

Dynavista

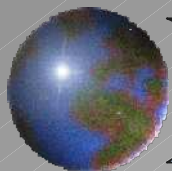
CAA V5 based

V10.2 / V11.2

Formability Fillet

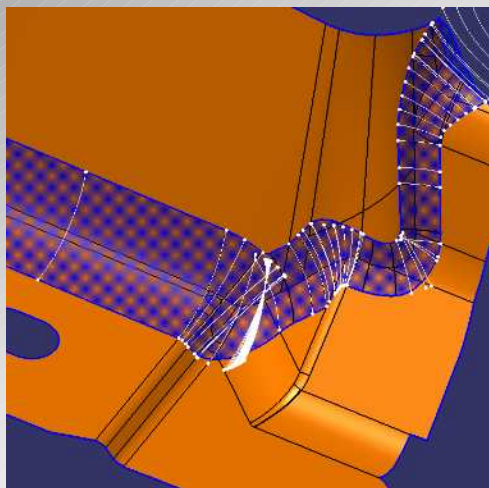
October, 2011

UNIADEX, Ltd.



Formability Fillet

High performance and robust fillet creation for complex support shape environment.



- **High robustness**

It uses specifically developed own geometric engine for supporting fillet functions.

- **Variety of functions**

1. Fillet options such as variable radius, chord length specification, curve passing fillet, three tangent fillet and Gradation, etc. are provided.

2. Variable radius/ independent end conditions/ arbitrary stop position, etc. are commonly provided to all the functions.

- **High flexibility**

Separate or combined running of fillet creation/edit of existing fillet/ merger of fillets to base shape are provided, which supports high quality and efficient fillet creation work.



V5R18



V5R19



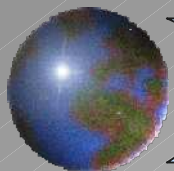
V5R20

CAA^{V5}
BASED

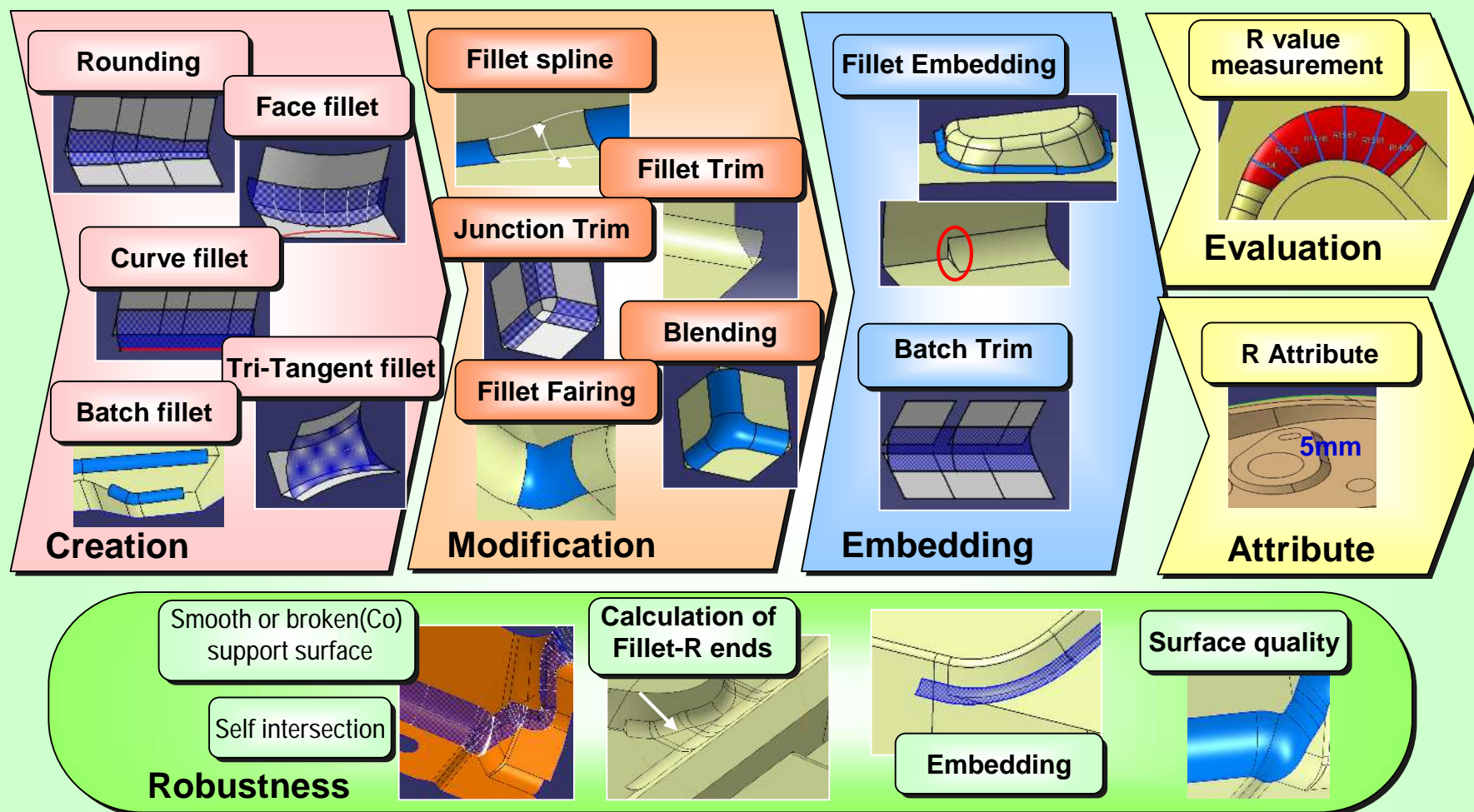
V5 prerequisite: GSD

Dynavista

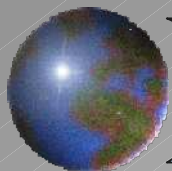
Production level evaluation by some Japanese automotive OEM(N) shows 1/3 of panel modeling man hours is spent for fillet modeling and 3-5 times reduction is obtained by Dynavista against CATIA V5 fillet.



Formability Fillet command

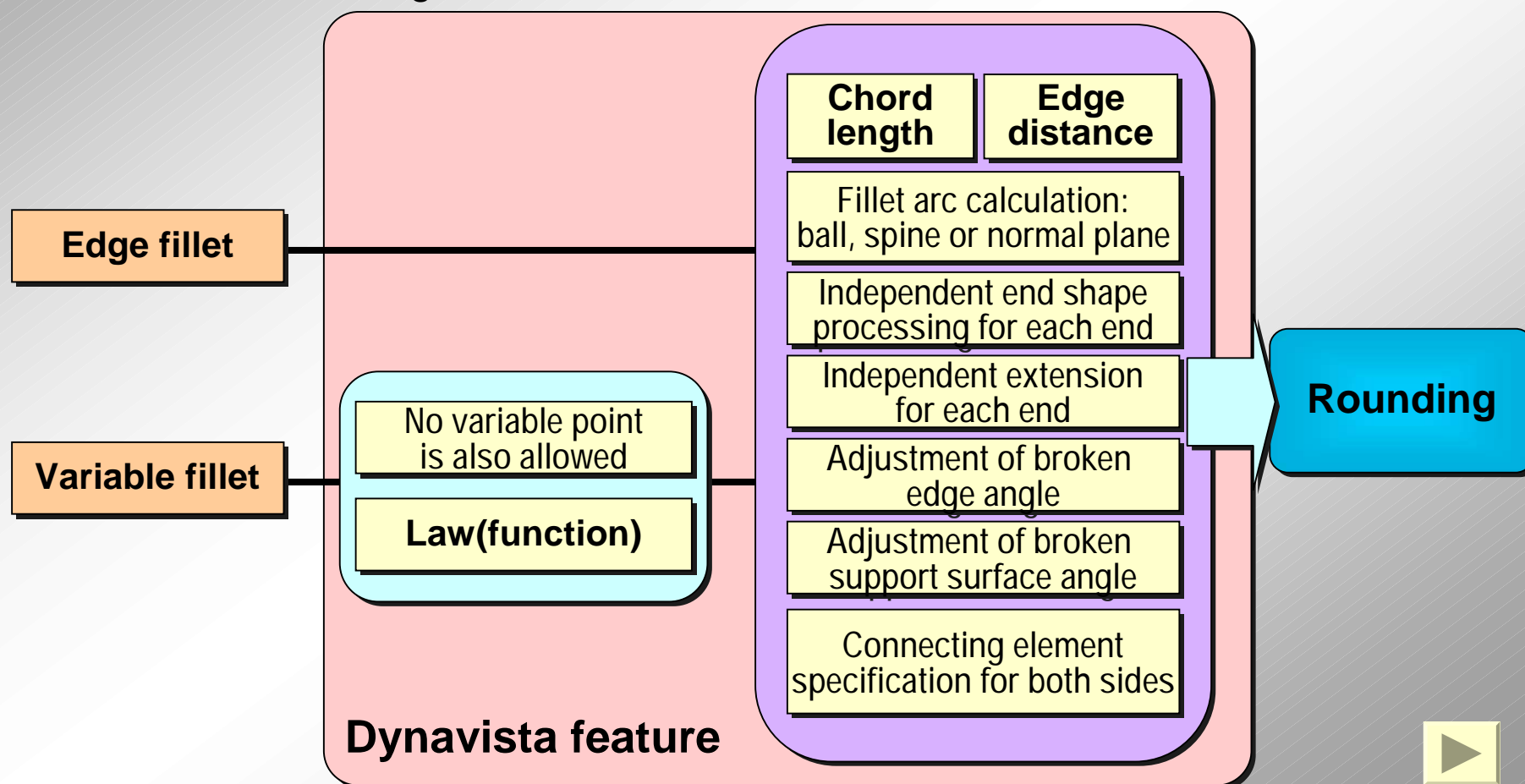


Dynavista / Formability Fillet



Rounding - Creation -

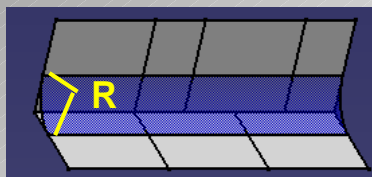
- Rounding edge fillet surface will be created. (for both a part body and an open body)
- Robust creation of a fillet surface even for complex shape.
- Extensions to “Edge fillet” of CATIA are as follows.



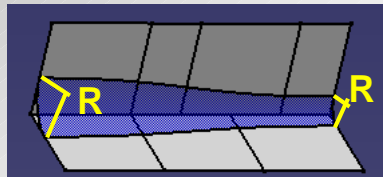


Rounding - Creation -

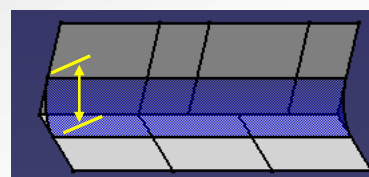
(1) Constant or variable can be selected for radius and chord length.



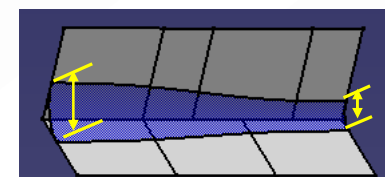
[constant radius]



[variable radius]

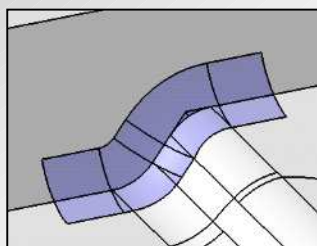


[constant chord length]

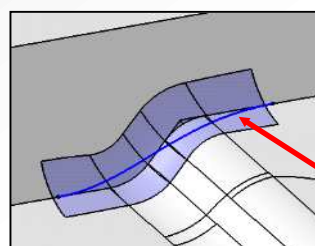


[variable chord length]

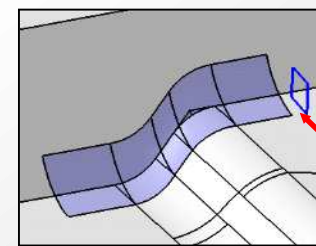
(2) Ball/spine/plane can be selected for circular arc calculation.



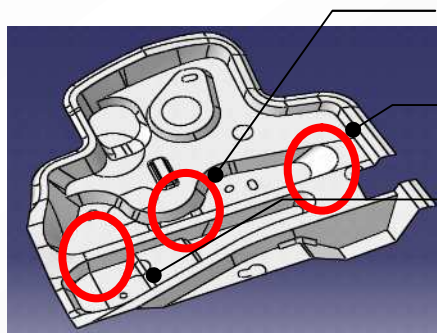
[Ball]
Ball rolling circular arc
between two surfaces



[Spine]
Circular arcs are on the
planes normal to given
spine curve.



[Plane]
Circular arcs are on a plane
normal to specified direction.

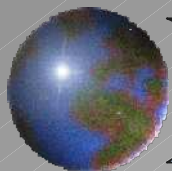


**Interference of existing
edge and fillet end**

**Variable chord length,
connection and merger**

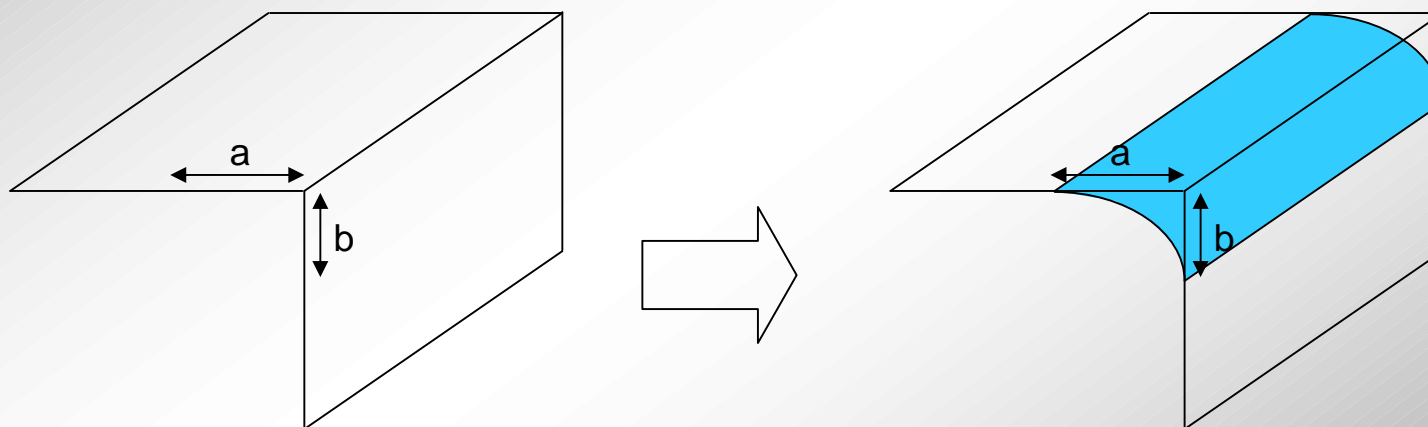
Normal plane specification

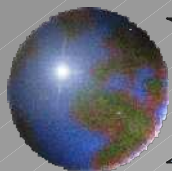




Different width for each end

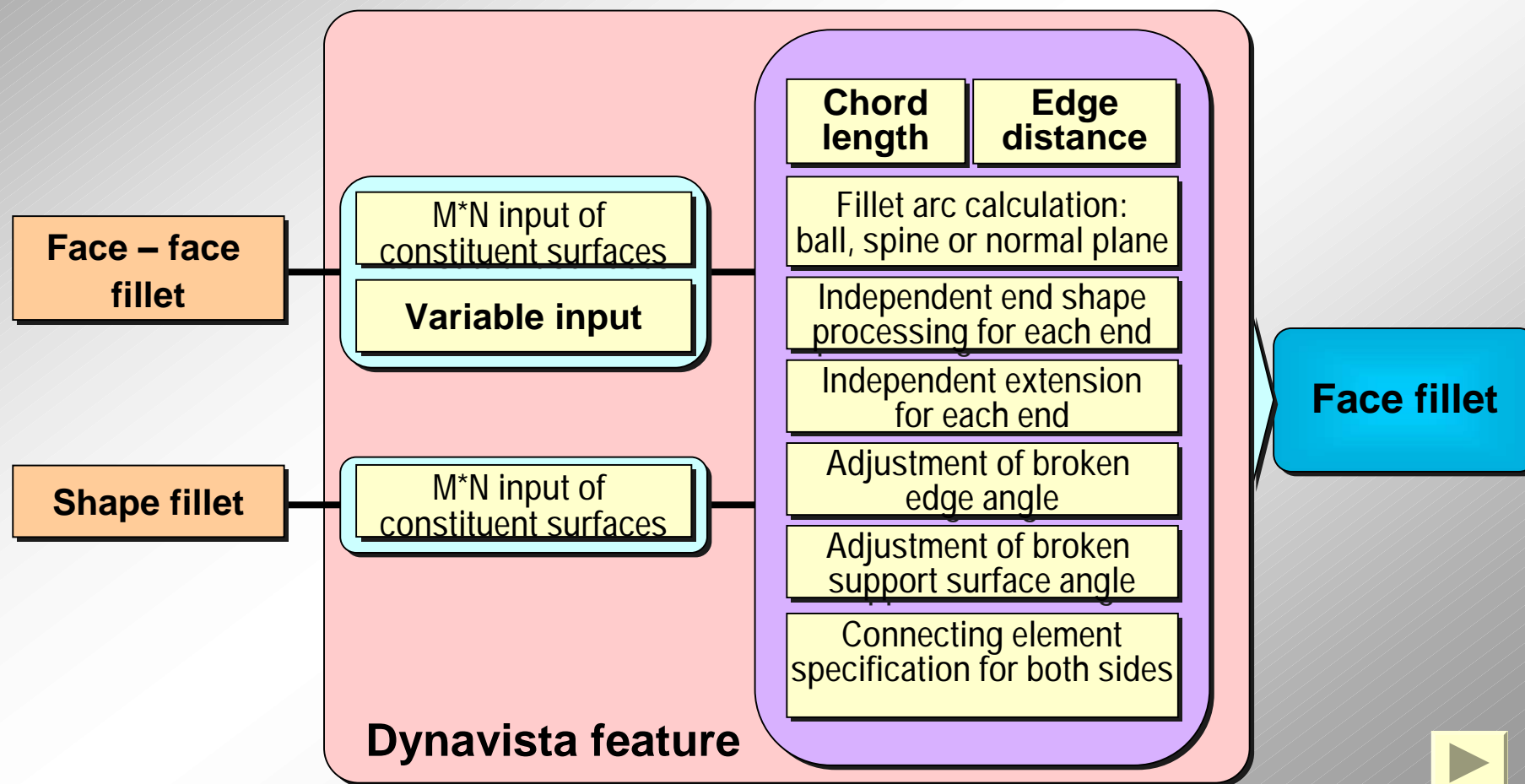
A fillet surface is created so that distance from an edge to an R end curves is different from one of the other side.

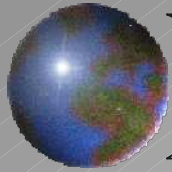




Face Fillet - Creation -

- Create a fillet surface by specifying two sets of surfaces and radius or chord length (constant/variable).
- $M * N$ surfaces input is available for support surfaces.
- Extensions to “Face fillet” of CATIA are as follows.





Face Fillet - Creation -

- Variation of fillets is the same as Rounding

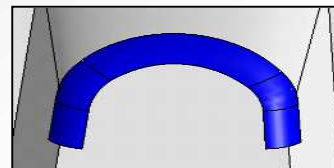
(1) Constant or variable can be selected for radius and chord length.



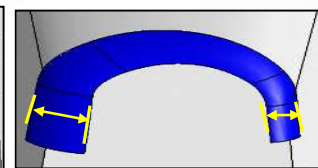
[constant radius]



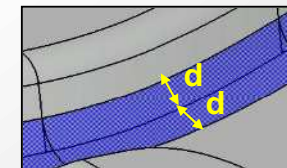
[variable radius]



[constant chord length]

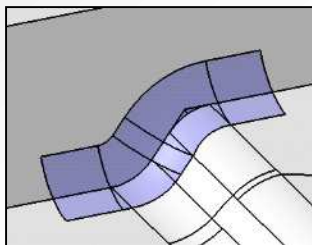


[variable chord length]

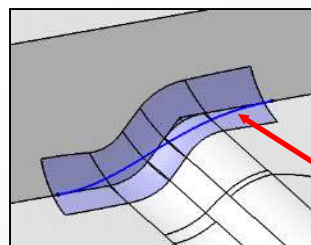


[constant edge length]
[variable edge length]

(2) Ball/spine/plane can be selected for circular arc calculation.

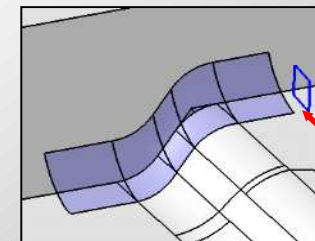


[Ball]
Ball rolling circular arc
between two surfaces



[Spine]
Circular arcs are on the
planes normal to given
spine curve.

Spine curve



[Plane]
Circular arcs are on a plane
normal to specified direction.

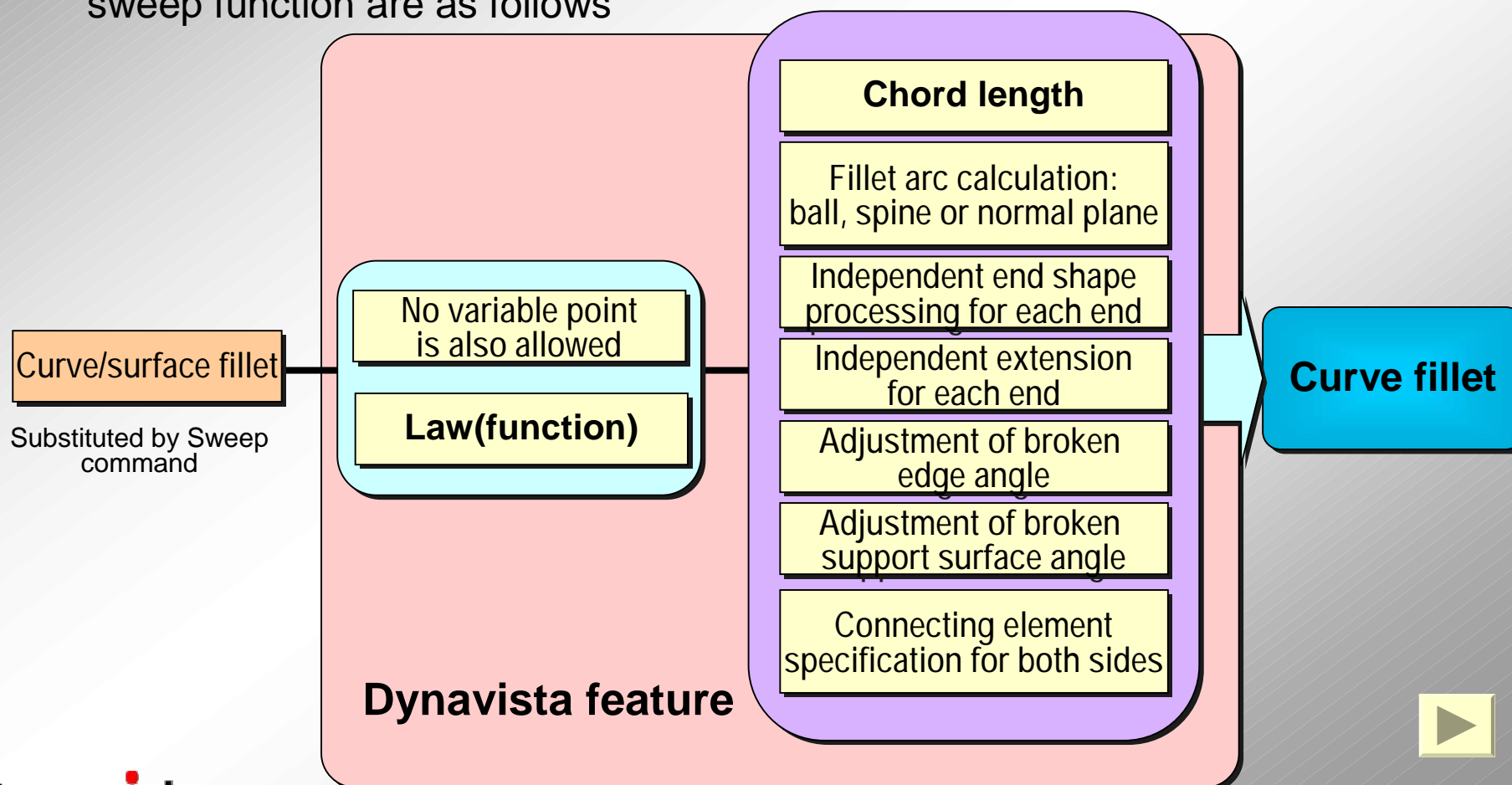
A plane with
given normal
vector

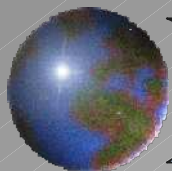




Curve Fillet - Creation -

- Create a fillet of which one or both sides are bounded by a curve.
- Variety of fillet surfaces can be created by the combination of 'pass through type' and 'fillet type'.
- Sweep command is used for this purpose in CATIA. Extensions to CATIA's sweep function are as follows



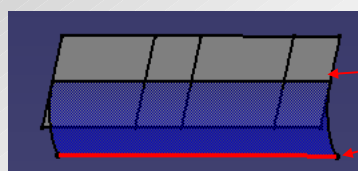


Curve Fillet - Creation -

- A Fillet surface can be created between two or more faces without any preparation (connection, extraction, etc.), regardless of status of the connection or disconnection of the faces.

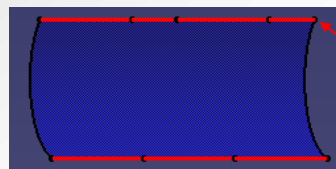
[Pass through type]

[Curve-surface]



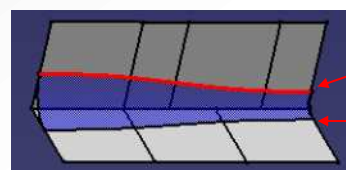
"Tangent to a surface"
"Pass through a curve"

[Curve-curve]

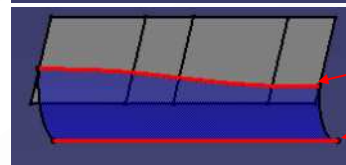


"Pass through curves on both sides"

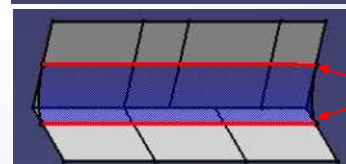
[Curve on surface]



"Pass through a curve and tangent to a surface"
"Tangent to a surface"



"Pass through a curve and tangent to a surface"
"Pass through a curve"



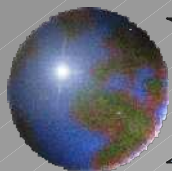
"Pass through curves and tangent to surfaces"

[Fillet type]

Constant-R, variable-R, constant chord length or variable chord length are selected depending on the pass through type.

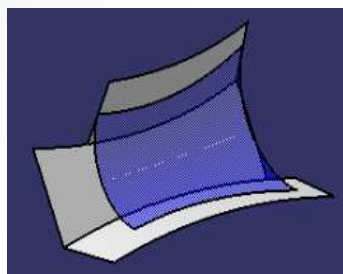
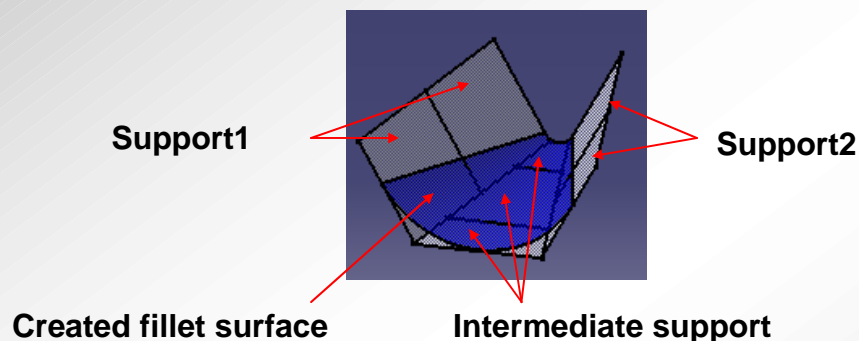
- Either ellipse approximation or parabola approximation can be selected if the fillet section shape is not circular arc.



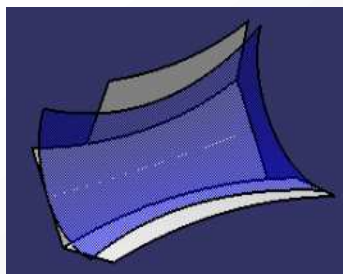


Tri-Tangent Fillet - Creation -

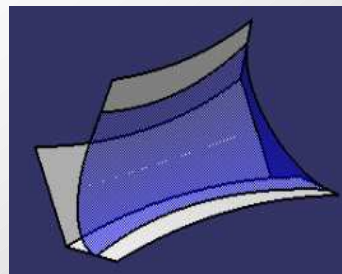
- Create a fillet surface tangent to three groups of surfaces.
- Difference from “three tangent fillet” of CATIA is that two or more faces can be input for each support.
- A Fillet surface can be created between two or more faces without any preparation (connection, extraction, etc.), regardless of status of the connection or disconnection of the faces.



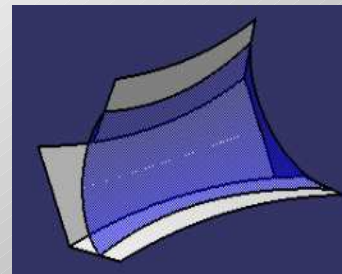
[Minimum]



[Maximum]

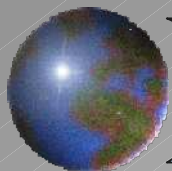


[Smooth]



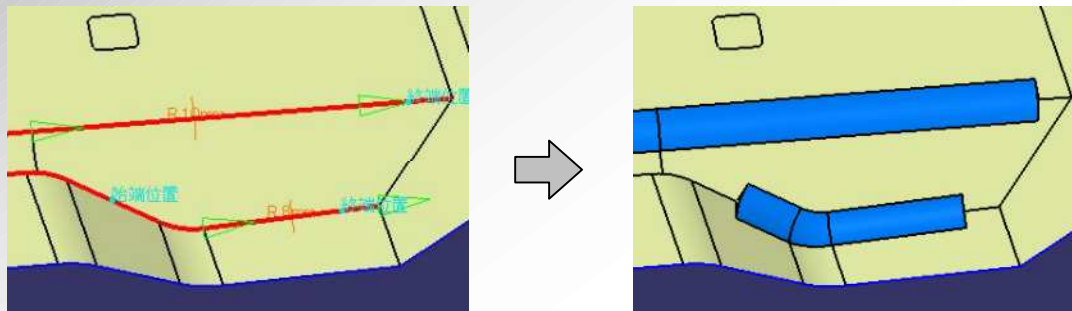
[Straight]



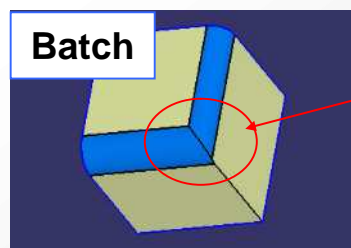
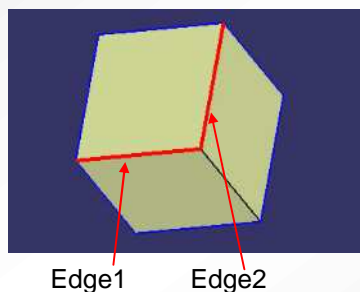


Batch Fillet - Creation -

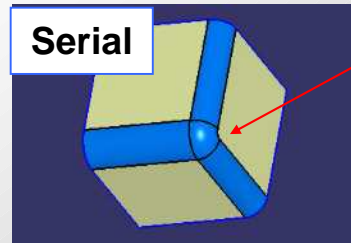
- Collective creation of fillets Specifying R value to each edge among edges.
- Start and end points of each fillet can be specified separately.



- Method of fillet embedding can be specified.



Embedded fillets makes an intersection shape.



Secondly created fillet extends to another edge because the corner is rounded by the result of embedding of firstly created fillet.

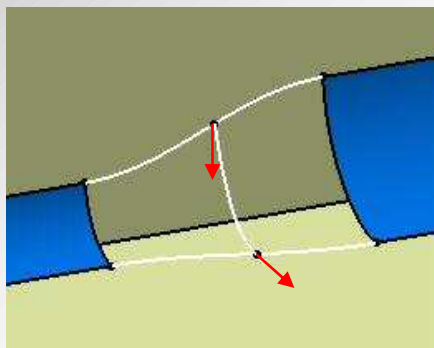




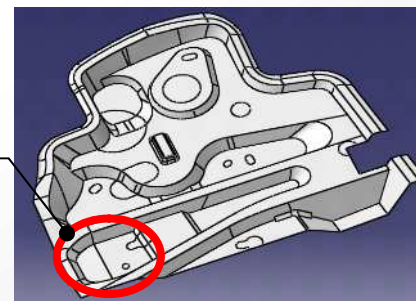
Fillet Spline - Modification -

- Auxiliary spline curve for user defined fillet surface is created.
- Especially effective for creating a free shape fillet.
- A spline can be created with a few inputs without reversing tangent direction by an automatic calculation of tangent direction by a sequence of input points when tangent curve/tangent surface restraint.

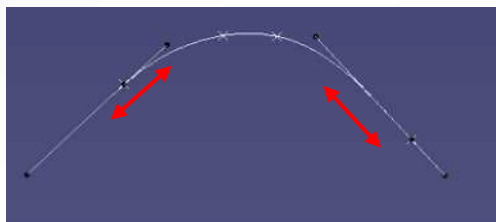
(1) A spline curve tangent to support surfaces can be created.



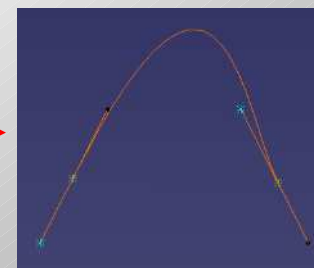
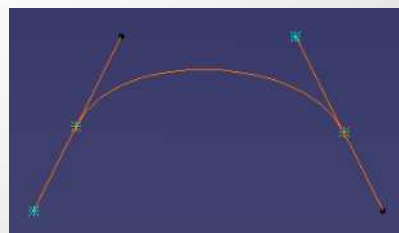
Spline for connection



(2) Real time movement of spline curve end points and change of tangent vector magnitude are available.



Movement of a end points



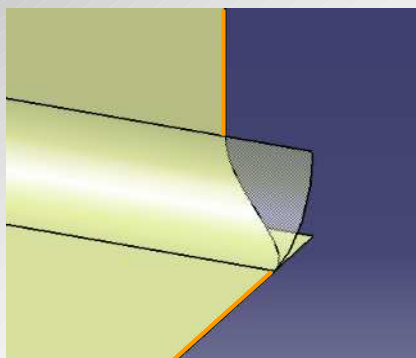
Modification of magnitude of a tangent vector



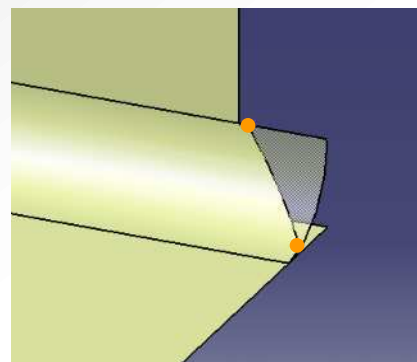


Fillet Trim - Modification -

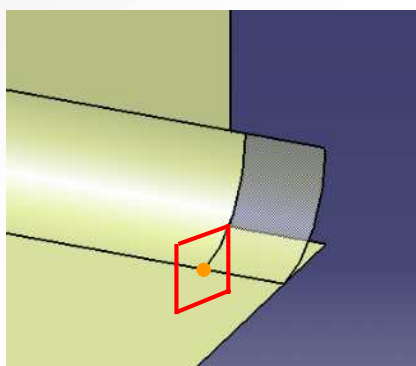
- Trim a fillet surface according to a specified trim method.
- Creation of a trim curve beforehand is not required.



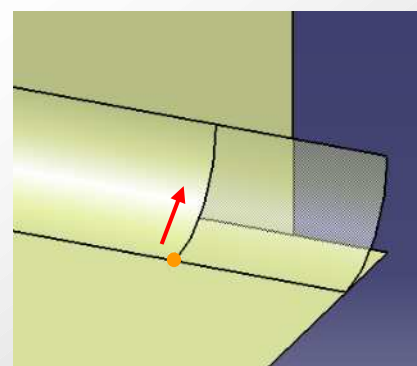
Trim method: [Projection-curve]



Trim method: [Projection-point]

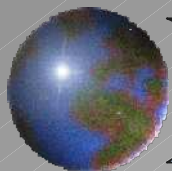


Trim method: [**Normal plane**]



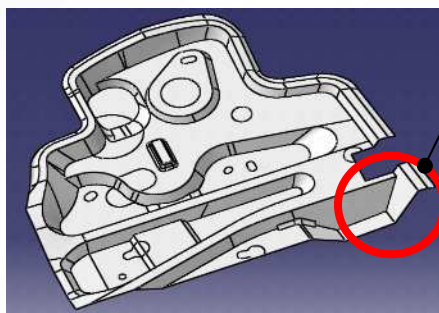
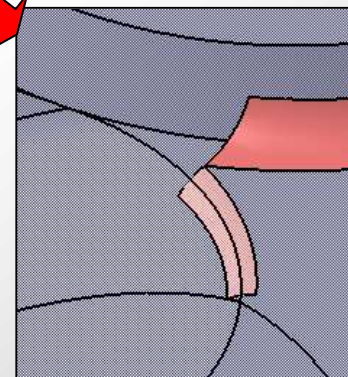
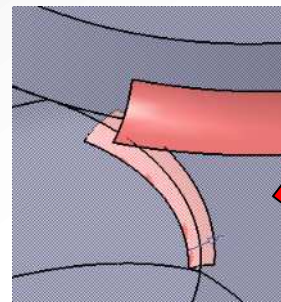
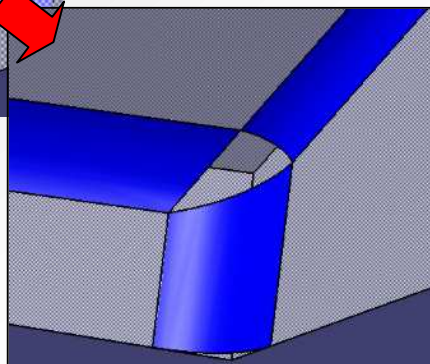
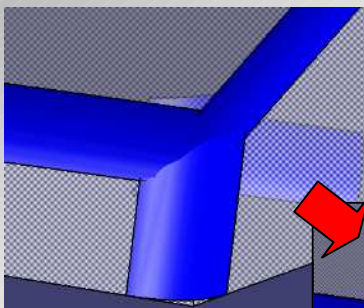
Trim method: [**Parameter**]





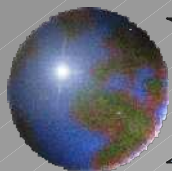
Junction Trim - Modification -

- Fillet surfaces are trimmed at their joining portion.
- Creation of a trim curve beforehand is not required. All of the fillet surfaces are collectively trimmed at the joining portion.



Joining
portion of
three fillets

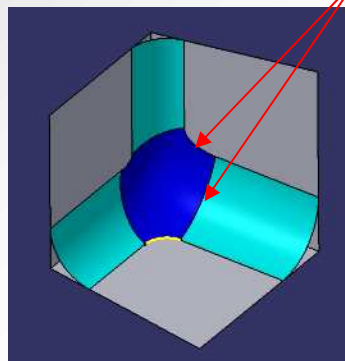
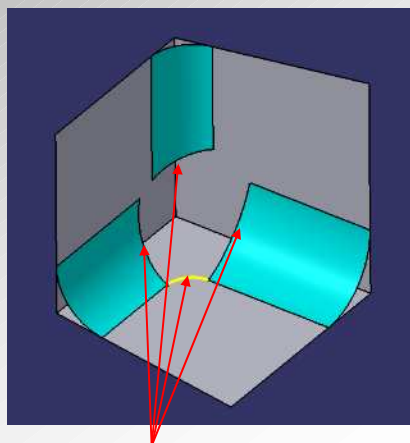




Blending / Gradation - Modification -

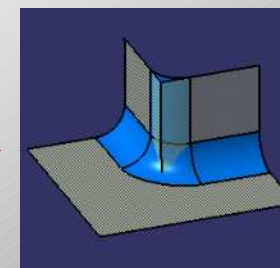
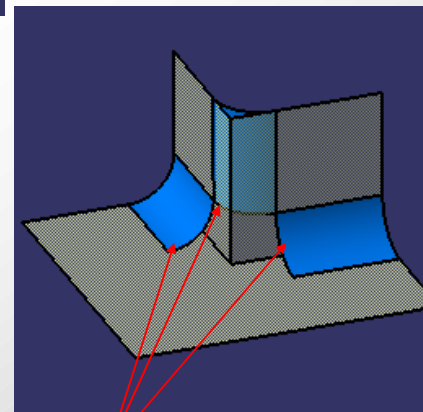
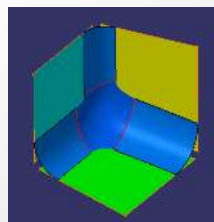
Create a gradation surface where fillets join.

[Gradation]



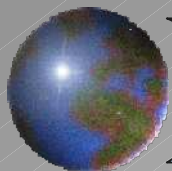
Tangent continuation to specified fillet and supports are guaranteed.

- When fillet end is open, filling surface is automatically created
- Any curves or inside edges can be specified as a frame curves.
- Support surfaces where automatically created edges lie should be specified.
- Two or more support surfaces can be specified.



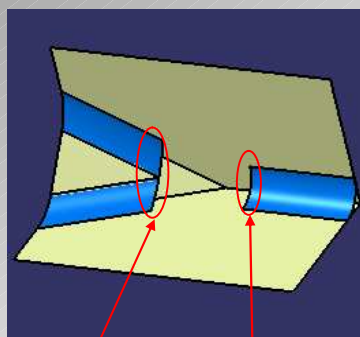
Frame curves





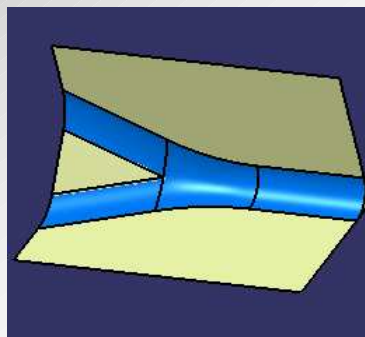
Blending / Connection - Modification -

[connecting surface]



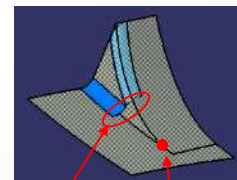
Cross section1

Cross section2



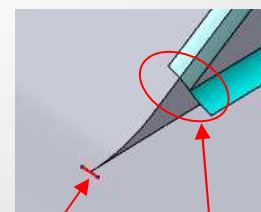
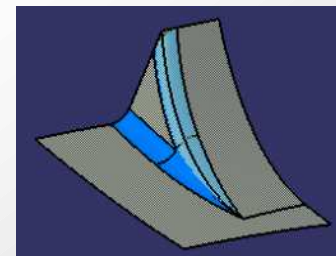
A surface is created which smoothly connects given section curves

<Can be used for degeneracy portion>



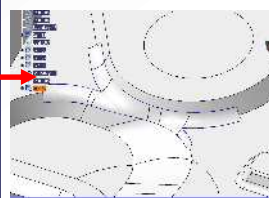
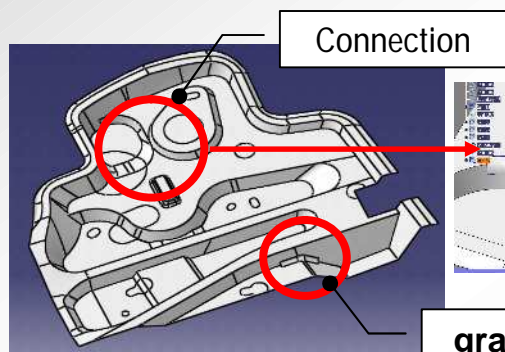
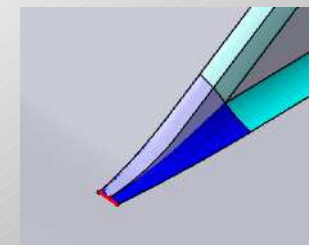
Cross section1

Cross section2 (Vertex)



Cross section2 (Curve)

Cross section1



gradation

(CATIA requires 55 commands which is not realistic to use)

gradation



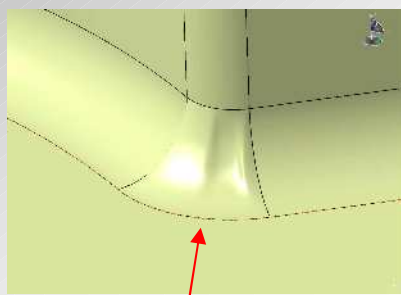
connection



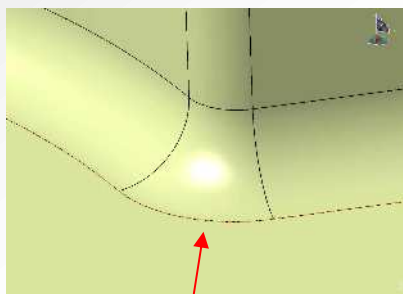


Fillet Fairing - Modification -

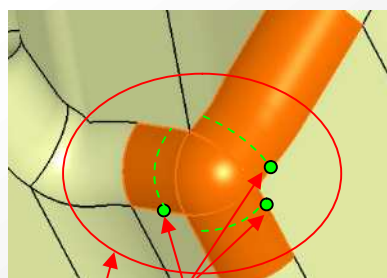
- Reshape a fillet surface by easy operation in case a wrinkle or distortion is exists on the surface or in case a bend is generated between fillet surface and support or between fillet surfaces.
- It is also possible to specify multiple surfaces or to specify range for fairing.



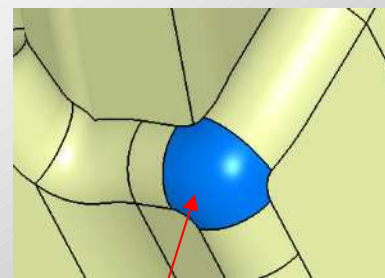
A fillet surface with a wrinkle or a bend to supports is specified.



The fillet surface after reshaped (Wrinkle and bend to supports are eliminated.)



Specified range (pick points)
Specified fillet surface



Reshaped fillet surface (Joining portion is a blended surface)

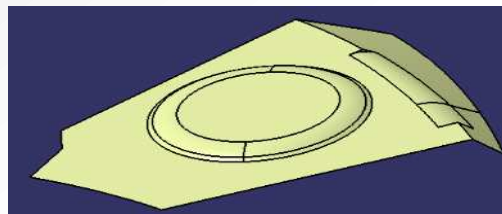
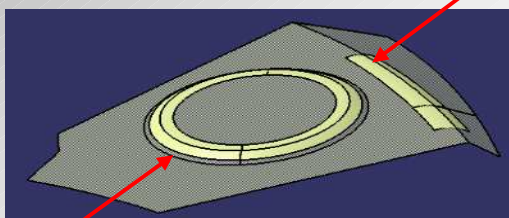




Fillet Embedding - Embedding -

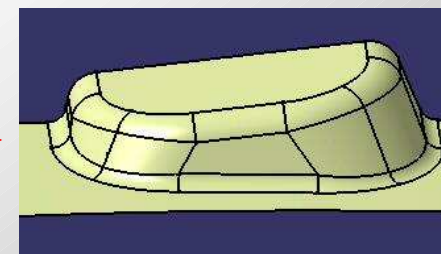
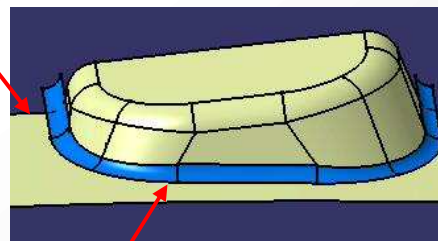
- A fillet surface is merged into a support open body.
- There is no comparable function in CATIA V5. A trim command of CATIA can merge fillets. But the command can not solve the case when surfaces contact each other which frequently occurs in production level modeling.

A fillet which terminates at intermediate location

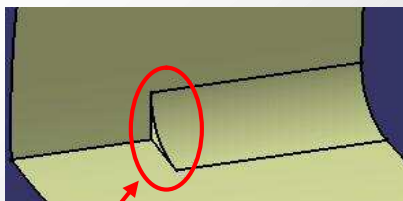
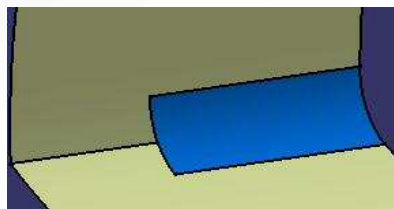


A fillet of which edges are all on a support.

Outer boundary

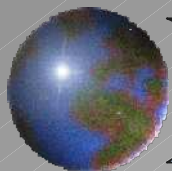


A fillet which reaches to outer boundary of the support



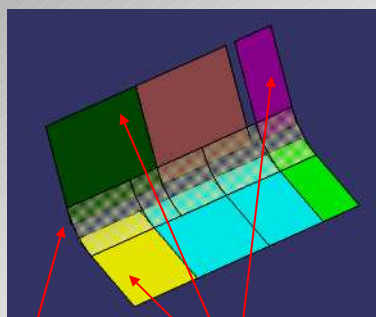
Side cover face is automatically created and merged.





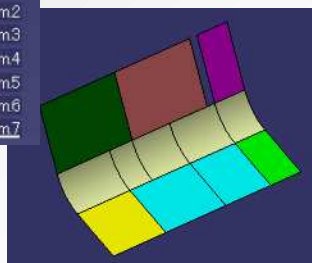
Batch Trim - Embedding -

- Two or more features in an open body are collectively trimmed at R end curve of a fillet surface.
- This command is used in conventional surface modeling.
Two or more features can be trimmed without connecting them beforehand.

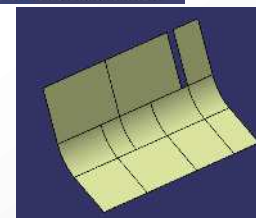


Fillet surface

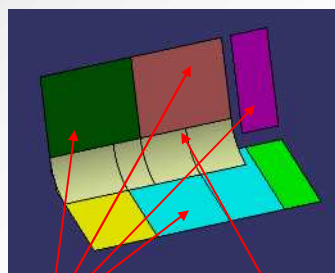
Elements specified for trimming
(Two or more features in an open body)



Sides which are not covered by fillet surface (outer side) remain after trimming.

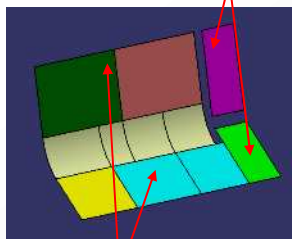


Can be connected smoothly to the specified fillet.



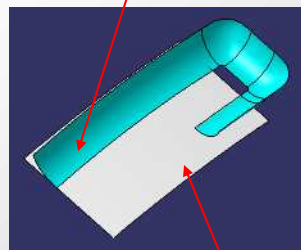
Elements specified for trimming
(Two or more features in an open body)

Only this element is trimmed.

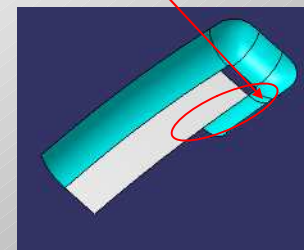


These elements are not processed because they cannot be divided by the trim line.

Fillet surface

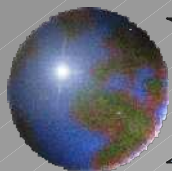


Elements specified for trimming



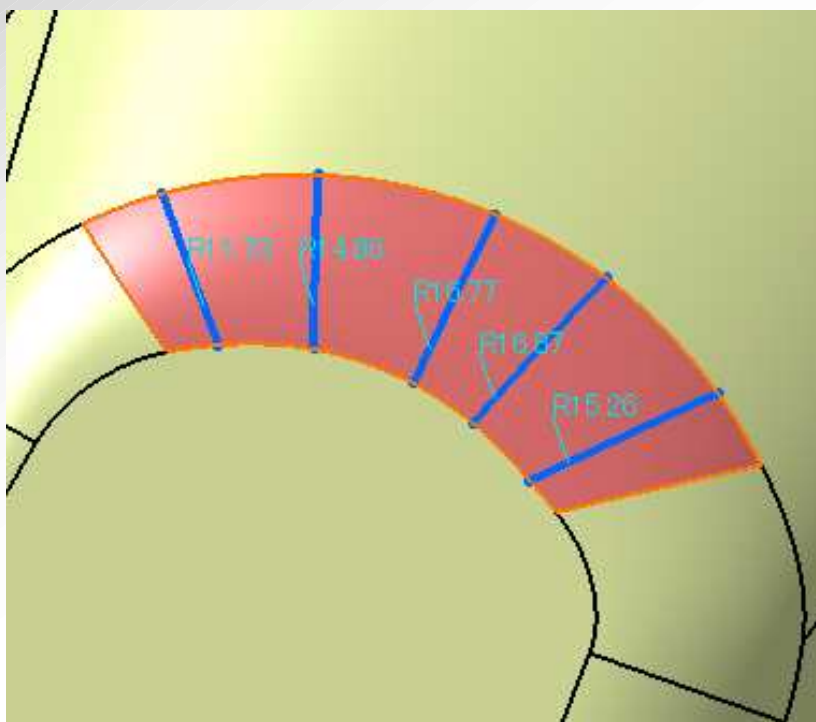
Trimming is extended if the trim line does not reach to outer boundary of the elements to be trimmed.



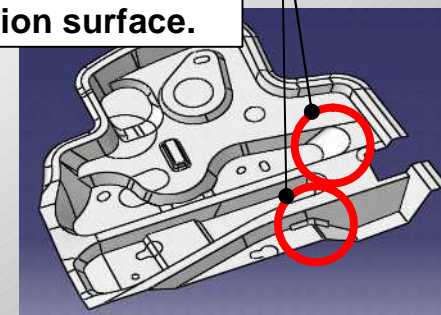


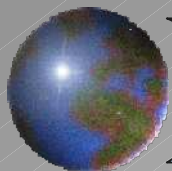
R value measurement - Evaluation -

- R value of a fillet can be measured.
- It is also useful for checking R value change at variable fillet and the check of R value of a fillet in a model imported from other CAD systems. Gradation surface can also be processed.
- Result of the measurement remains as a temporary figure for easing visual confirmation.



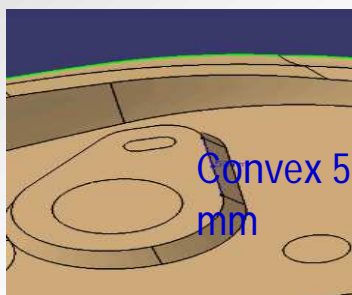
Measurement at a fillet and a gradation surface.





R-attribute - Attribute -

- By giving R value as an attribute at rounding edges or vertex (gradation portion), reduction of the input operations and prevention of input error are expected.
- R values and edges can be collectively input only by hitting R-attributes.
- By the use of confirmation function of R attribute, missing of input can be checked visually.



Hit a R-attribute

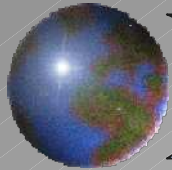


Edges with the R-attribute are selected at the same time.



A curve with R-attribute

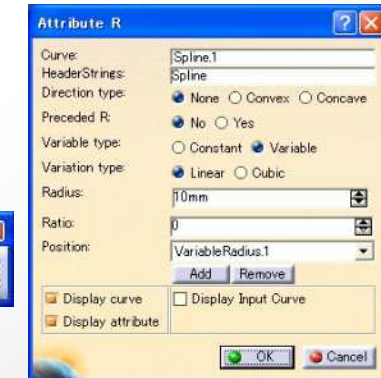
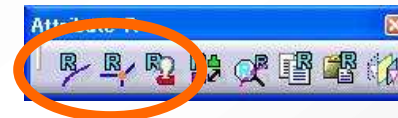
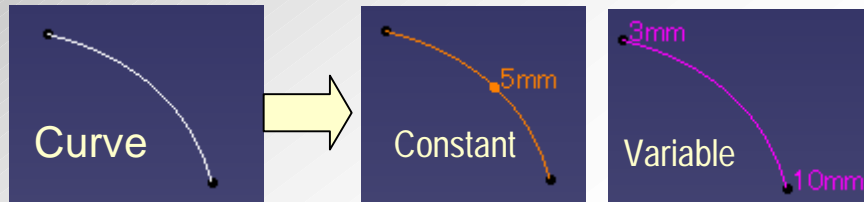




R-attribute - Creation

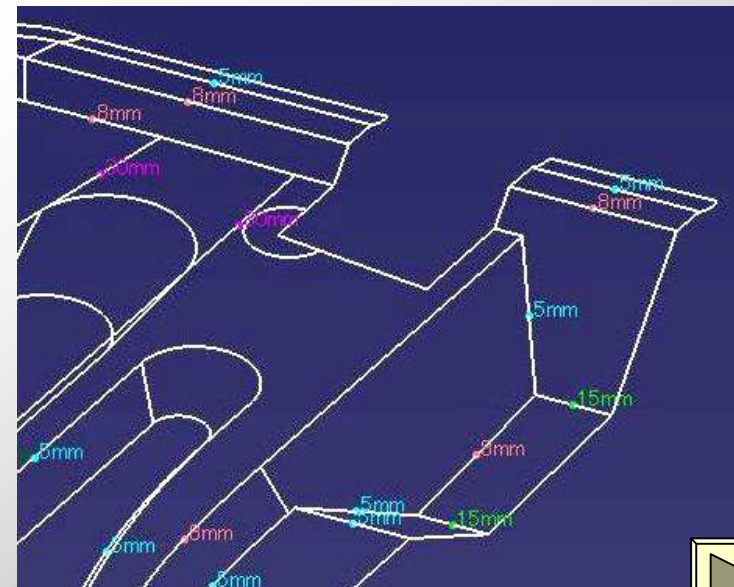
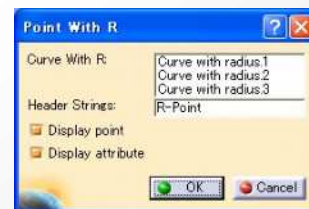
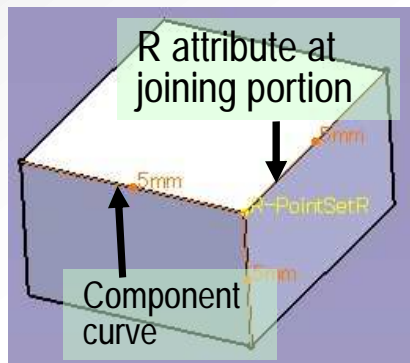
- Curve with R attribute

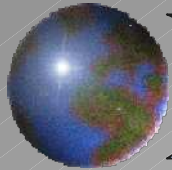
- Constant/variable R attribute is attached to a curve or component curve.
- Variable position by a mouse picking and fine adjustment by spinner.
- Can be referred by Flange expansion and Fillet.
- Classification such as priority or convex/concave.



- Curve with R attribute

- R attribute is attached at intersecting point of two or more curves with R attribute.
- Comments can be input for header character string.





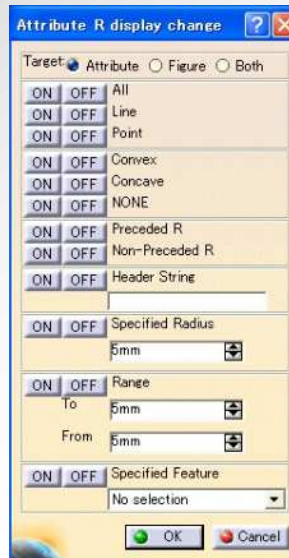
R-attribute – Related functions

- Switch R attribute display

- Switching of display on/off according to attribute type

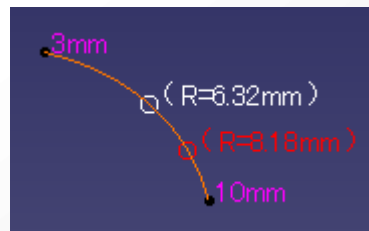
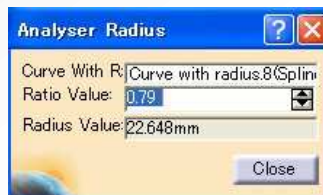
- Switch convex/concave of R attribute

- Collective switching of convex/concave



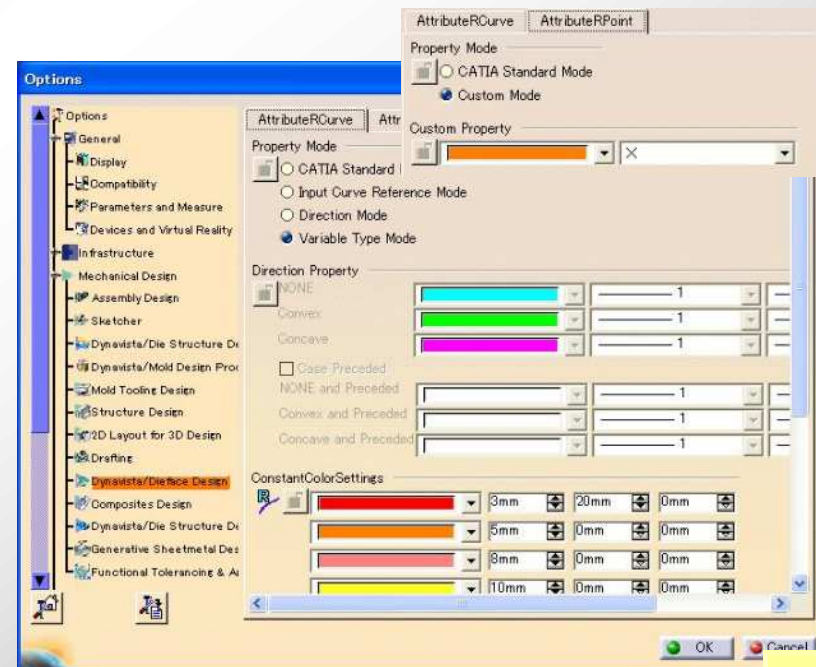
- Analyze R attribute value

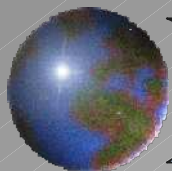
- Analysis and display of R value at any position on a curve with variable R attribute



- Customization of R attribute

- Arbitrary customization of display property.
- Color/line type (point type)/line thickness (point symbol shape) can be customized by type of attribute or R value.
- Color before attribute attachment can be seen by the use of tandard mode/original line display mode of CATIA.



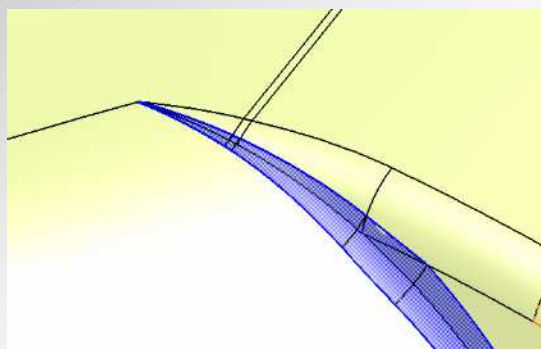


Degeneracy, non-smoothness(C0) and self-intersection of support surfaces - Robustness -

Fillet robustness

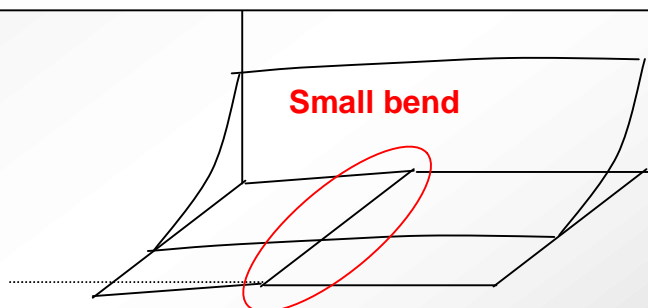
- Inheritance of fillet creation and merge algorithms used in the well established hybrid modeling.
- High robustness guaranteed even for complex shaped automotive parts.

Both sides gradually become tangent connection

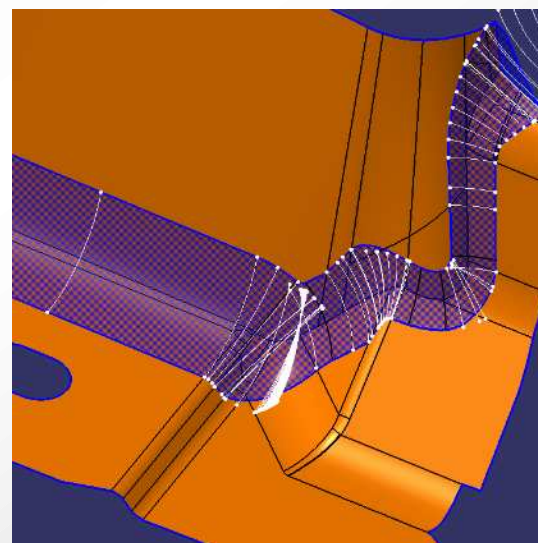


Degeneration at the end of a curve

Small non-smoothness between surfaces



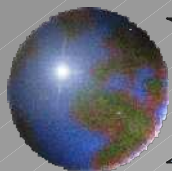
Self intersection case



Removal of self intersection

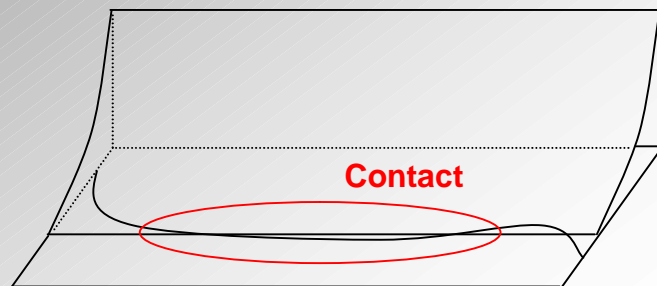
Tolerance for judging broken surface or edge can be specified.



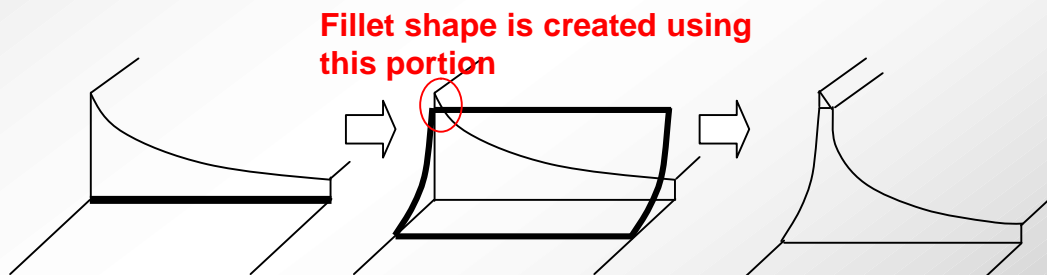


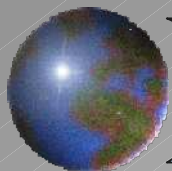
Edge of fillet - Robustness -

Contact or coincidence of an fillet R-end edge and another edge on a support surface



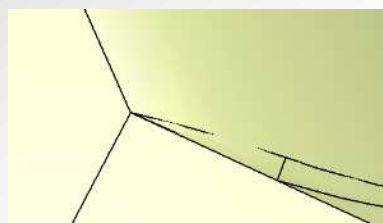
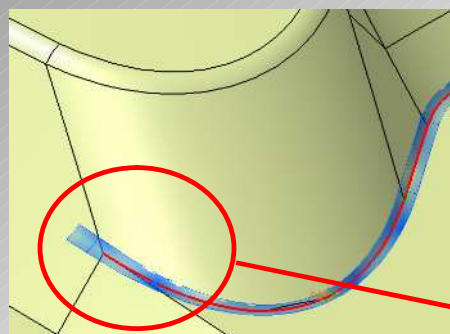
When only small portion allows the calculation of fillet shape.



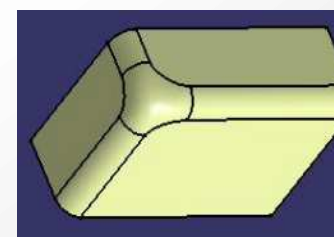
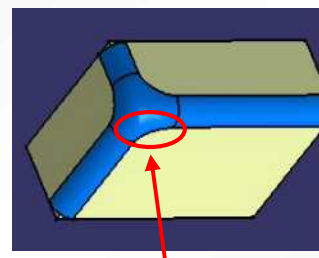


Embedding - Robustness -

Contact of a side cover surface and a fillet surface

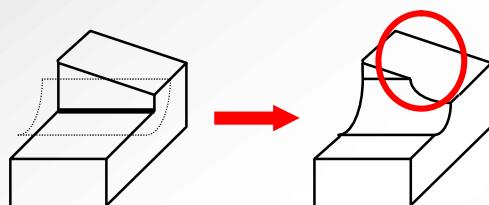


Contact of a fillet surface and a support surface

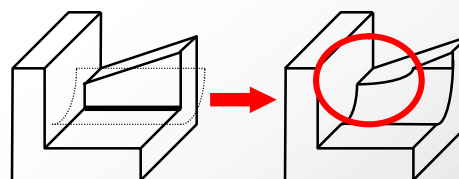


Surface-surface contact

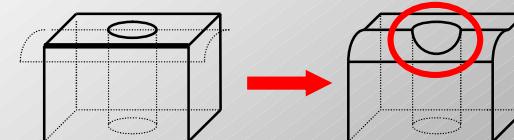
Other cases of tough merger



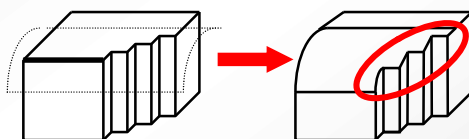
(1) Extension of a cover consisting of 2 surfaces



(2) Mixture of extension and trim of a cover



(3) A fillet trimmed by a hole shape

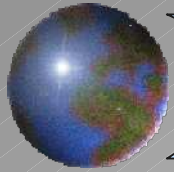


(4) Multiple end surfaces



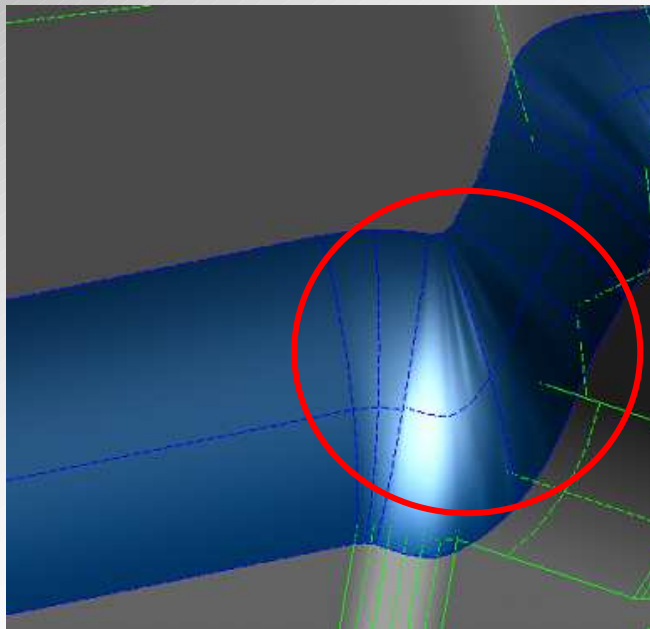
(5) Trim at the end of support surfaces





Surface quality - Robustness -

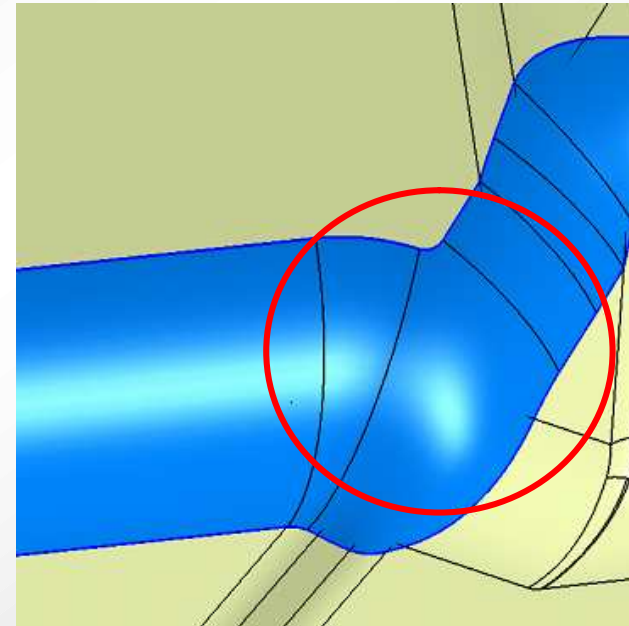
- Special consideration is taken to prevent “wrinkle”.



“Wrinkle” is created by the concentration of patch boundaries caused by complex shape change.

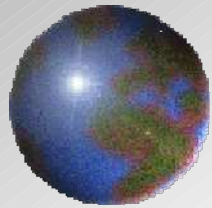


Dynavista



“Wrinkle” is avoided by the smooth gradation where fillet surfaces are tangent to adjacent fillet surfaces and support surfaces.





Dynavista

CAA V5 based

<http://www.unisys.co.jp/e/dynavista/>

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