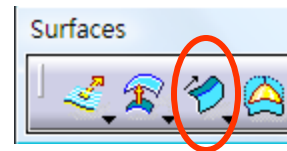
A- 30

Tutorial 6B

- Click icon “**Translate**”
- Select the “Join Surface” as Element
- Select Yz plane as Direction
- Enter -5mm as Distance
- Click ok



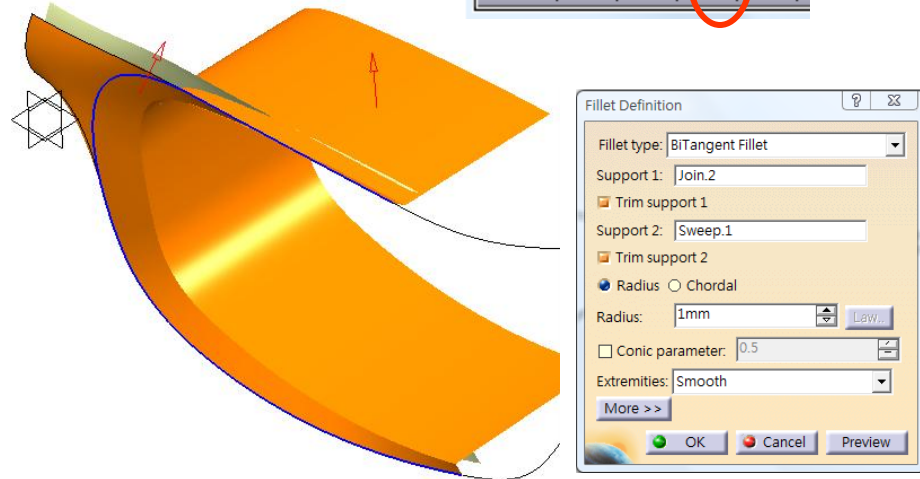
- Click icon “**Sweep**”
- Select “Linear” as Profile Type
- Select “with draft direction” as Subtype
- Select Split.7 (a split curve on “Lens”) as “Guide Curve”
- Select Yz plane as “Draft Direction”
- Enter 1 as degree
- Select 1 (/4) as Angular Sector
- Enter 20mm as Length1
- Click ok



Tutorial 6B

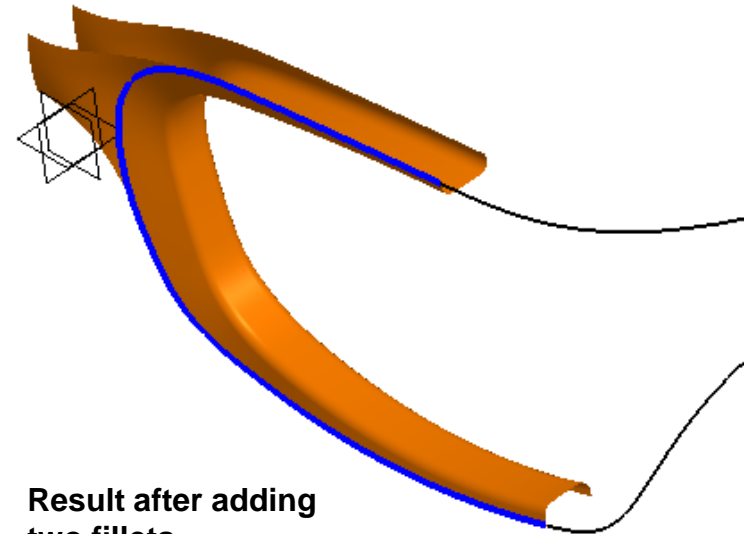
(Create a Surface-to-Surface Fillet in front)

- Click icon “**Shape Fillet**”
- Define Support.1
- Select option “Trim Support.1”
- Define Support.2
- Select option “Trim Support.2”
- Enter 1mm as Radius
- Click ok



(Create another Surface-to-Surface Fillet at the back)

- Click icon “**Shape Fillet**”
- Define Support.1
- Select option “Trim Support.1”
- Define Support.2
- Select option “Trim Support.2”
- Enter 1mm as Radius
- Click ok

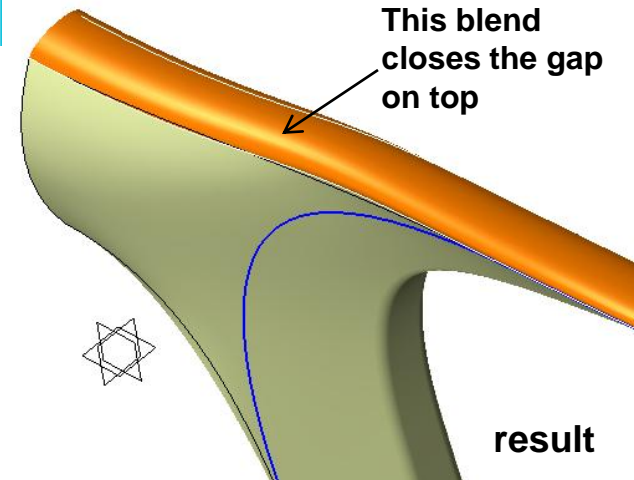
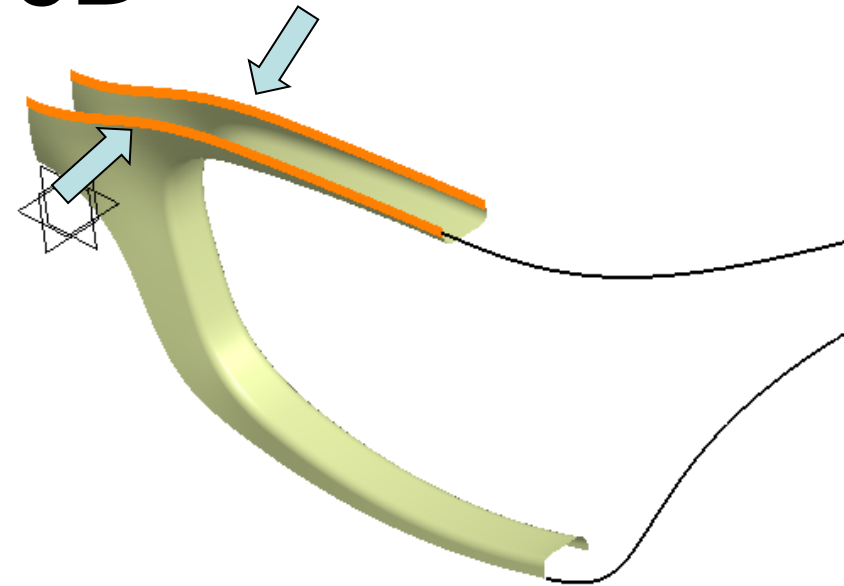
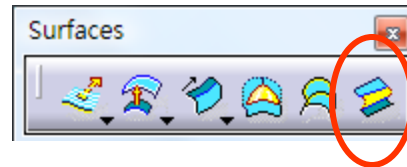


Result after adding two fillets

Tutorial 6B

(Create a Blend surface to close the upper gap)

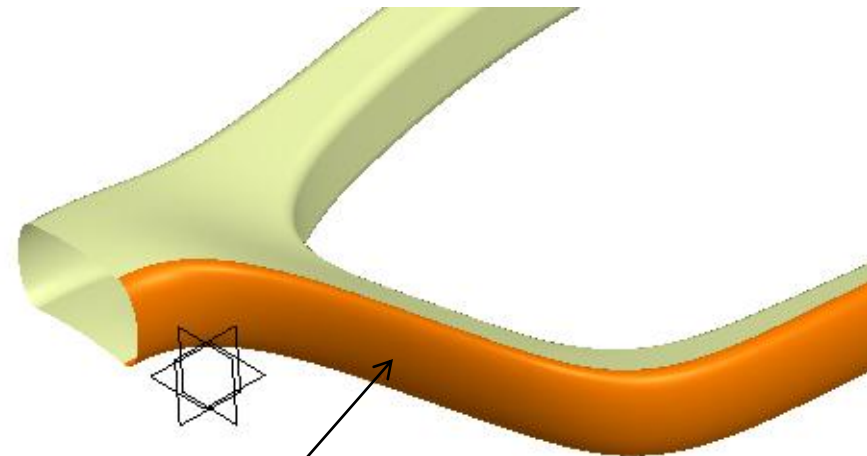
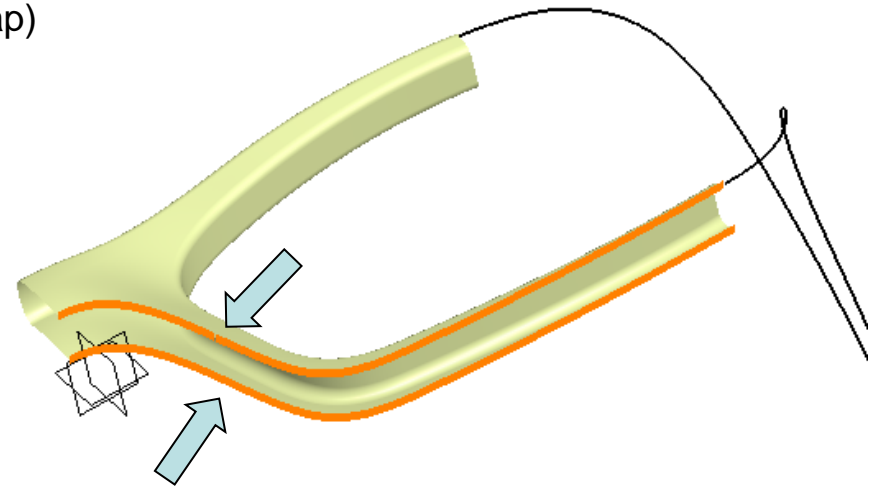
- Click icon “**Boundary**”
 - Select “Tangent Continuity” as Propagation
 - Click the surface edge
 - Click ok
 - Similarly, Click icon “**Boundary**”
 - Select “Tangent Continuity”
 - Click the surface edge
 - Click ok
-
- Click icon “**Blend**”
 - Define First Curve & First Support
 - Define Second Curve & Second Support
 - Select **Tangency** as First & Second Continuity
 - Adjust Tension = 0.5
 - Select option “Trim first support”
 - Select option “Trim second support”
 - (if the option “Trim support” is selected, the related surfaces will be joined together)
 - Click ok



Tutorial 6B

(Similarly Create a Blend surface to close the lower gap)

- Click icon “**Boundary**”
 - Select “Tangent Continuity”
 - Click the surface edge
 - Click ok
 - Click icon “**Boundary**” again
 - Select “Tangent Continuity”
 - Click the surface edge
 - Click ok
-
- Click icon “**Blend**”
 - Define First Curve & First Support
 - Define Second Curve & Second Support
 - Select Tangency as First & Second Continuity
 - Adjust Tension = 0.5
 - Select option “Trim first support”
 - Select option “Trim second support”
 - Click ok



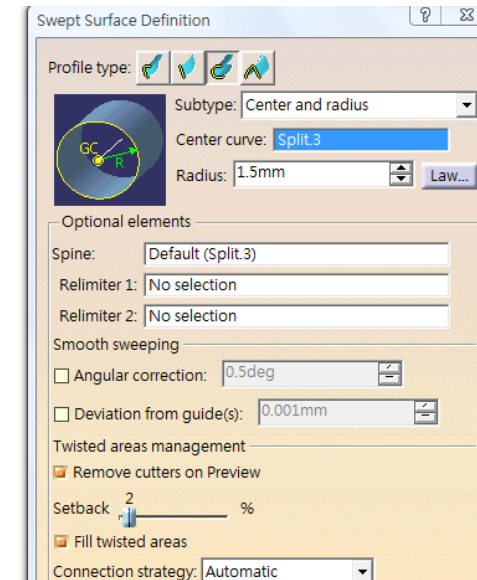
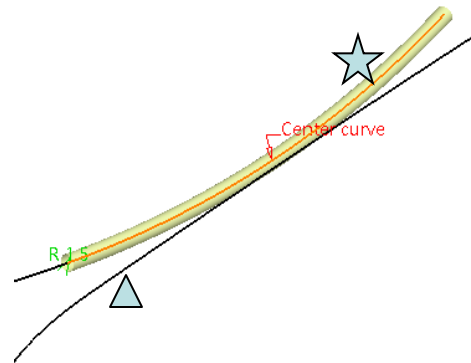
This blend
closes the gap

result

Tutorial 6B

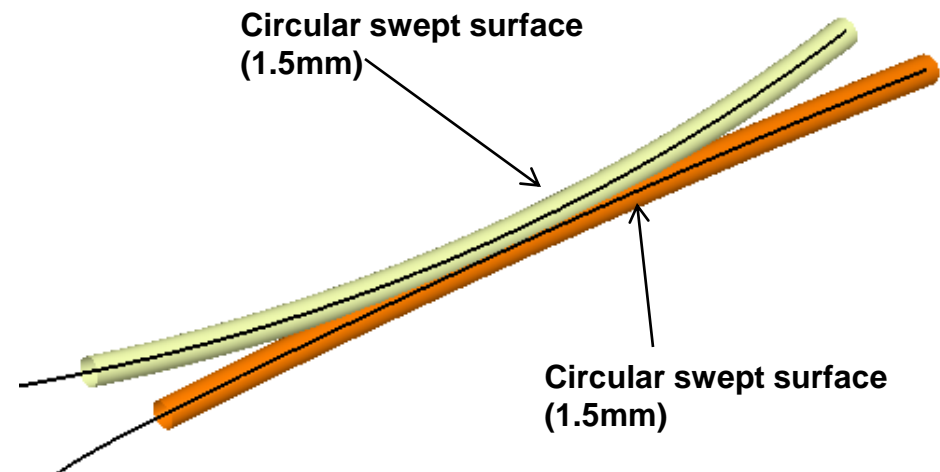
(Create a Swept Surface for Upper Arm)

- Click icon “**Sweep**”
- Select “Circle” as Profile Type
- Select “Centre and Radius” as Subtype
- Select the 3D curve ★ as Center Curve
- Enter 1.5mm as Radius
- Click ok



(Create another Swept Surface for Lower Arm)

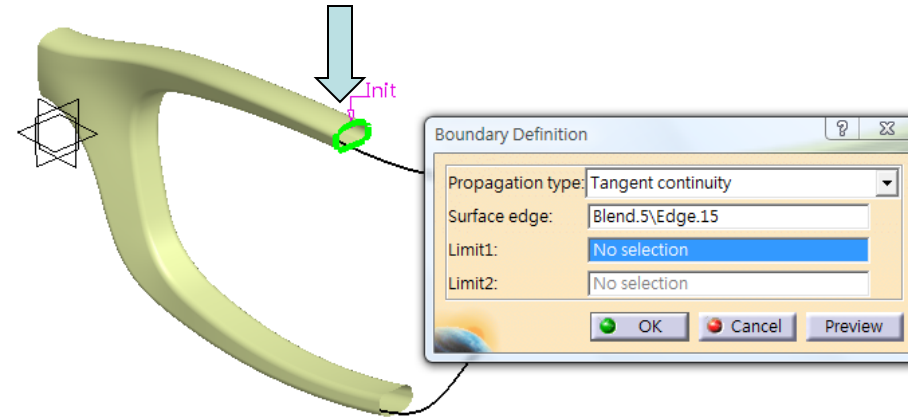
- Click icon “**Sweep**”
- Select “Circle” as Profile Type
- Select “Centre and Radius” as Subtype
- Select the 3D curve ▲ as Center Curve
- Enter 1.5mm as Radius
- Click ok



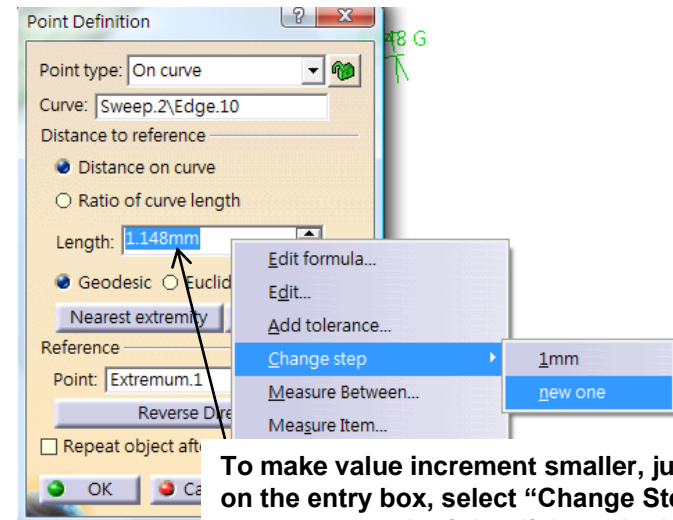
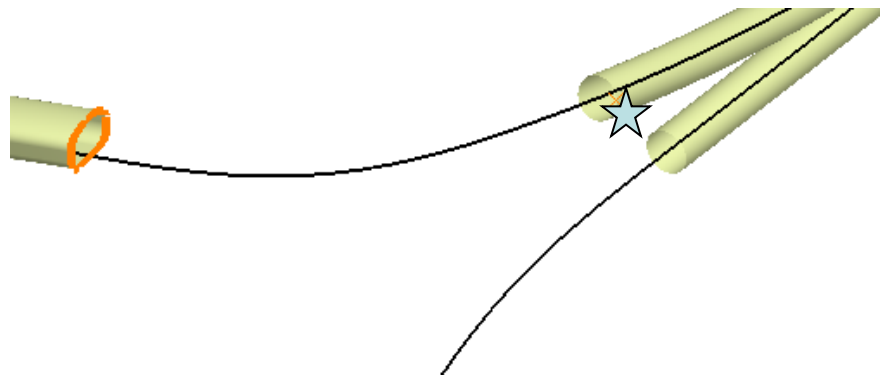
A- 35

Tutorial 6B

- Click icon “**Boundary**”
- Select the surface edge (Tangent Continuity)
- Click ok



- Click icon “**Point**”
- Select the edge of the Circular Sweep (Point type will be selected as “On curve” automatically)
- Enter a value of “Distance on Curve” (so that the point moves to the outermost position★)

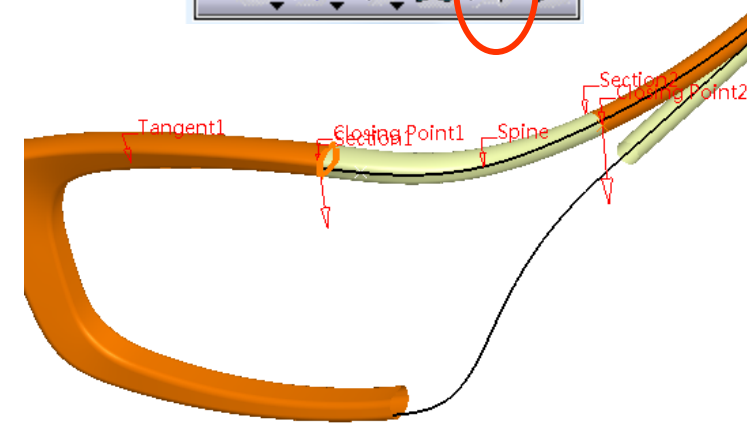


To make value increment smaller, just Right-click on the entry box, select “Change Step / New one”, enter 0.1mm, ok; right-click on the box again, select “Change Step/0.1mm”

Tutorial 6B

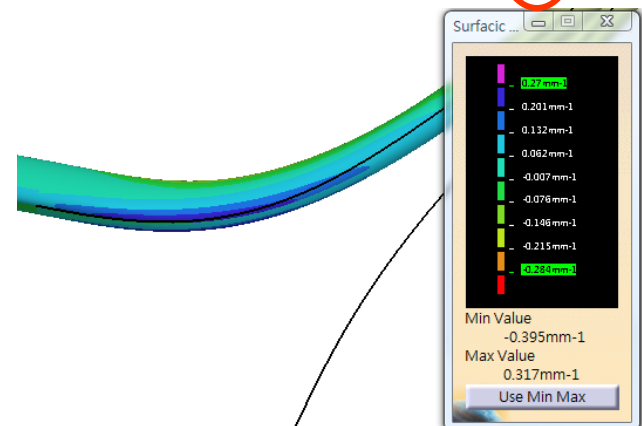
- Click icon “**Multi-Sections Surface**”
- Define Section1, Tangent Surface1, closing point 1
- Define Section2, Tangent Surface2, closing point 2
- Check if the arrows point to the same direction, either both clockwise or both anti-clockwise)
- Select Tab-page “Spine”
- Select the 3D curve as Spine
- Click ok

- (Study the resultant surface carefully, it may not be smooth.)



(Check the curvature distribution on Surface)

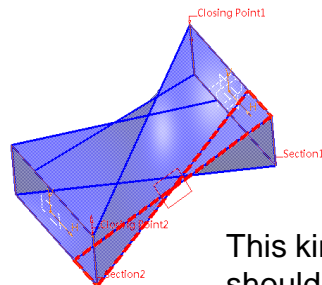
- Switch to “Shading with Material”
- Click icon “**Surface Curvature Analysis**”
- Select the surface
- Click option “Color Scale”
- Click “Use Max/Min” to regenerate the scale
- (Color on surface changes gradually, ok to accept)
- Click “Cancel”



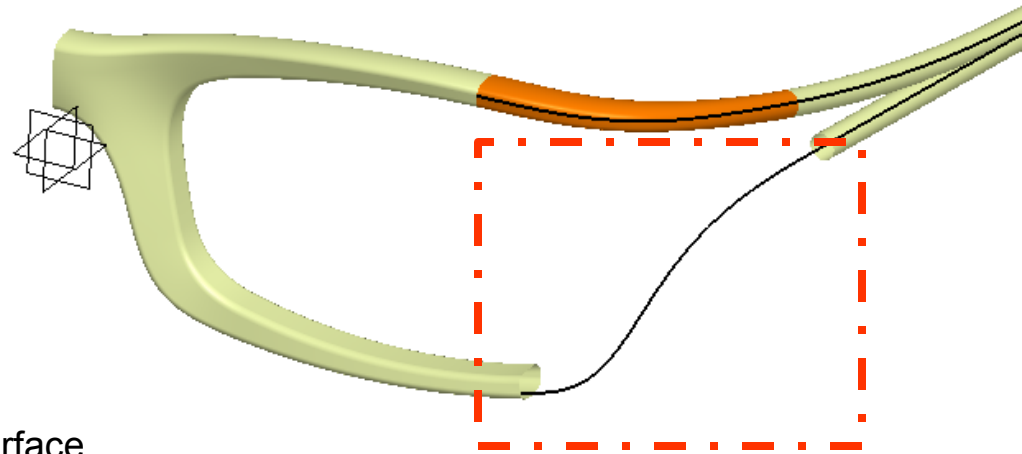
Tutorial 6B

(Create 2nd Multi-sections surface)

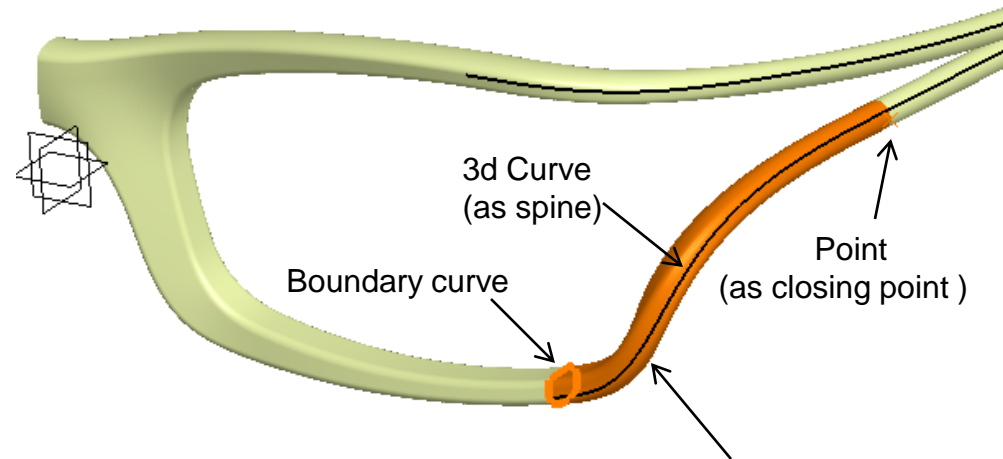
- Create a **“Boundary”** curve
- Create a **“Point”** on the circular swept surface
- Create a **“Multi-Sections Surface”** with a Spine & Coupling Control
- Adjust the position of the point so that the resultant surface is NOT twisted.



This kind of Twisting should be avoided



The following steps to complete the portion are similar to those in the previous pages



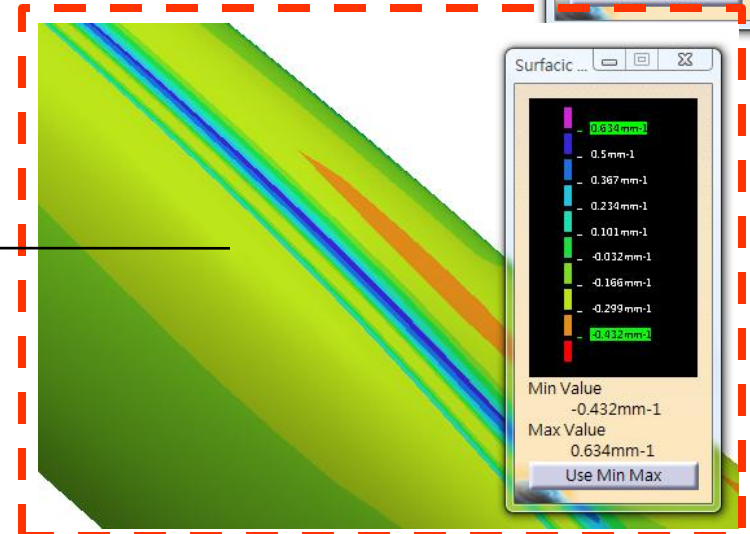
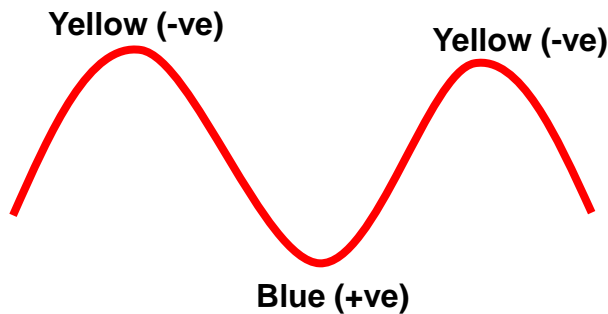
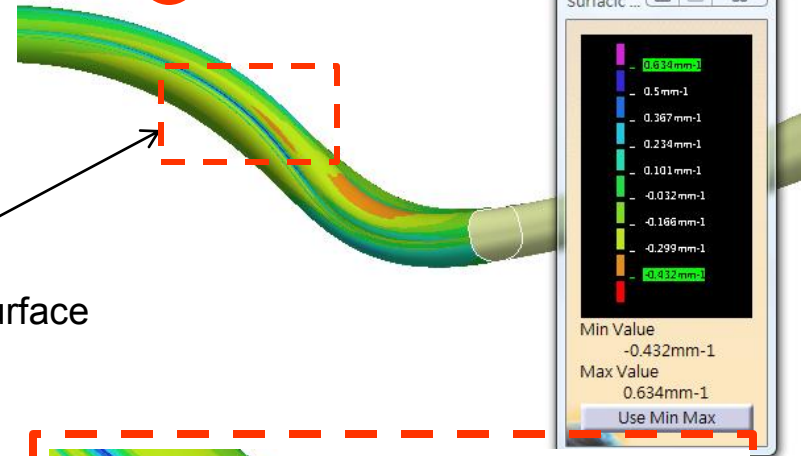
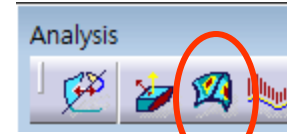
Multi-sections surface

Tutorial 6B

(Again, the resultant surface may not be smooth.)

(Check the curvature distribution on Surface)

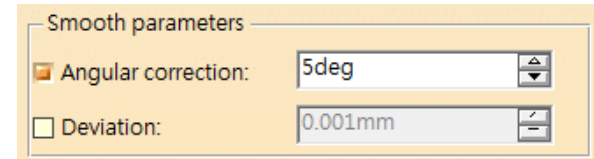
- Switch to “Shading with Material”
- Click icon “**Surfacic Curvature Analysis**”
- Select the surface
- Click option “Color Scale”
- Click “Use Max/Min” to regenerate the scale
- (Result shows that the surface is **not smooth**)
- Click “ok” to keep the result on the surface (if the surface is changed, the analysis result will be updated automatically)



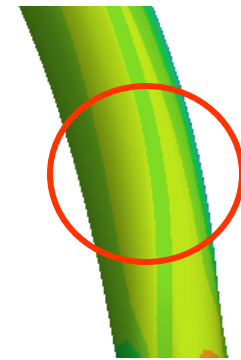
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Tutorial 6B

- Double-Click the surface “**Multi-sections Surface**”
- Highlight option “Angular Correction”
- Increase the value, then click preview (colors in the defect area become less)
- Enter the maximum value 5 degree
- Click ok to accept
- **(Remark: the tangent continuity may be lost)**
- **Delete the analysis result on the tree**



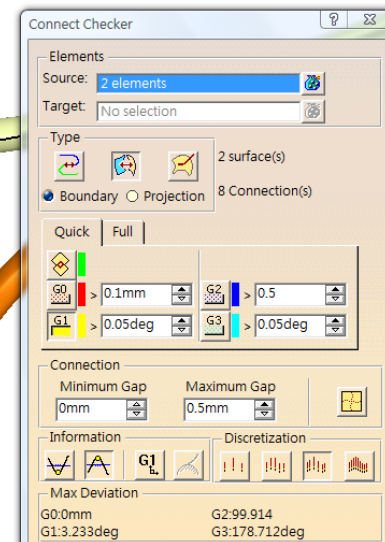
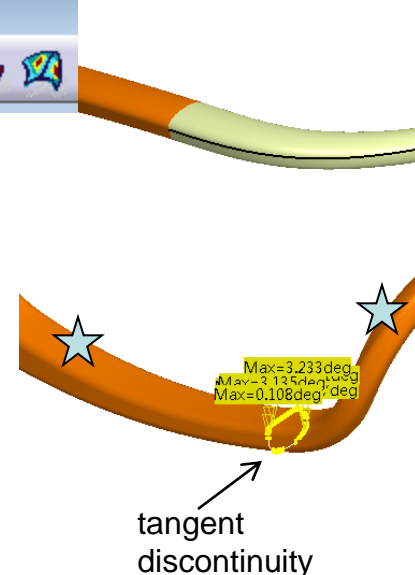
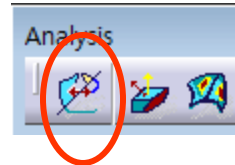
before



after

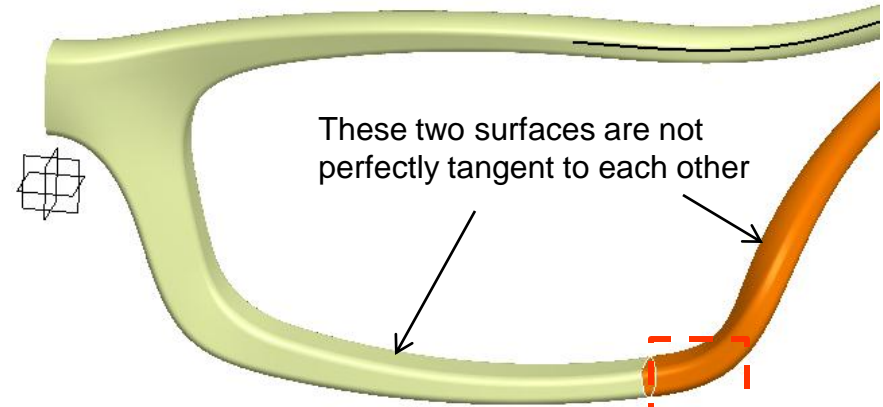
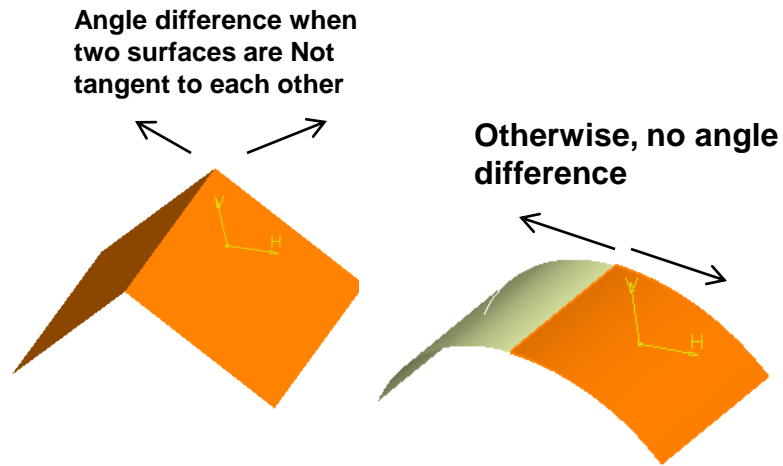
(Check Tangency Continuity between two surfaces)

- Click icon “**Connect Checker Analysis**”
- Multi-select the 2 surfaces ☆
- Select option “G1” (tangency)
- Deselect option “Min info”
- Highlight option “Max Info”
- Enter 0.5mm as Maximum Gap (elements apart from this value will NOT be analyzed)
- (Result shows that the max degree difference is ~3 degree or larger, thus these two surfaces are NOT perfectly tangent to each other.)
- **Click “Cancel”**



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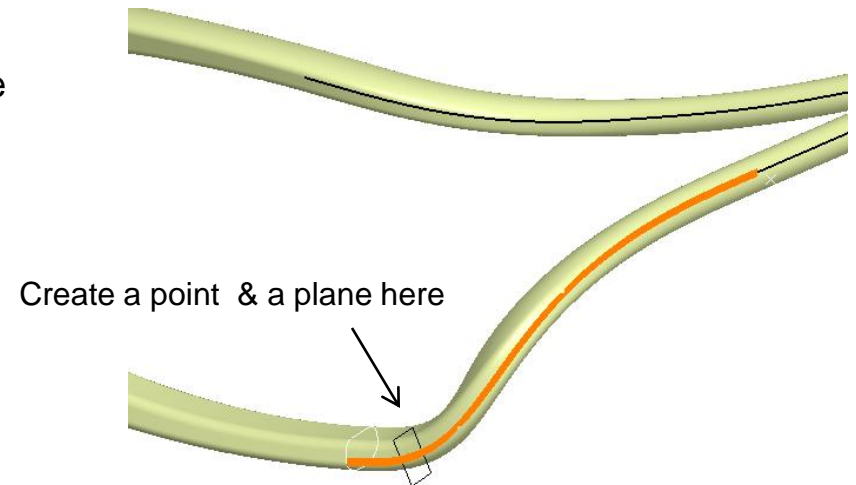
Tutorial 6B



To solve this problem, remove this small portion and then create another Multi-sections surface to bridge them

- Click icon "Point"
- Select the 3d curve
- Drag green dot on curve (point is ~5mm from the endpoint)
- Click ok

- Click icon "Plane"
- Select the curve & the point
- Click ok



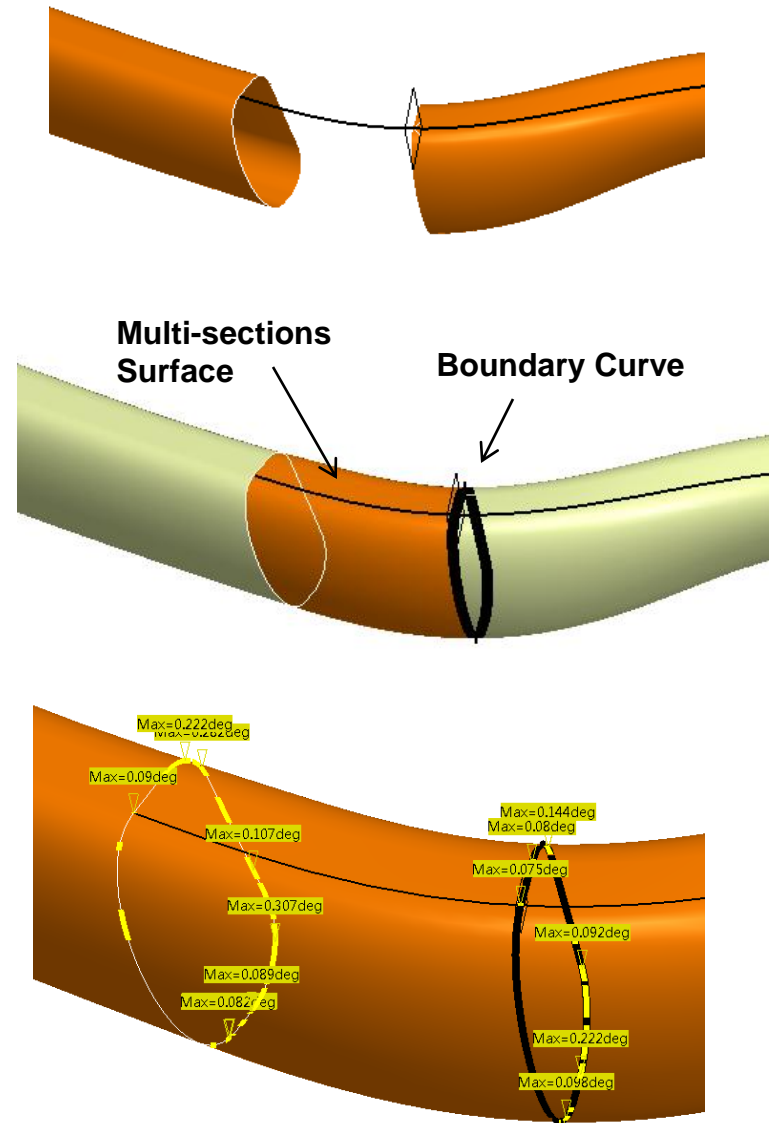
Tutorial 6B

- Click icon “**Split**”
- Select the multi-sections surface as “Element to cut”
- Select the plane as “Cutting Element”
- (Click “other side” if needed)
- Click ok

- Create a “**Boundary**” Curve on the cut edge

- Create “**Multi-sections surface**”
- Define Section1, Tangent Surface1, closing point1
- Define Section2, Tangent Surface2, closing point2
- Click ok

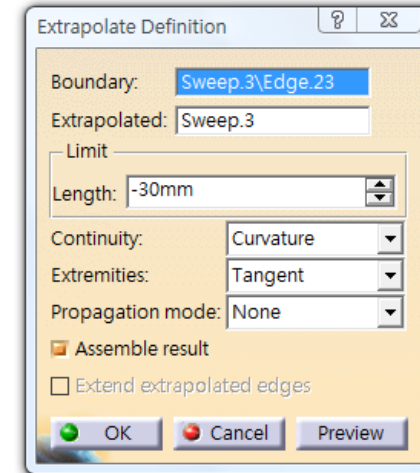
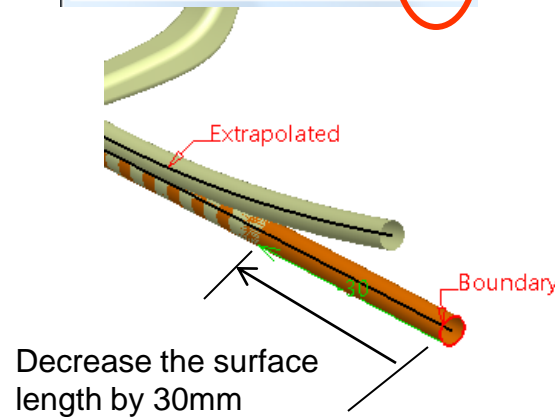
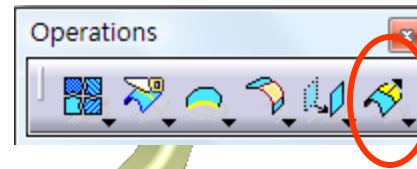
- Click icon “**Connect Checker Analysis**”
- Multi-Select the three surfaces
- Click “Max info”
- (the tangency discontinuity is largely improved; ALL less than 1 degree)
- Click Cancel



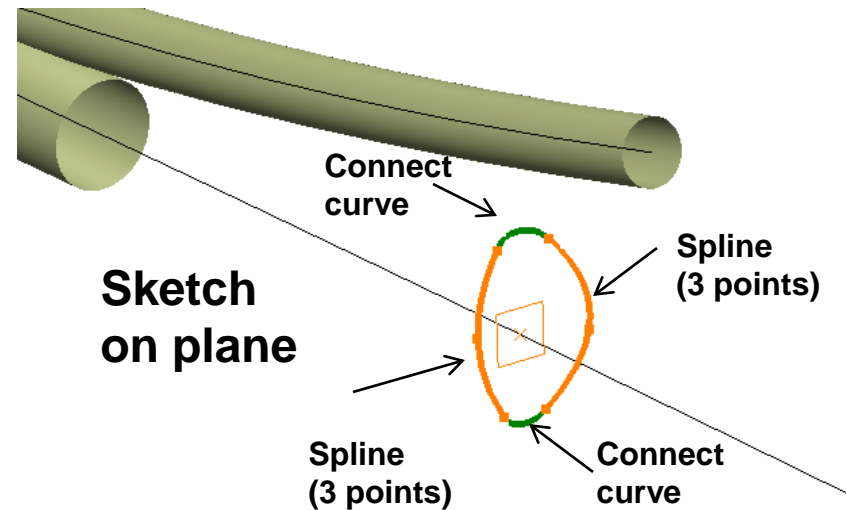
Tutorial 6B

(Create another group of surfaces on the Arm)

- Click icon “**Extrapolate**”
- Select the open edge
- Select the circular Swept Surface as “Extrapolated”
- Select “Curvature”
- Select “Assemble Result”
- Enter - 30mm as Length
- Click ok
- (the surface is shortened by 30mm)

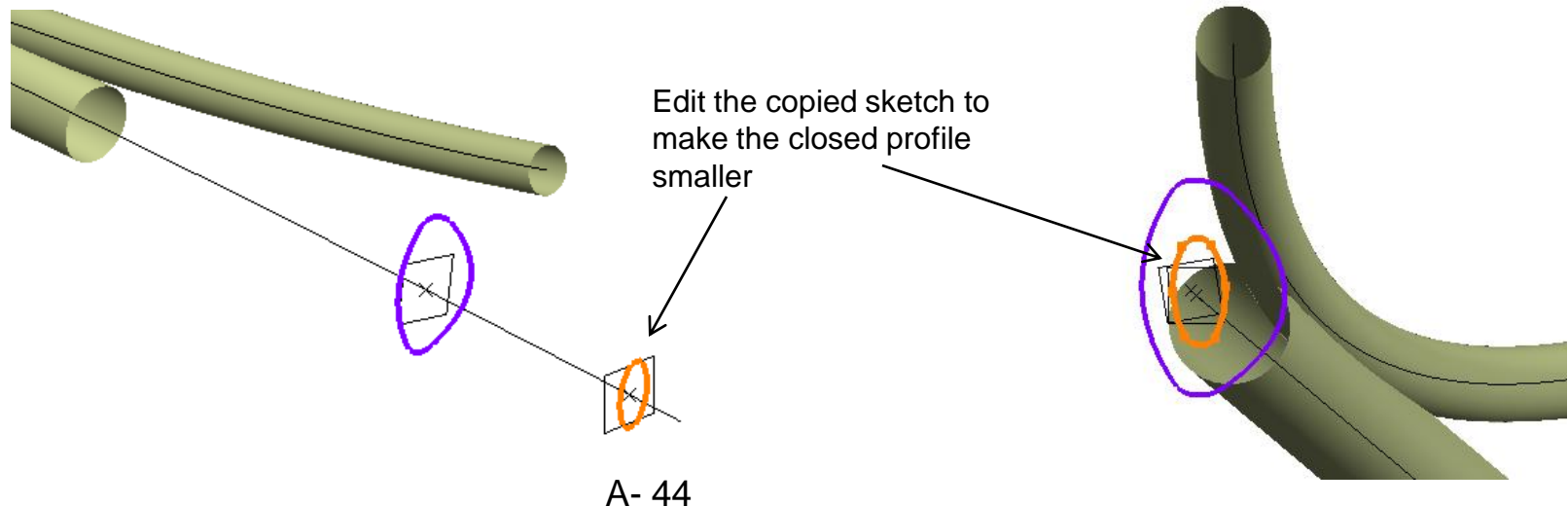
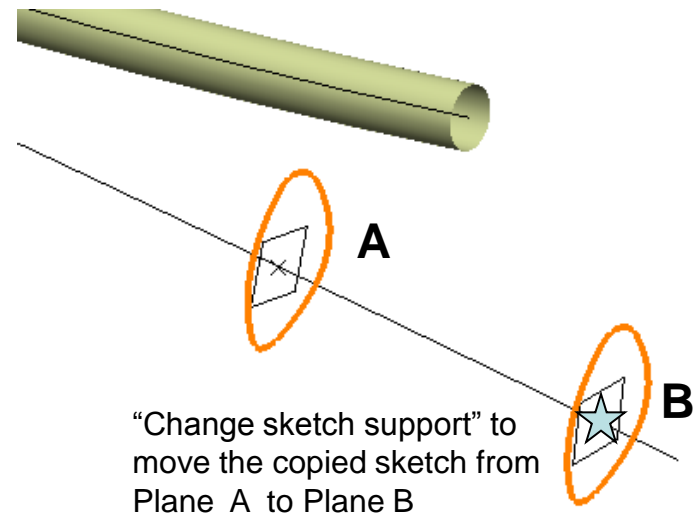


- Create a “**point**” (15mm from endpoint)
- Create a “**plane**” (normal to curve)
- Click Icon “**Sketch**”, select the plane
- Draw a profile (4 connecting splines)
- “Exit Sketch”




Tutorial 6B

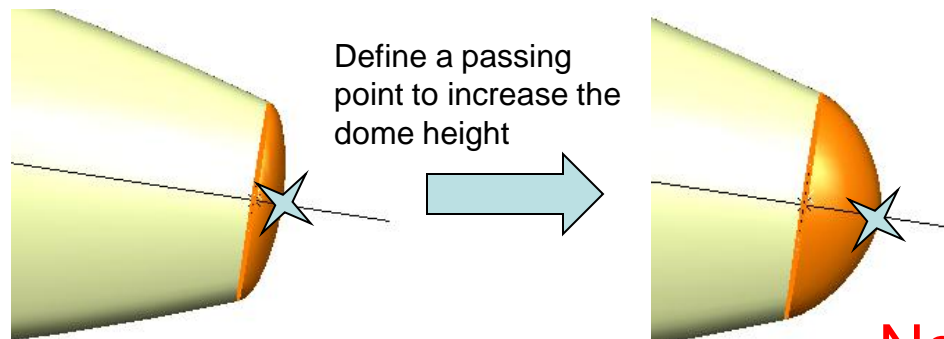
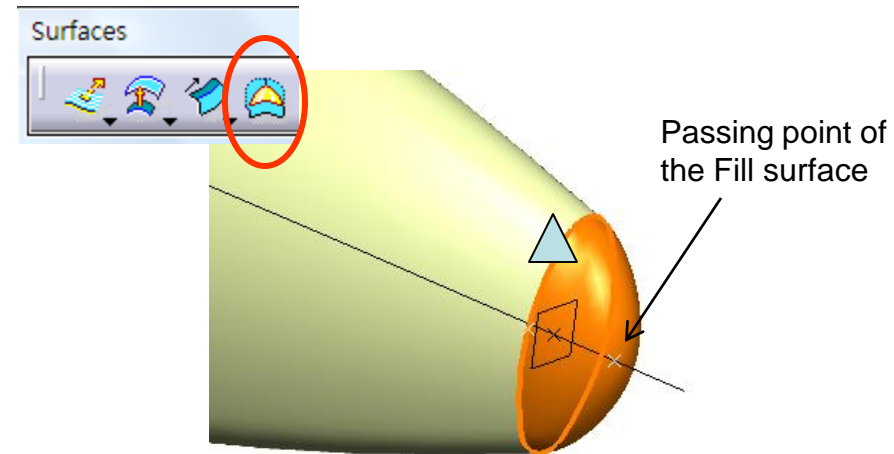
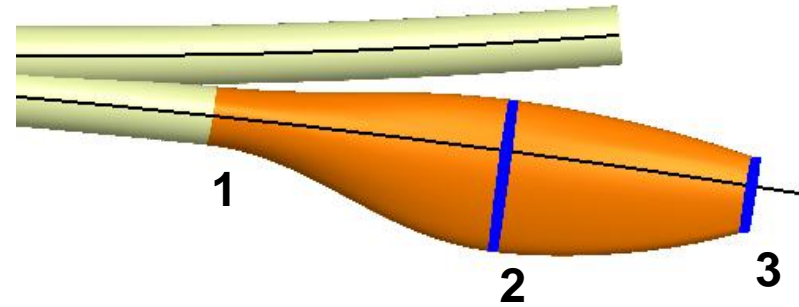
- Create a “**point**” ☆ (3mm from endpoint)
 - Create a “**plane**” at the point (normal to curve)
 - **Copy & paste** the previous sketch
 - Right-click on the copied sketch and select “**Change Sketch support**”
 - Select the new plane (the copied sketch will be moved to this new plane)
-
- **Double-Click** the Sketch to edit
 - Modify the profile to make it smaller
 - “Exit Workbench” to complete



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Tutorial 6B

- Click icon “**Multi-Sections Surface**”
- Define Section1, Tangent1
- Define Section2
- Define Section3
- Click ok
- Click icon “**Fill**”
- Select Sketch  as “Boundary”
- Select the Multi-sections surface as “Support”
- Select “Tangent” as Continuity
- (You can create a point on the 3d curve, as the passing point of this Fill surface)
- Click ok

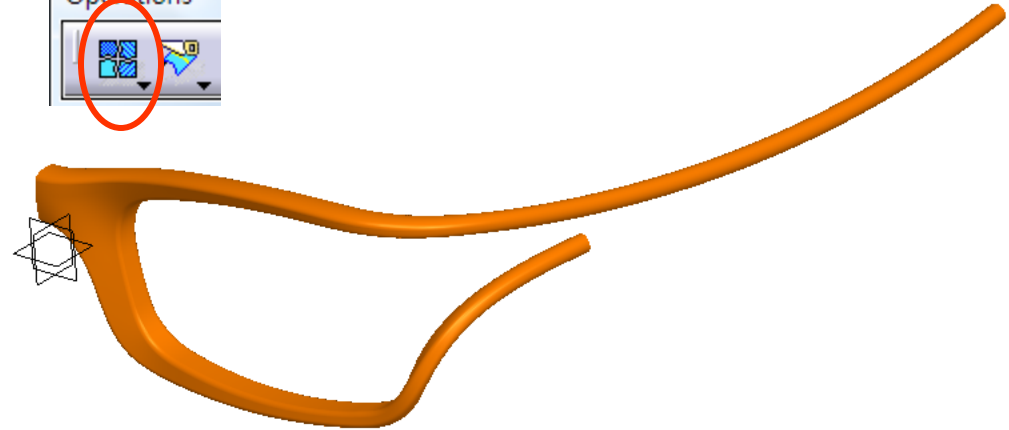
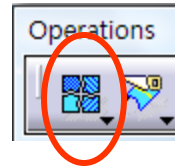


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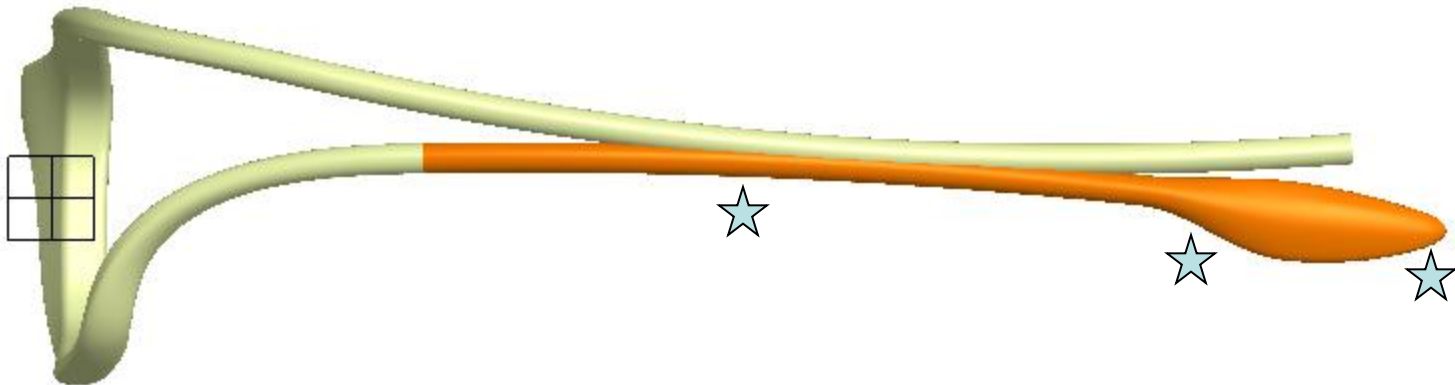
Not For Commercial Use

Tutorial 6B

- Click icon “**Join**”
- Select all surfaces,
except the 3 surfaces of lower arm ★
- Click ok

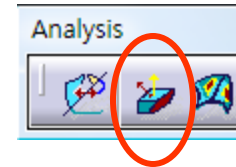


- Click icon “**Join**” again
- Select the remaining 3 surfaces ★
- Click ok

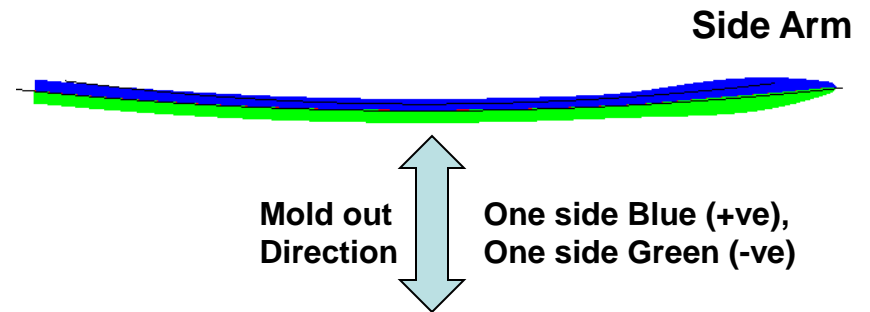
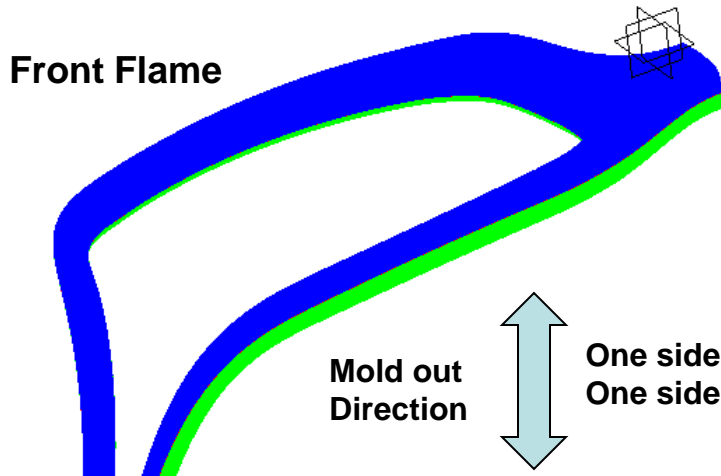
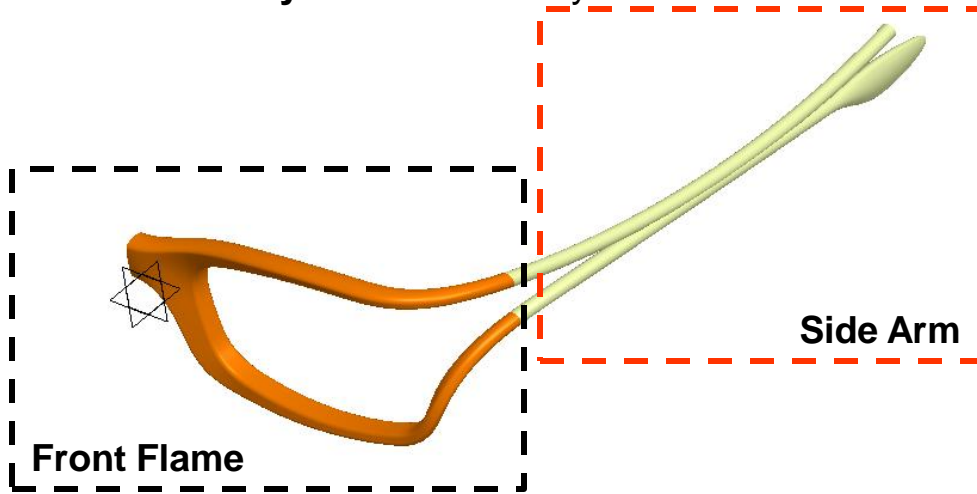


Tutorial 6B

- (BEFORE splitting the model into 2 parts)
- Do “**Draft analysis**” to check any undercut



Draft analysis



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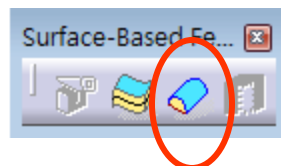
File SAVE again !
End of Tutorial 6B

Tutorial 6C

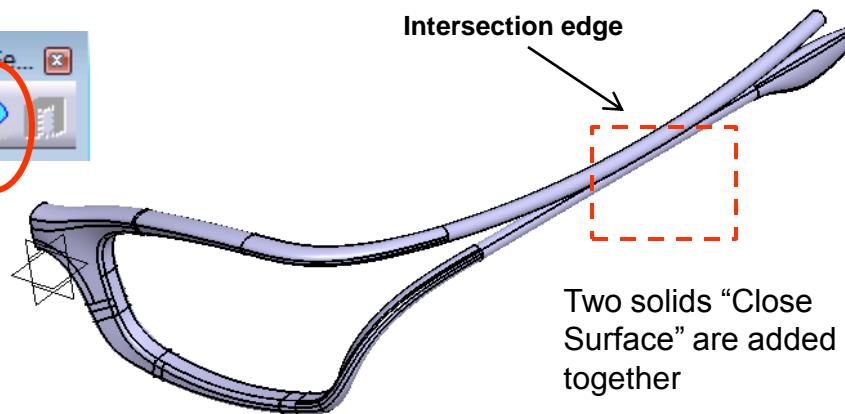
(Switch workbench to Part Design)

- Select “**Start/ Mechanical Design / Part Design**” on the top menu

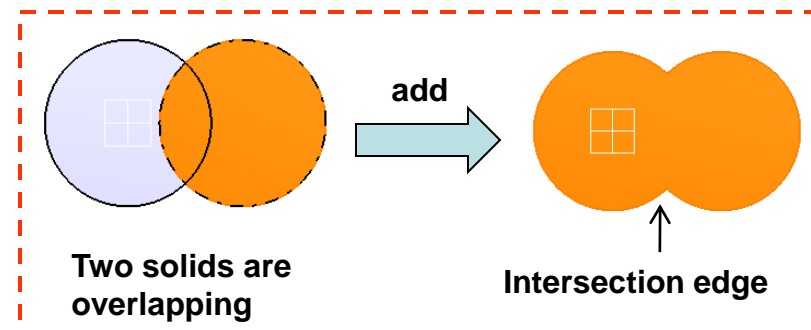
- Click icon “**Close Surface**”
- Select a Join Surface



- Click icon “**Close Surface**”
- Select another Join Surface
- (Two Solids are added together. An intersection edge can be found)

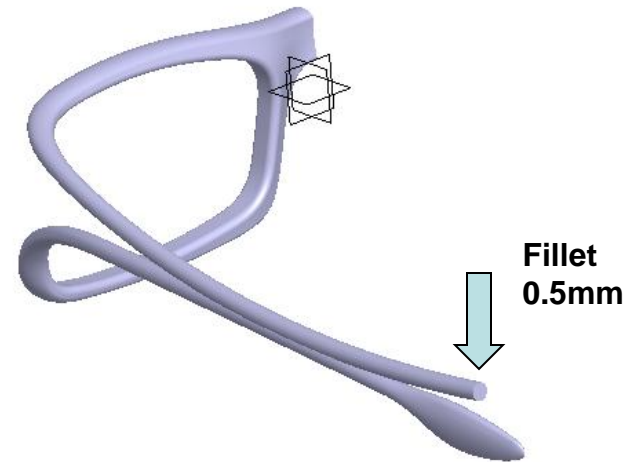
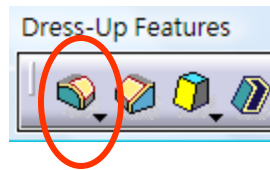


- **Hide** “Geometrical Set.3” on tree
- **Hide** Geometrical Set “Control_Curve” on tree

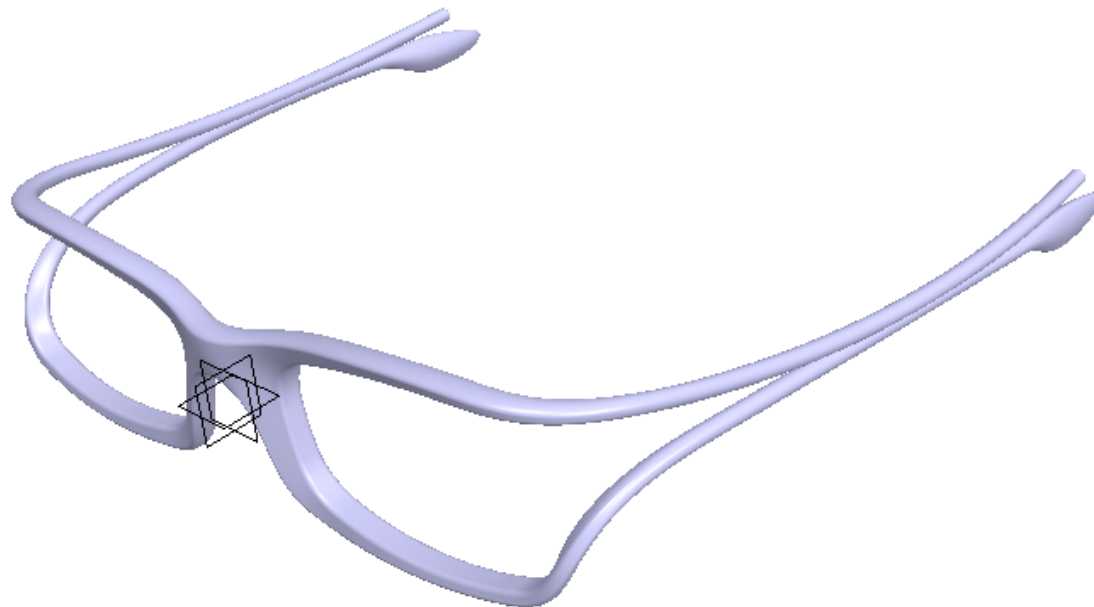
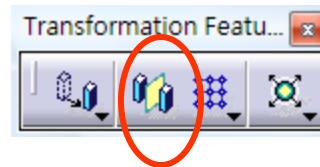


Tutorial 6C

- Click icon “**Edge Fillet**”
- Select the solid edge
- Enter 0.5mm as Radius
- Click ok



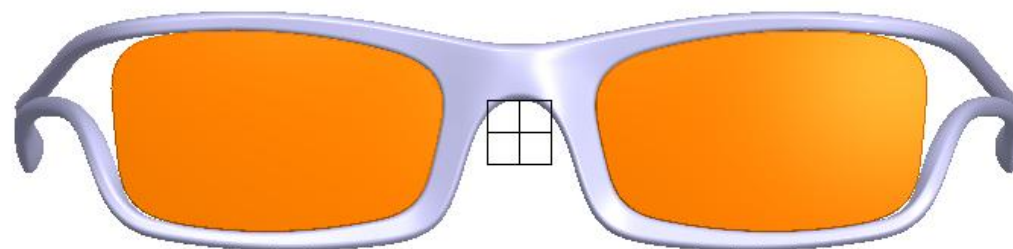
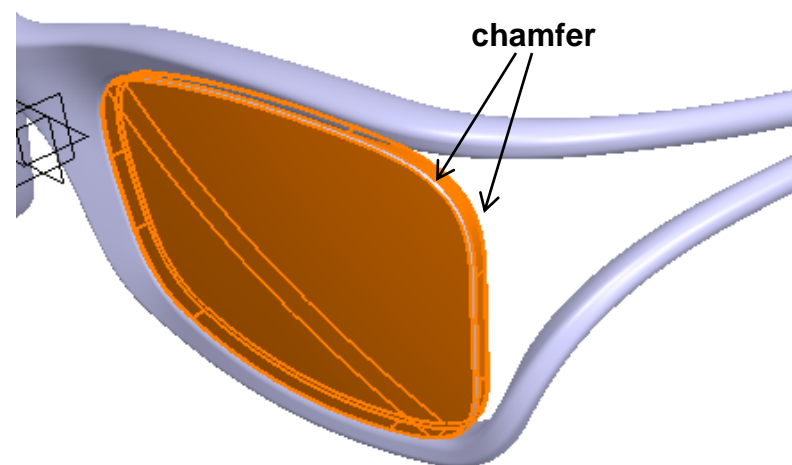
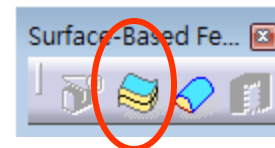
- Click icon “**Mirror**”
- Select ZX plane as Mirror plane
- Click ok



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Tutorial 6C

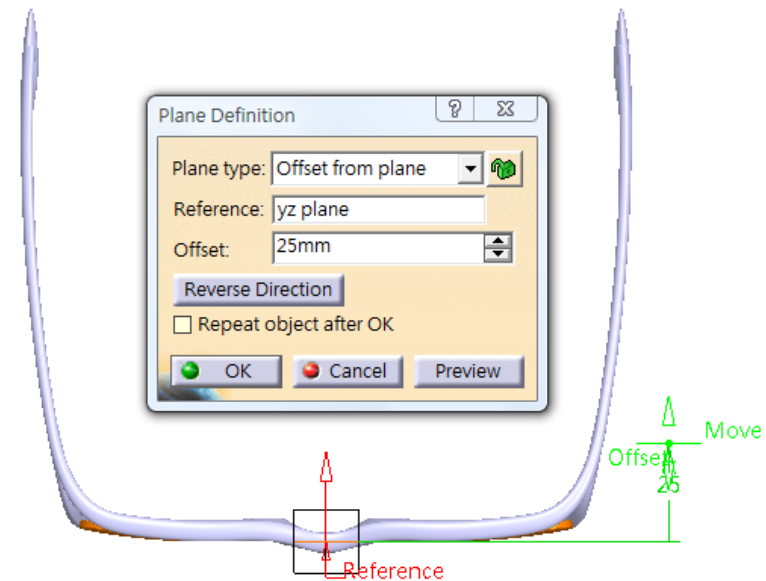
- Select “**Insert/ New Body**” on the top menu
- Click icon “**Thick Surface**”
- Select the surface (lens) in Geometrical.Set “Control_Curve”
- Enter 2mm as First Offset
- Click ok
- Click icon “**Chamfer**”
- Select the 2 solid edges
- Enter 0.3mm as Length1
- Enter 45deg as Angle
- Click ok
- Click icon “**Mirror**”
- Select ZX plane as Mirror plane
- Click ok



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Tutorial 6C

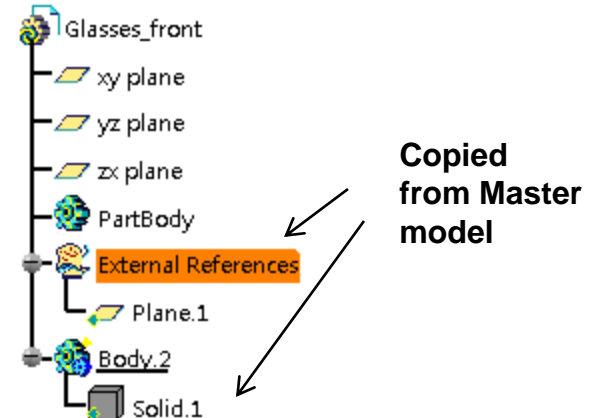
- Select “**Insert/ Geometrical Set...**” on the top menu
- Enter “Parting_Surface” as Name, click ok
- Click icon “**Plane**”
- Select Yz plane as “Reference”
- Click option “Reverse Direction”
- Switch to Top View
- Drag the offset value to around 25mm (~just behind the u turn)
- Click ok



- **File Save Again**

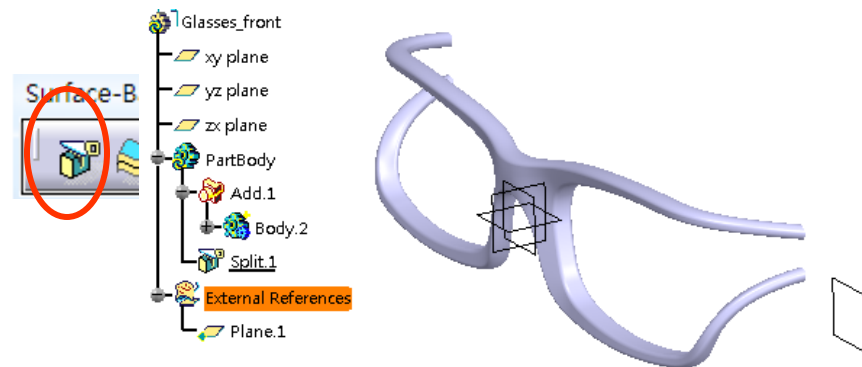
- **File /New/ Part**

- Name it as “Glasses_Front”
- Select “Window/ Glasses_master” on the top menu
- Multi-select the **Solid** (“PartBody”) & **the offset plane**
- Right-click, then select “**Copy**”
- Select “Window/ Glasses_Front” on the top menu
- Right-Click the part tree, “**Paste Special**”
- Select “**As Result with Link**”
- Click ok

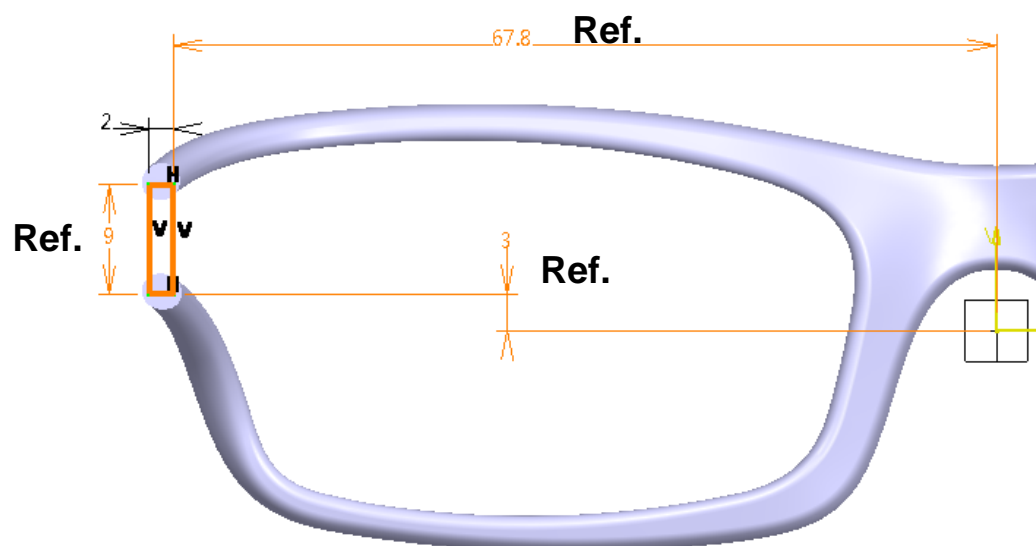


Tutorial 6C

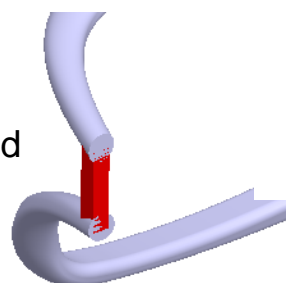
- Right-Click **“Body.2”**, then select **“Body.2/ add”**
- Click icon **“Split”** (in Part Design workbench)
- Select **“Plane.1”** under **“External Reference”**
- (Reverse Direction if needed)
- Click ok



- Select **“Insert/ Body”** on the top menu
- Click icon **“Sketch”**
- Select the planar face
- Draw a profile as shown
- **“Exit Workbench”**



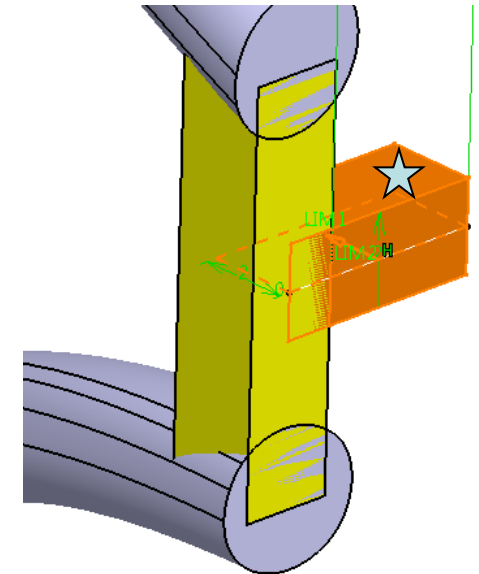
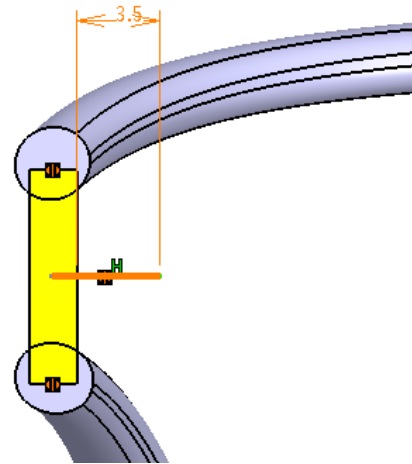
- Click icon **“Pad”**
- Select the sketch
- Enter 2mm as First Limited
- Click ok



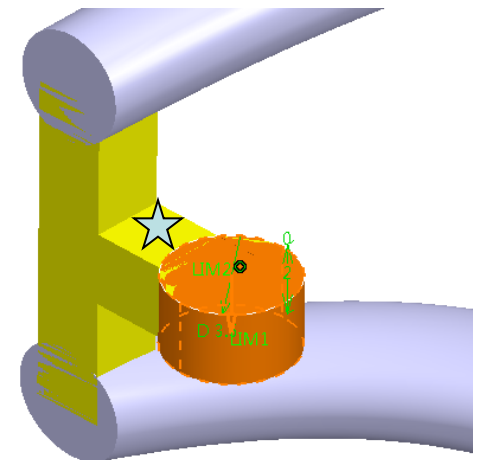
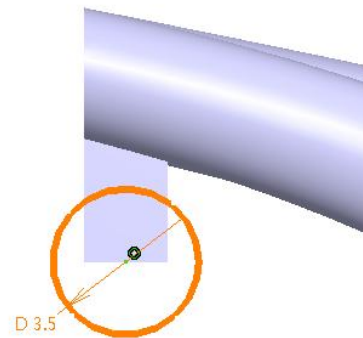
A- 52

Tutorial 6C

- Click icon “**Sketch**”
- Select the planar face
- Draw a horizontal line
- Exit Workbench
- Click icon “**Pad**”
- Select the sketch
- Select option “Thick”
- Enter 2mm as Thickness1
- Select option “Neutral Fiber”
- Enter 2mm as First Limit
- Select “Reverse Direction” for First Limit
- Click ok



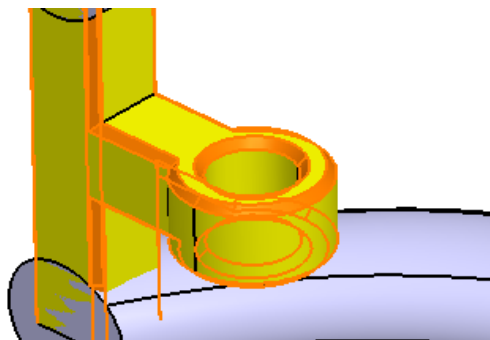
(Similarly, Create another “**Pad**” as shown)
 (Select this plane★ as Sketch Plane)



Tutorial 6C

- Click icon “**Hole**”
- Multi-select the circular edge (first pick) and the planar face
- Enter 1mm as Diameter
- Type = Up to Last
- Click ok

Not For Commercial Use



- Click icon “**Chamfer**”
- Enter 0.2 as Length1
- Enter 45 deg as Angle
- Select all sharp edges
- Click ok

- Click icon “**Mirror**”
- Select Zx Plane as Mirror (plane)
- Click ok



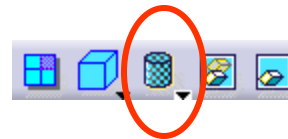
A- 54

Tutorial 6C

- Click icon “**Apply Material**”
- Select Tabpage “Painting”, click “**DS Red**”
- Select “PartBody” on tree
- Click ok
- (the texture property is added on tree)



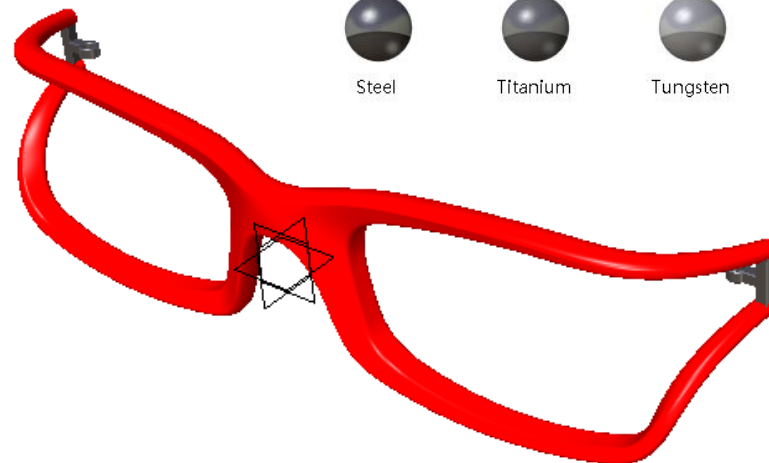
- Click icon “**Shading with Material**” to view the texture



- Click icon “Apply Material” again
- Select Tabpage “Metal”, click “Steel”
- Select Body.3 (any face of the new solid)
- Click ok
- (texture property is added on tree)

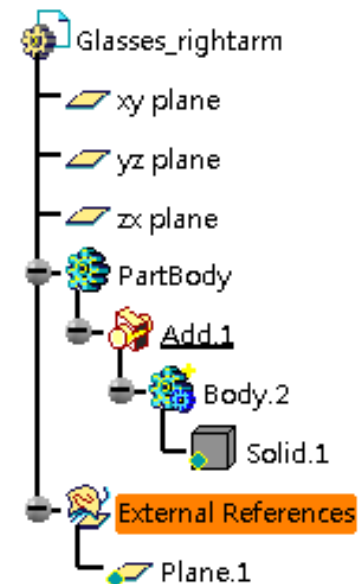
File/Save

- Enter “glasses_front_a” as File Name

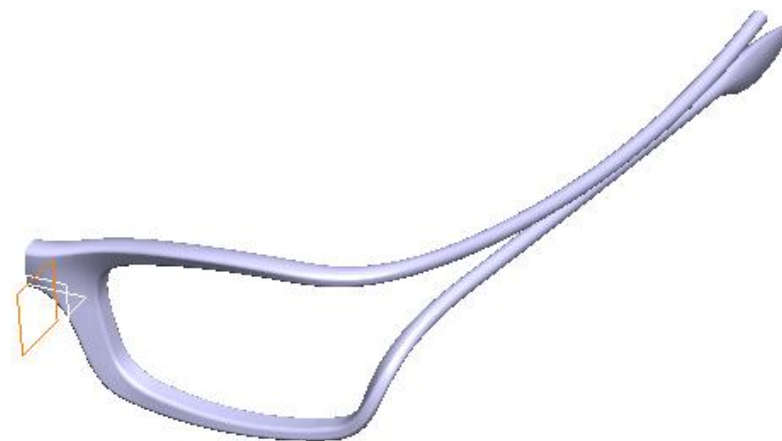
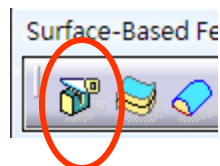


Tutorial 6C

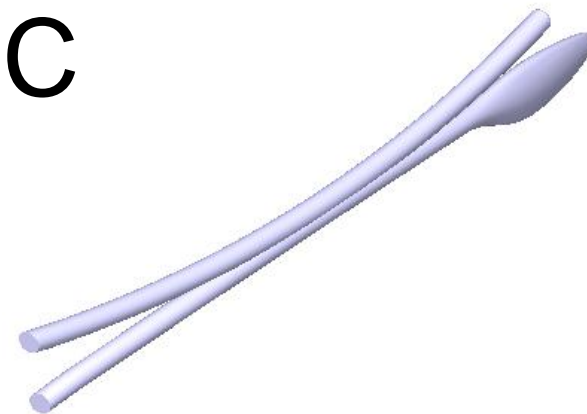
- **“File /New/ Part”**
- Name it as “Glasses_rightarm”
- Select **“Window/ Glasses_master”** on the top menu
- Multi-select the Solid (“PartBody”) & the parting plane
- Right-click , then select “Copy”
- Select **“Window/ Glasses_rightarm”** on the top menu
- Right-Click the part tree, “Paste Special”
- Select “As Result with Link”
- Click ok
- Right-Click “Body.2”, then select “Body.2 Object/ **Add**”



- Click icon **“Split”** (in Part Design workbench)
- Select Zx plane
- Click ok

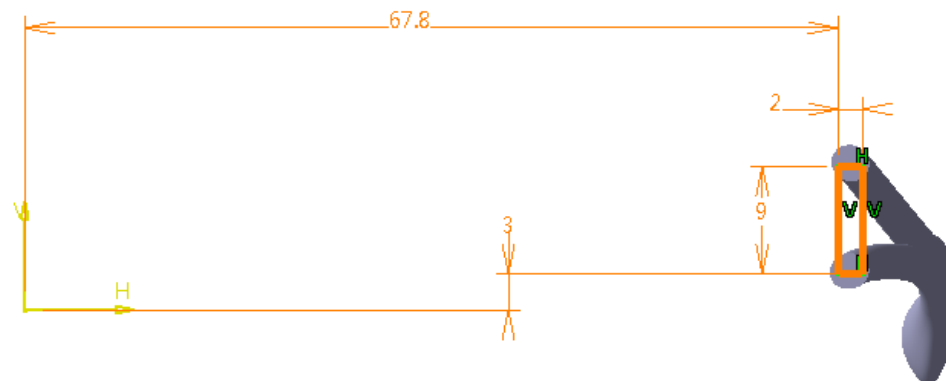


Tutorial 6C



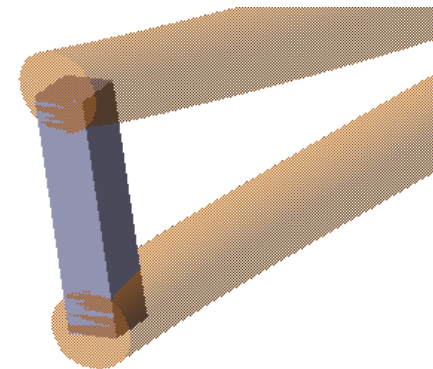
- Click icon “**Split**” again
- Select “Plane.1” under “External References”
- “Reverse Direction” (Click on the arrow to change)
- Click ok

- Select “**Insert/ Body**” on the top menu
- Click icon “**Sketch**”
- Select the planar face
- Draw a profile as shown
- “Exit Workbench”



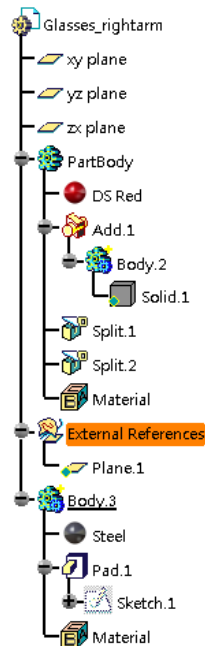
- Click icon “**Pad**”
- Select the sketch
- Enter 2mm as First Limited
- Click ok

- (For the remaining features, we have no idea how to match the front frame. Make them later)



Tutorial 6C

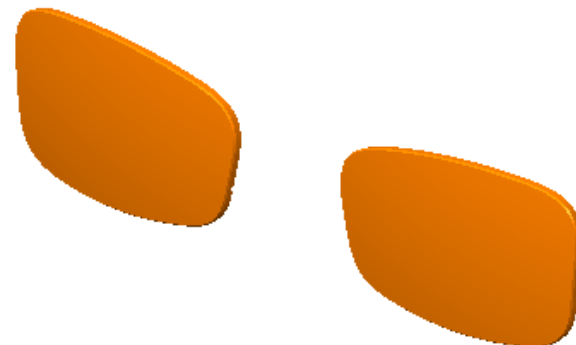
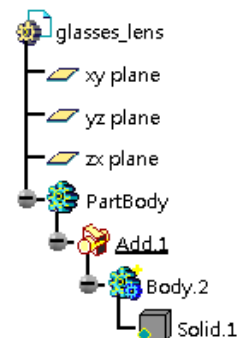
- Click icon “**Apply Material**”
- Select Tabpage “Painting”, click “DS Red”
- Select the solid (any face)
- Click ok
(texture property is added on tree)
- Click icon “**Shading with Material**” to view the texture
- Click icon “**Apply Material**”
- Select Tabpage “Metal”, click “Steel”
- Select the new solid (any face)
- Click ok
- **File/Save**
- Enter “glasses_rightarm_a” as file name



Tutorial 6C

(Create a part file for “Lens”)

- “File /New/ Part”
- Name it as “Glasses_Lens”
- “Window/ Glasses_master”
- Select Body.2 (solid body of “lens”)
- “Window/ Glasses_Lens”
- Right-Click the part tree, “Paste Special”
- “As Result with Link”
- Click ok
- Right-Click “Body.2”, then select “Body.2 Object/ add”
- Click icon “Apply Material”
- Select Tab-page “Other”, click “Glass”
- Select “PartBody” on tree
- Click ok
- **“File/Save”**
- Enter “glasses_lens_a” as File Name



Black Smoke



Blue Grid



Bright Plastic



Epoxy



Flat Polystyrene



Glass



Multicoloured Flag



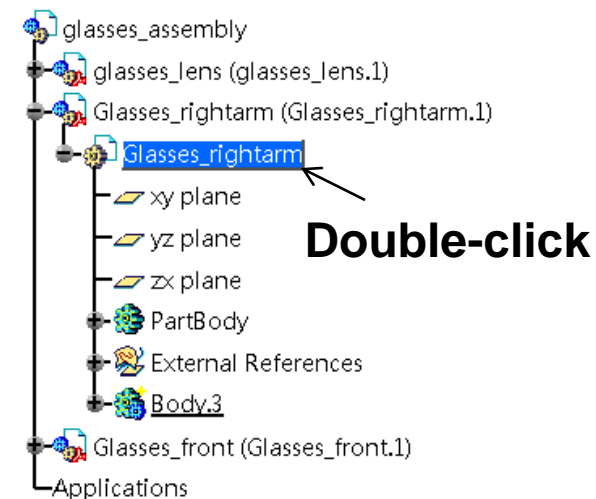
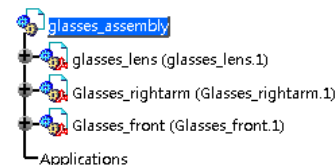
Neons Wall






Ox B&W Stripes

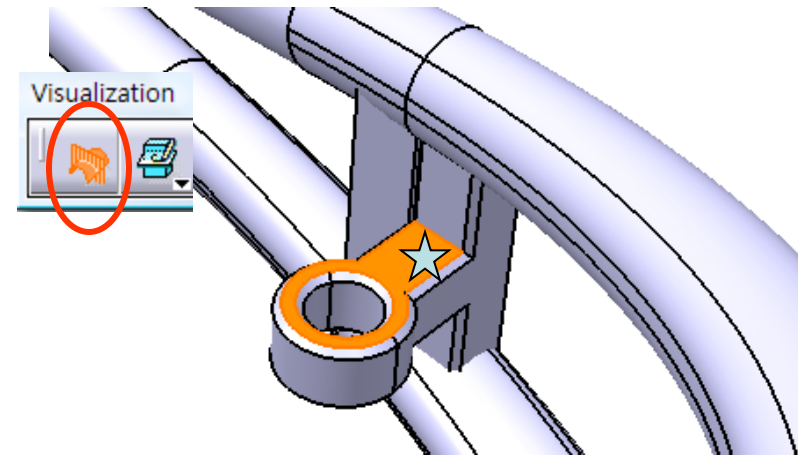
Tutorial 6C

- Select **“File/ new/ Product”** on the top menu
- Name it as **“Glasses_assembly”**
- **(Switch workbench to “Assembly Design”)**
- Single-Click on Product Tree
- **“Insert/ Existing component”**
- Multi-Select the three files **“glasses_front”**, **“glass_rightarm”** & **‘glasses_lens”**
- **(Design In Context:** Design the remaining features in **“Glasses_Right arm”** in Assembly Mode)
- Double-Click the part **“glass_rightarm”** on tree to edit
- (Workbench is switched automatically from Assembly Design to Part Design)

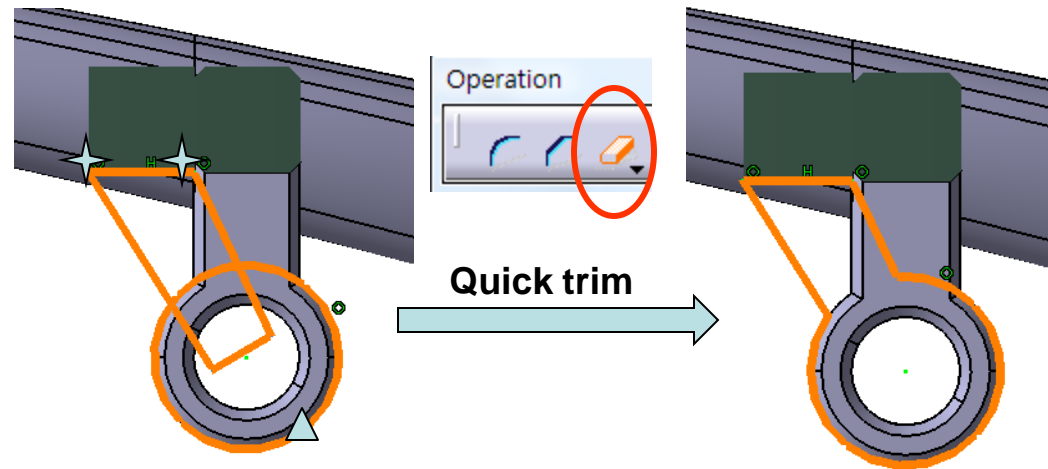
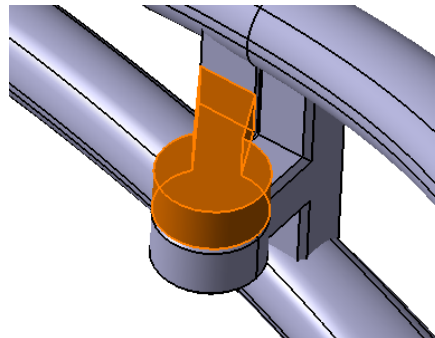


Tutorial 6C

- Click icon “**Sketch**”
- Select the planar face  (of “Front Frame”)
- Click icon “**Cut Plane by Sketch Plane**”
- Draw a profile (one circle & one 4-sided profile)
- Add two coincidence constraints (a point aligned to an edge) 
- Add a Coincidence constraint (circle to circle) 
- Double-click icon “quick trim”, then erase unnecessary portion
- “Exit Workbench”



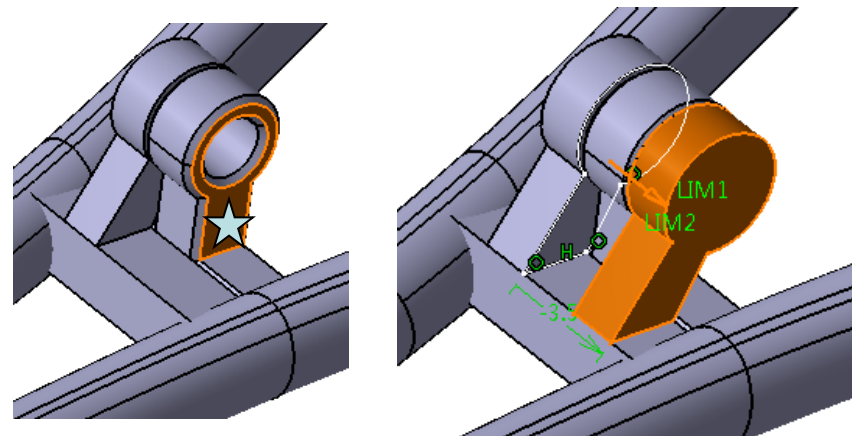
- Click icon “**Pad**”
- Select the sketch
- Enter 1.5mm as First Limit
- Click ok



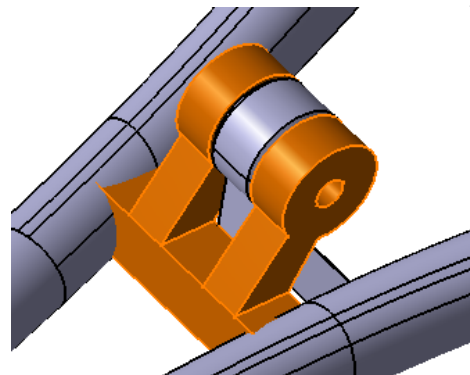
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Tutorial 6C

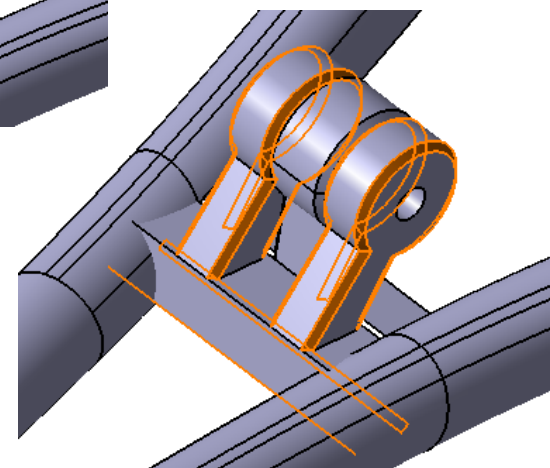
- Click icon “**Pad**”
- Select the same sketch on tree
- First Limit = “UP to plane”, select the bottom planar face ★
- Second Limit = -3.5mm
- Click ok



- Click icon “**Hole**”
- Select the circular edge, then the planar face
- Enter 1mm as Radius
- Select “Up to Last”
- Click ok

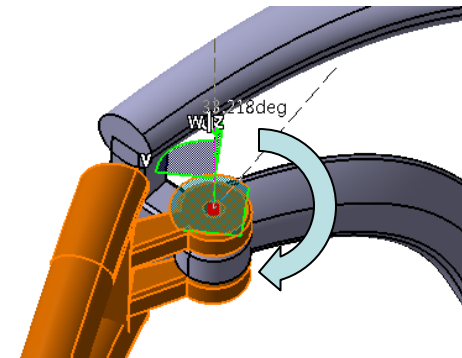
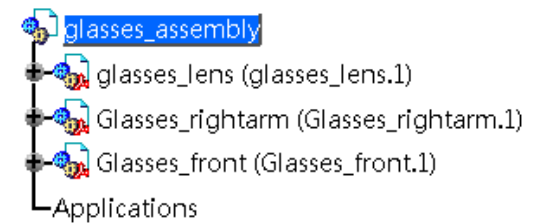


- Click icon “**Chamfer**”
- Enter 0.2 as Length1
- Enter 45 deg as Angle
- Select all sharp edges
- Click ok

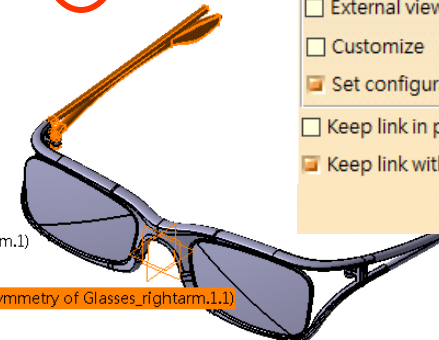
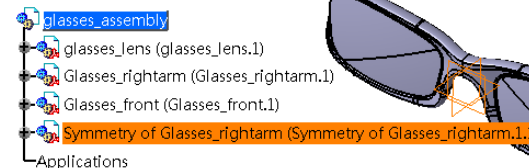
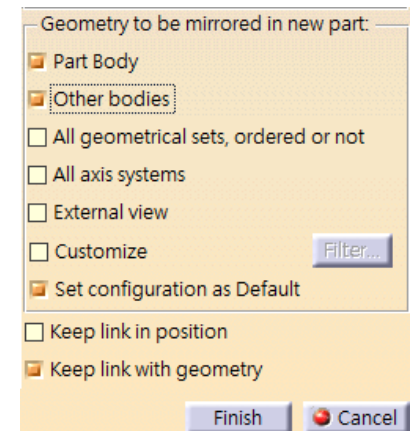
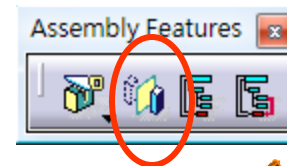


Tutorial 6C

- **Double-Click** the Product Tree (to move from part level to product level)
- Drag and drop the compass onto the hole axis
- Rotate the arm to check if there is any collision (if yes, modify the joint geometry)



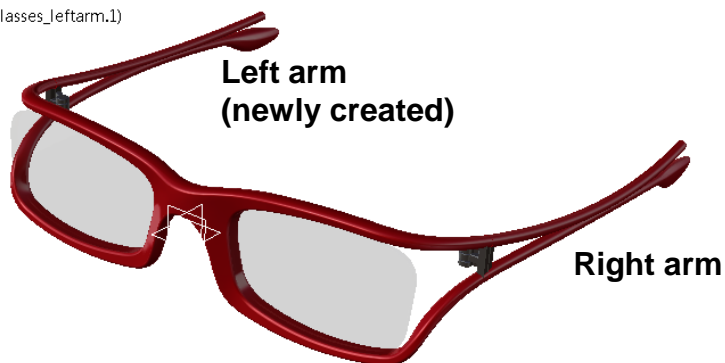
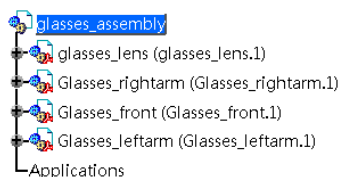
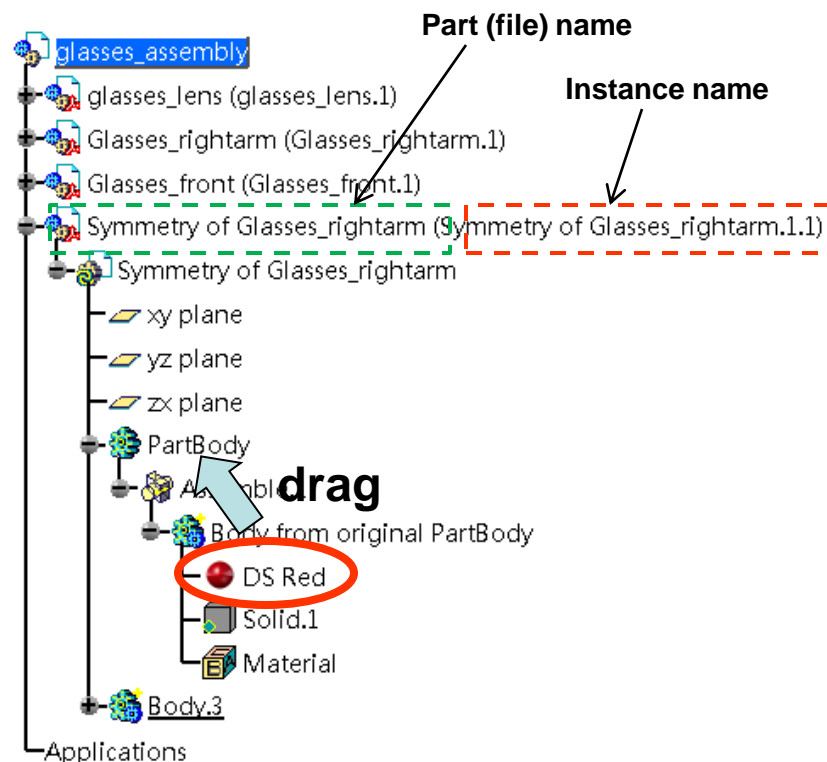
- Click icon “**Symmetry**” under Assembly Features
- Select Zx plane of the first component
- Select the component “Glasses_rightarm”
- Select “**Other bodies**”
- **Deselect “Keep Link in position”**
- Select “Keep link with Geometry”
- Click button “Finish”
- Click “Close”
- (a new “mirrored” part is created)



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Tutorial 6C

- Maximize the part tree
- **Drag** “DS red” to PartBody (Partbody will then appear with texture “DS red”)
- Right-click **“Symmetry of glasses_rightarm”**
- Rename “Instance Name” to “glasses_leftarm.1”
- Rename “Part name” to “glasses_leftarm”
- **File /Save all**
- Click ok on the popup window
- (2 new files are created, 1 product & 1 part)

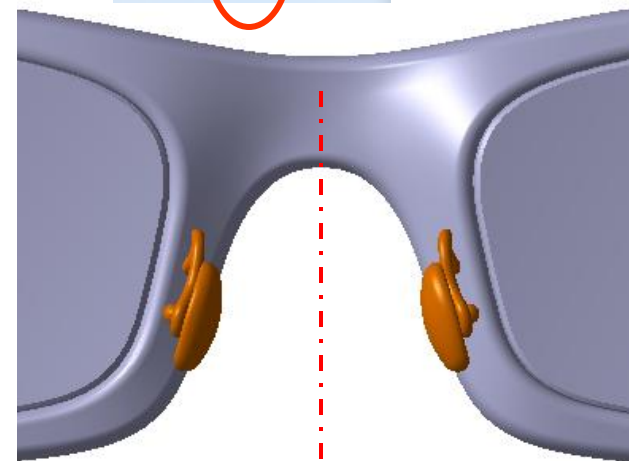
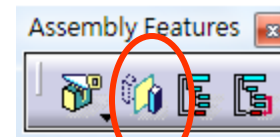
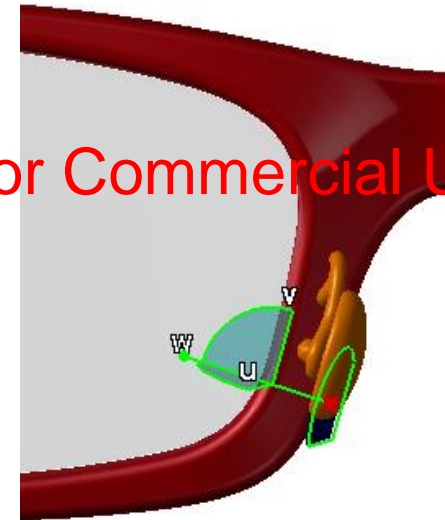


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Tutorial 6C

- Right-Click on the product tree
- Select “**Components/ Existing Component**”
- Select the downloaded file “**Nose_pad_right.stp**”
- Click Open
- Drop the compass onto the Nose Pad
- Relocate it to a proper position
- Click icon “**Symmetry**” under “assembly features”
- Select Zx plane of the first part as “Symmetry Plane”
- Select the Nose_Pad as “product to transform”
- Highlight “Part Body” & “Other bodies”
- “Keep link in position”
- “Keep link in geometry”
- Click “Finish”
- Click “Close”

Not For Commercial Use



Zx plane

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Tutorial 6C

- “Apply Material (Texture)” to both Nose Pads
- Rename Part Name to “Right_nosepad” & “Left_nosepad” respectively
- Rename Instance Name to “Right_nosepad.1” & “Left_nosepad.1” respectively
- **FILE SAVE ALL AGAIN**

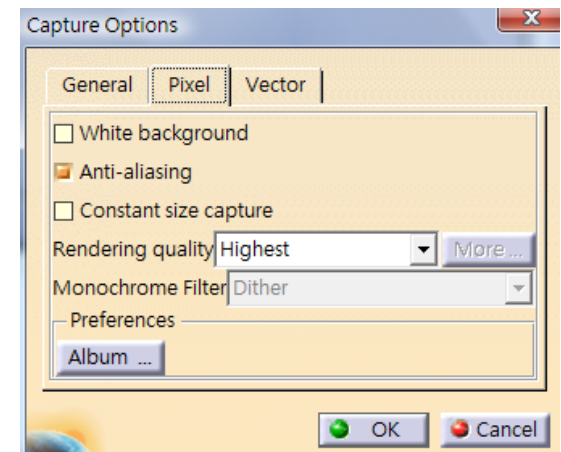
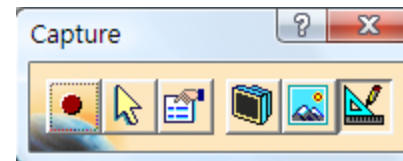
(EXTRA – there are Three ways to capture images in CATIA)

#1 (fastest) simply press the keyboard key “Print Screen”

OR

#2 (better image quality)

- Select “Tools/Image/capture” on the top menu
- Click icon “Options”
- Select the tab-page “Pixel”
- Select “Anti-aliasing”
- Select “highest” as rendering quality, Click ok
- Rotate/zoom the 3d model to the best orientation
- Press “F3” key on the keyboard to hide the specification tree
- Click icon “capture”
- Click icon “save as”
- Define file name & file path
- Click “ Save”

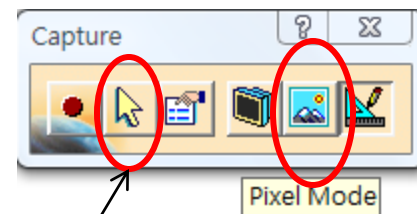


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Tutorial 6C

(Sometimes we may need a 3d wireframe image for a product manual or document; here is the way to capture)

- Select “Tools/Image/capture” on the top menu
- Click “Vector Mode”
- Click “Select Mode”
- Define the capture region on screen

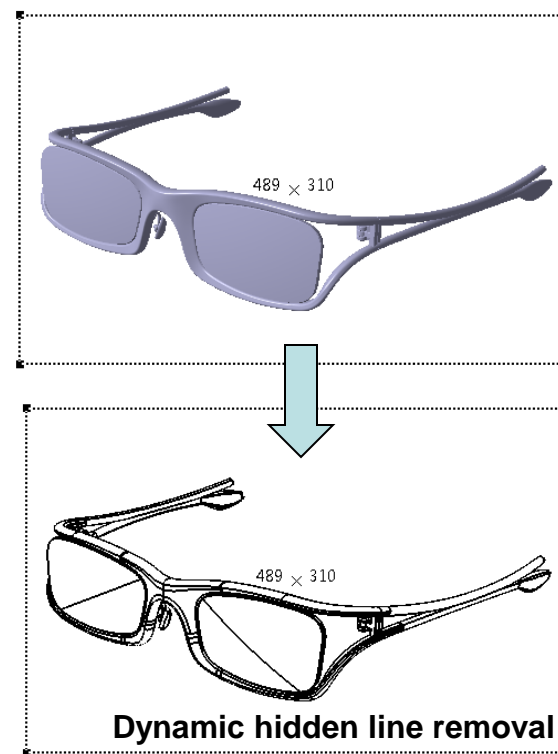


Select mode

- Click icon “Customize View Parameters”



- Deselect “shading” mesh
- Select “Dynamic Hidden Line Removal”
- Click ok
- Click icon “Capture”
- Save as **pdf** (This is a VECTOR graphic, that can be opened and edited by Adobe illustrator or other Vector graphic editors)



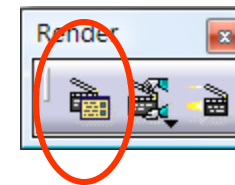
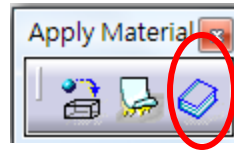
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Tutorial 6C

OR

#3 (Photo Rendering by CATIA “Photo Studio”)

- Select “**Start/ infrastructure/ Photo Studio**” on the top menu
- Click icon “**Catalog Browser**”
- Double-click “**Scenes**”
- Double-click “**Lakes**”
- Click Close (close the catalog)
- Right-click “**Lake**” on tree, then select “**Best Fit**” (the size is regenerated)
- Move the mouse cursor onto the bottom face of the scene until we can see a double arrow. Drag the face up, closer to the 3d model.
- Click “**Create Shooting**”
- Increase the image size close to your Screen Size (e.g. 1200 x 900 pixel)
- Set the highest Anti-aliasing
- Click ok

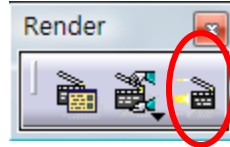


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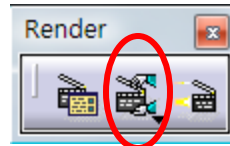
Tutorial 6C

- Rotate/Zoom the 3d model to the best orientation
- Select “**View/Render Style/ Perspective**” on the top menu

- Click icon “**Quick Render**”
- (the preview image looks too dim)



- Double-click “Light1” on tree
- Increase the light intensity by 100 % (Enter value 2.0)
- Click ok
- Click “Quick Render” again to preview (if ok, then proceed)



- Click icon “**Render Shooting**”
- “Shooting 1” should be selected (our setting of shooting1 will be used)
- Click “Render single frame”
- (wait for 1-5 minutes for rendering calculation)
- Click “save as” a file name
- Click ok
- (if we save all files again, this rendering setting will be stored in the product file)



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End of Tutorial 6C

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