

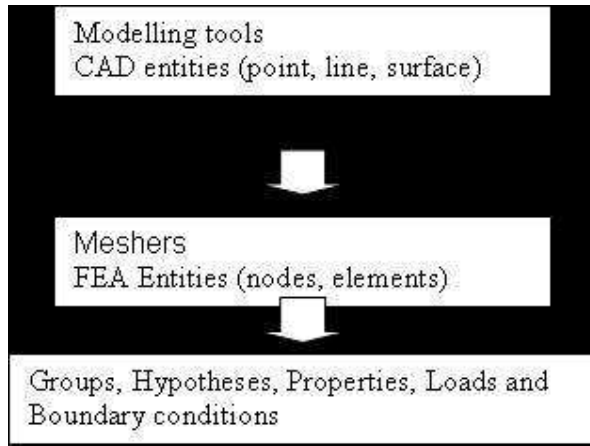
2D – 3D Geometry

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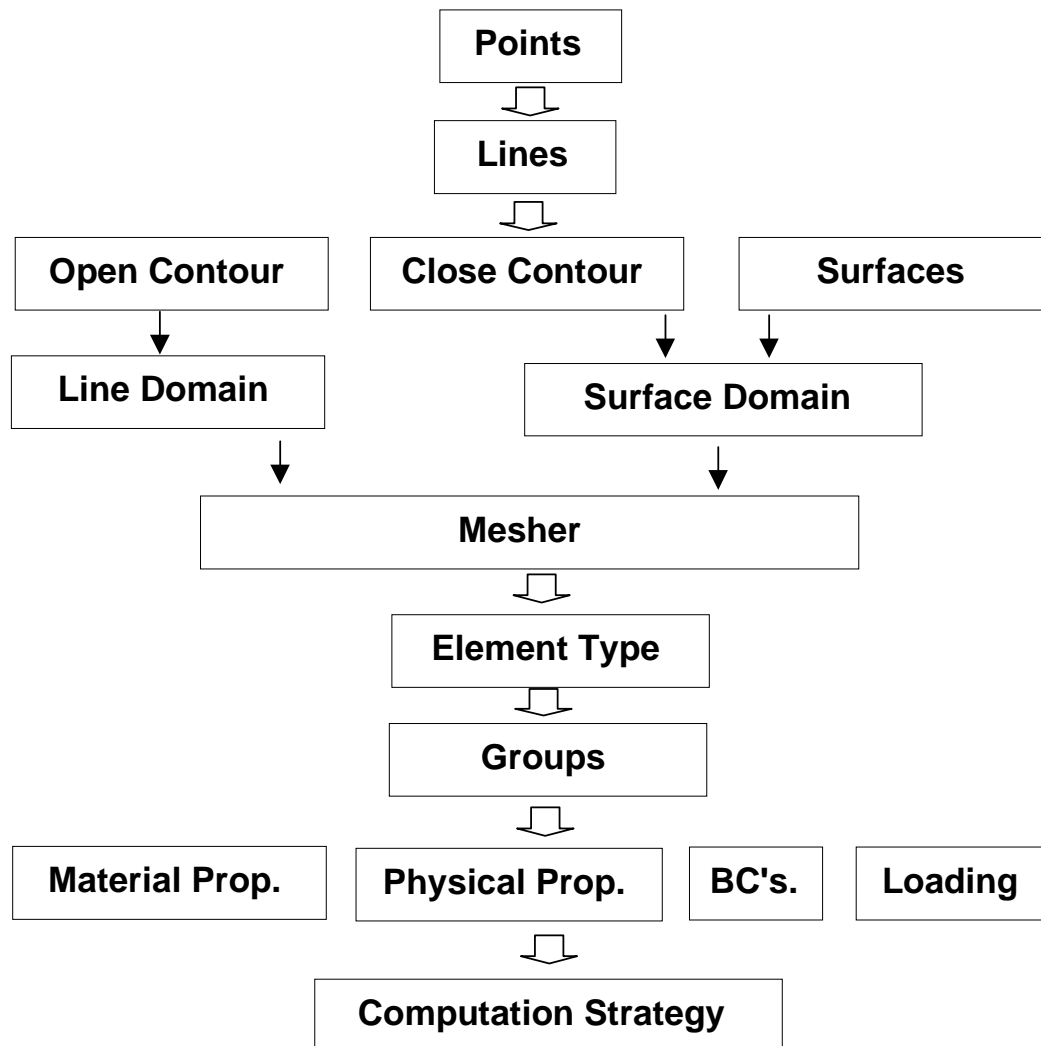
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1. Generalities

1.1. Scheme



1.2. Hierarchy of commands

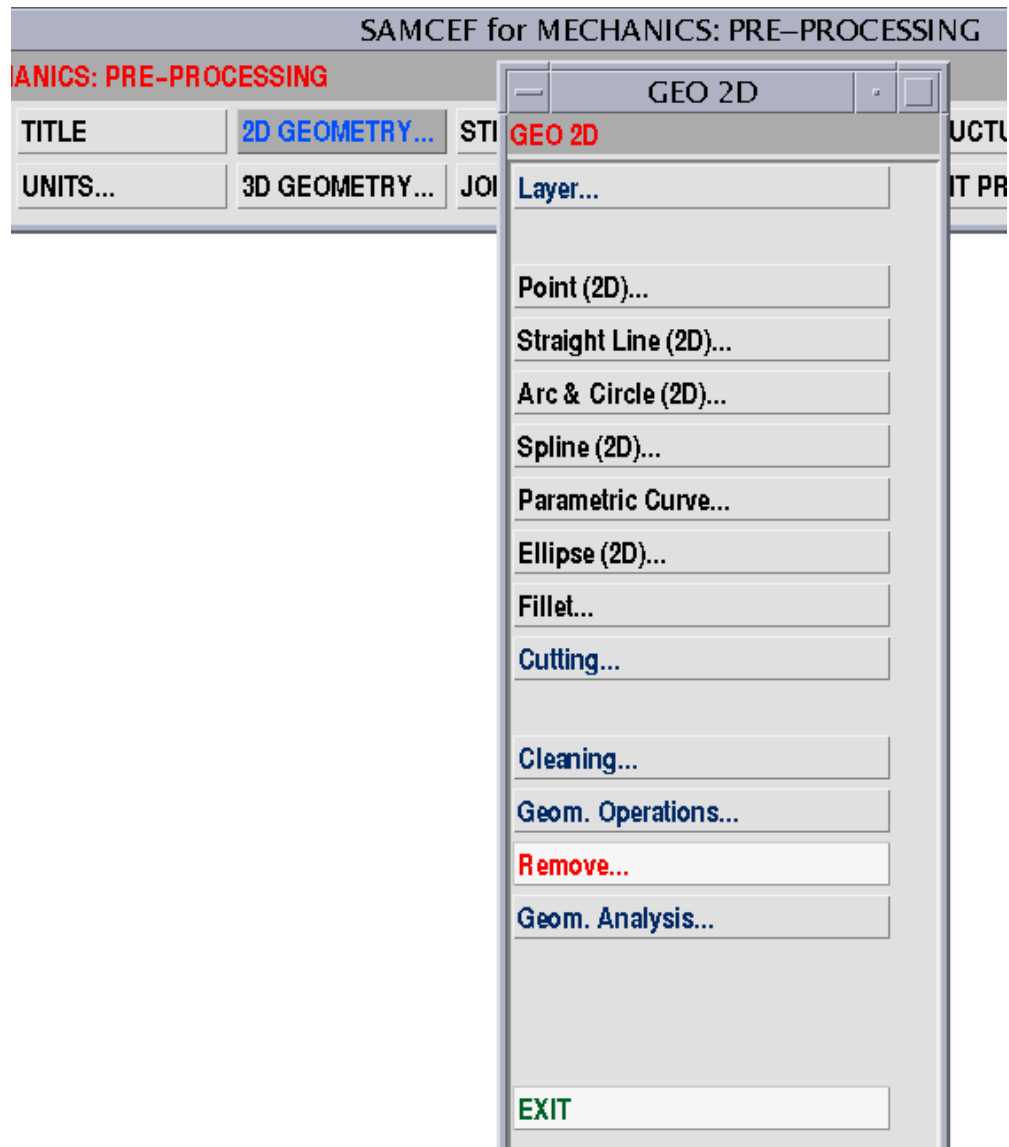


General rule : entity generation is only allowed with existing sub-level entities.

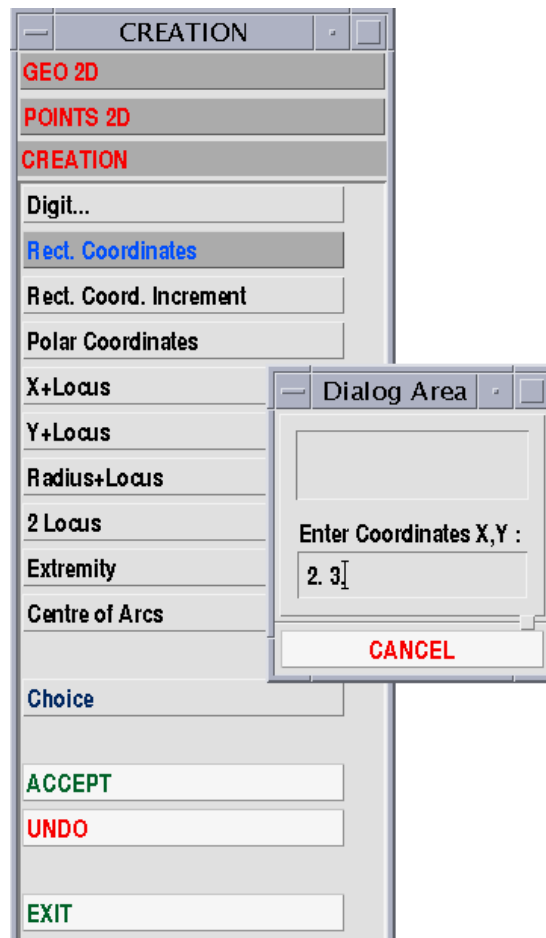
2. 2D geometry

The 2D geometry menu allows creating 2D entities. They are created in the **Z=0 plane**.

This menu can also be reached in the 3D menu activating a working plane.

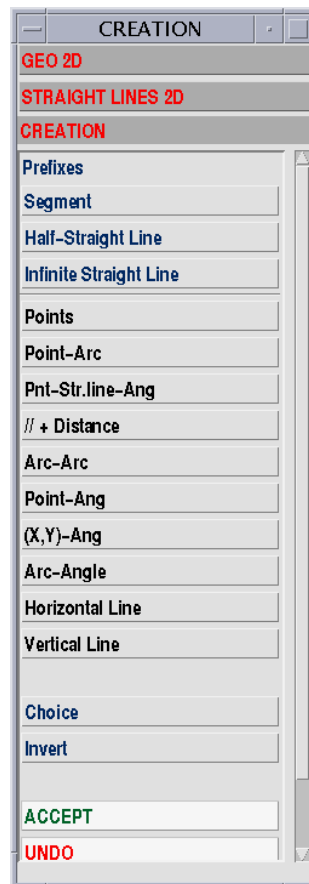


2.1. Points



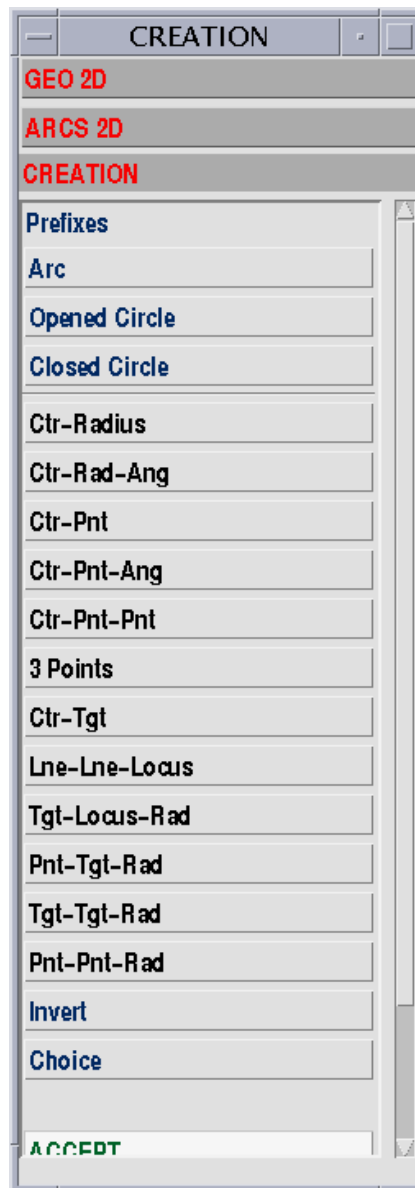
	<i>Create a point with Cartesian coordinates :</i>
<code>.point I 1 x 2. y 3.</code>	
	<i>Create a point with polar coordinates</i>
<code>.point I 1 rayon 10 angle 45.</code>	
	<i>Create points by intersection of lines 7 and 8.</i>
<code>.point I 8 lieu 7 8</code>	
	<i>Create points with changing the origin</i>
<code>.point I 9 origine 2 3 x 5 y 6 ! new origine is x=2 y =3</code>	
	<i>Create points with changing the origin</i>
<code>.point I 10 origine 9 x 5 y 6 ! new origine is point 9</code>	

2.2. Lines



	<i>Create lines across 4 points</i>
<code>.droite I 1 point 1 2 3 4</code>	
	<i>Create line parallel to a line</i>
<code>.droite I 9 distance 13.6 line 7</code>	
	<i>Create line with center and tangent to arc or circle.</i>
<code>.droite I 10 tangent 8 point 2</code>	
	<i>Create line tangent to 2 lines</i>
<code>.droite I 10 tangent 2 3</code>	
	<i>Create line with coordinates</i>
<code>.droite I 1 cpoints 0. 0. 2. 3.</code>	

2.3. Circles and arcs



	<i>Create circle with 3 points</i>
<code>.arc I 2 point 1 2 3</code>	
	<i>Create circle by center and radius</i>
<code>.arc I 9 centre 5 rayon 18.6</code>	
	<i>Create an arc by centre, radius and angles.</i>
<code>.arc I 11 point 7 rayon 10 angl 35 90</code>	
	<i>Create circle tangent to line 8</i>
<code>.arc I 13 point 7 tangent 8 rayon 2</code>	

2.4. Splines

The following commands can be used to **create one line passing trough many points.**

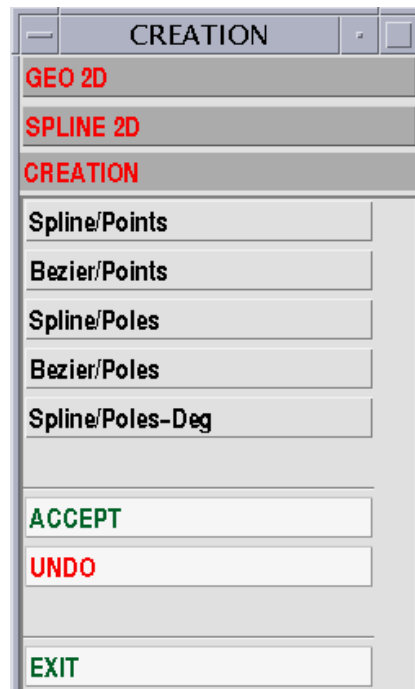
Possibility to create :

- Bezier
- Spline curve

➤ NURBS

The degree of a spline is equal to the number of poles (points) minus 1. This degree can be decreased for smoothing.

The expression of the polynoms of interpolation can be found in the help manual

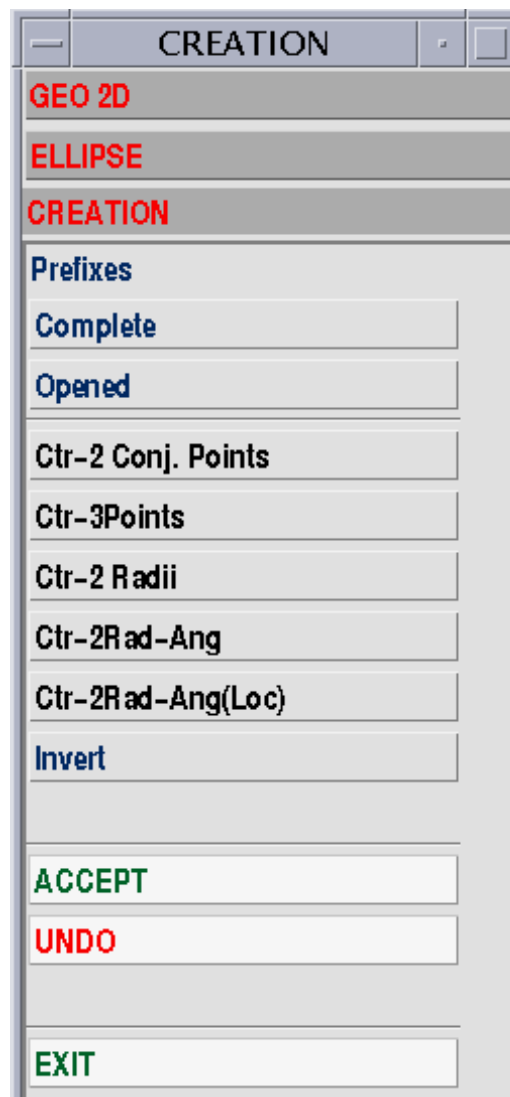


	<i>Create spline with 4 points</i>
<code>.spline I 4 point 4 5 6 1</code>	
	<i>Create bezier-spline with 4 points</i>
<code>.spline I 9 point 5 6 7 8 bezier</code>	
	<i>Create spline with 4 poles.</i>
<code>.spline I 11 poles 6 7 8 9</code>	
	<i>Create spline with 6 poles imposing the degree 4</i>
<code>.spline I 13 poles 6 7 8 9 10 11 degree 4</code>	

Remarks :

1. Minimum points or poles number is 3.
2. When a curve is defined by its passing points, it is calculated at degree 3.
3. Bezier curve degree defined by its poles is always equal to poles number minus 1.
4. **GRAP POLYGONE** allows to visualize the poles polygon for such curves. **GRAP ORIENT** can also be used.

2.5. Ellipses



<i>Create arc of ellipsis with centre and 3 points</i>
<code>.ellip I 1 centre 1 point 1 2 3</code>
<i>Create complete ellipsis with centre and 2 radii.</i>
<code>.ellip I 9 centre 3 ra 30 rb 60</code>
<i>To invert sens of created entity or choose solution i</i>
<code>Inverse sens or inverse or choice i</code>

2.6. Fillet

Only works in 2D on straight lines and arcs.

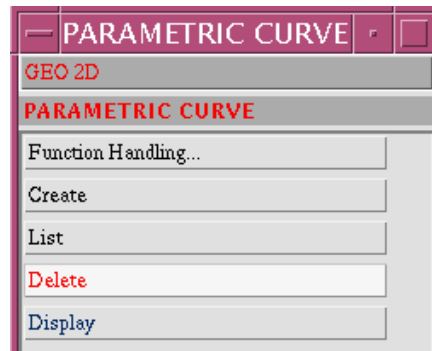


Create a fillet of radius 1. between lines 5 and 6.

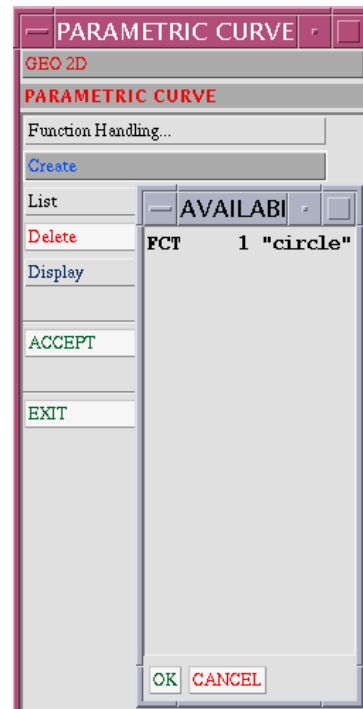
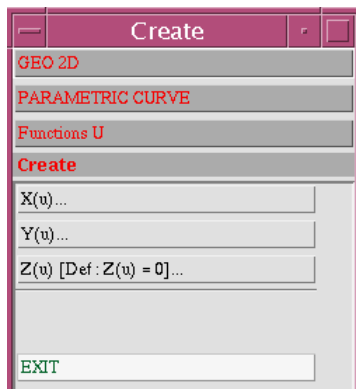
`.lim decoupe 5 6 conge 1.`

2.7. 2D Parametric Curve

To create a parametric curve based on functions $x=f(u)$ and $y=g(u)$.



One has first to create the function, then create the curve.



Create an arc based on function 1.

```
.fct cree fonction I 1 nom "circle"
  cree valeur x u bornes 0 3.14 analy "cos($u)"
  cree valeur y u bornes 0 3.14 analy "sin($u)"
.fcu I 4 fct 1
```

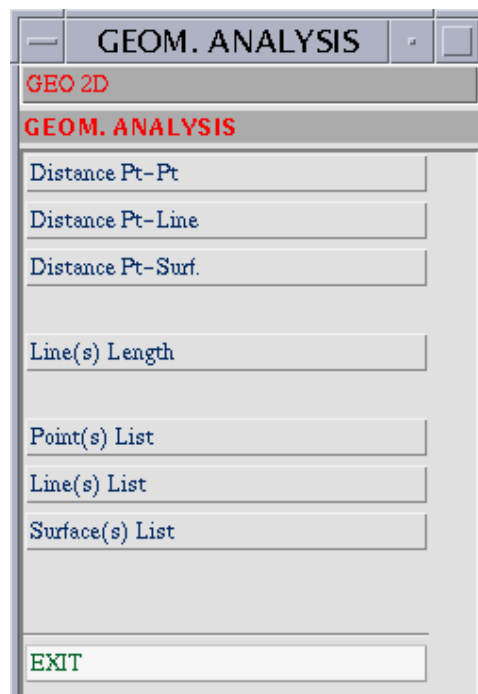
2.8. Cleaning

Mainly used when reading an IGES file.



<i>Merging of lines which have the same position (criteria 3)</i>	
.purge 3 lignes	
	<i>Automatically activate all criteria.</i>
.purge auto	

2.9. Geometric Analysis



Compute the distance between point 2 and 3

.analyse distance point 2 3

The command .ANALYSE allows putting some results in an abbreviation.

Example :

ABRE ('/LENGTH') '0'

ABRE ('/AREA') '0'

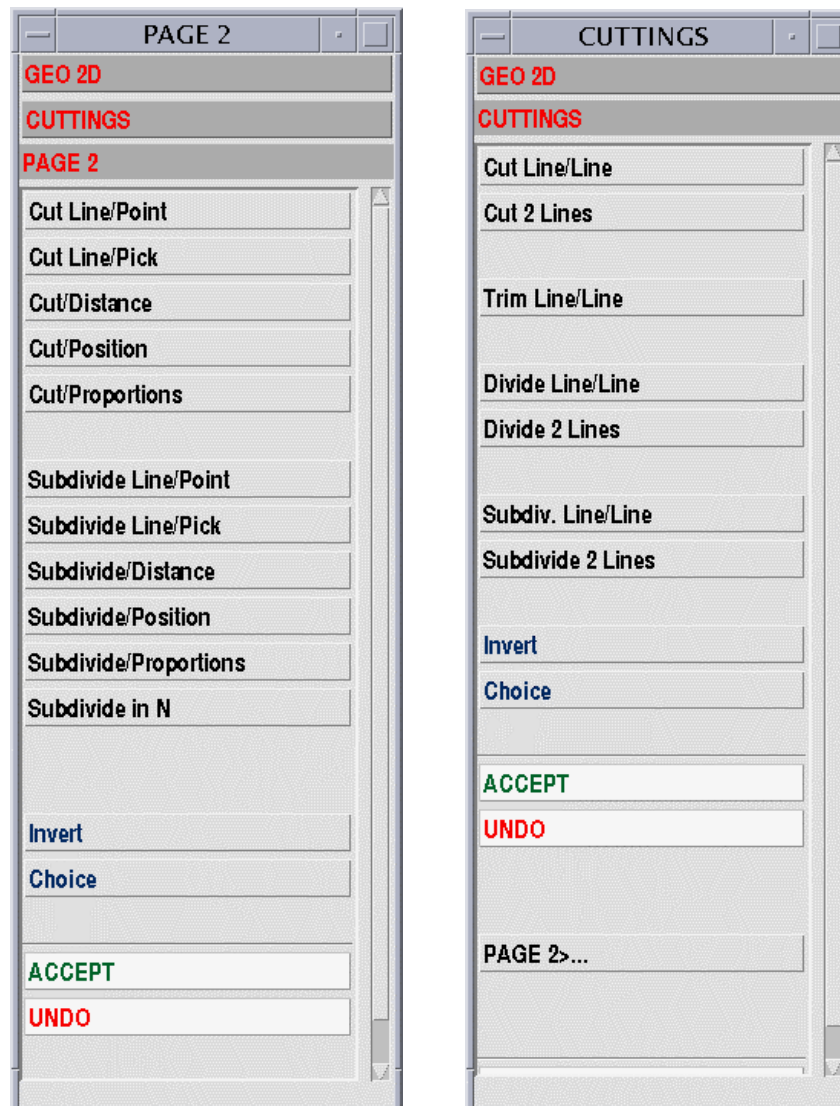
.ANALYSE longueur ligne 3 a 5 CABR "LENGTH" ! length from line 3 to 5)

.ANALYSE Aire group « shell » CABR "AREA "

Att --

2.10. Intersection of lines

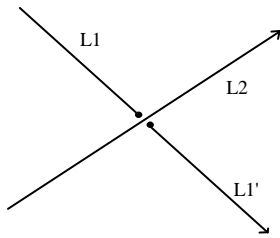
Same command than for the fillet



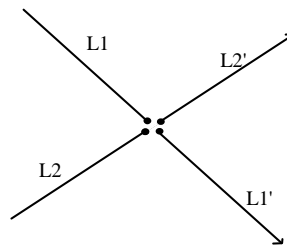
	<i>Divide line 4 by line 5</i>
<code>.lim divide 4 par 5</code>	
	<i>Divide 2 lines</i>
<code>.lim divide 8 23</code>	
	<i>Divide line 4 by line 5 and remove the extremity.</i>
<code>.lim decoupe 4 par 5</code>	

Division of one entity in 2 equivalent entities

Divide 1 by 2

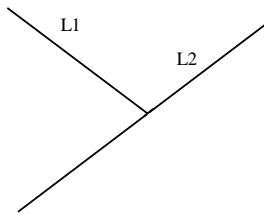
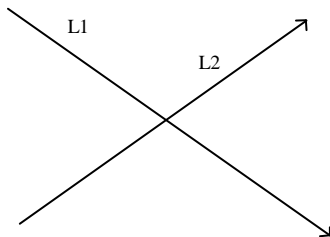


Divide 1 2

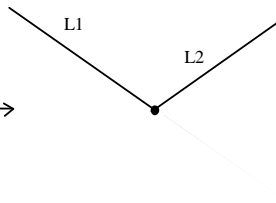
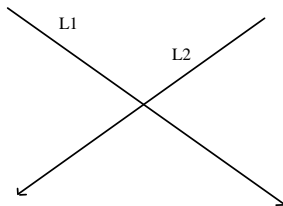


Cut an entity and suppression of the non retained part

Subdivide 1 by 2

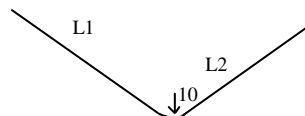
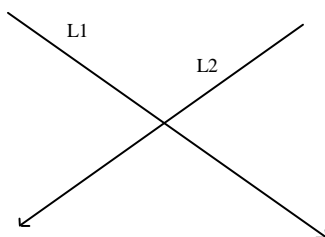


Subdivide 1 2



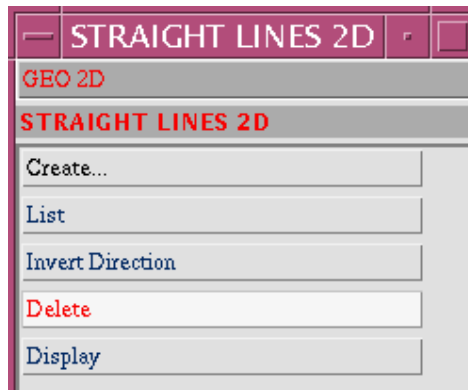
Fillet

Cut 1 2 fillet 10

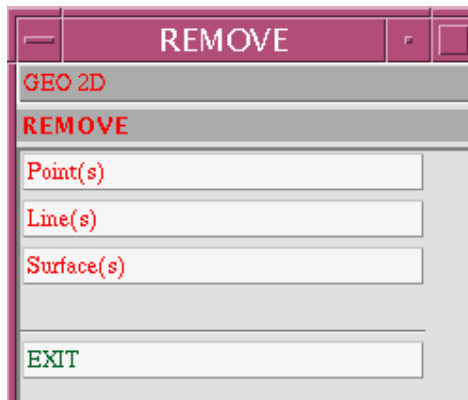


2.11. Entity deletion

An specific entity (arc, spline, ellipse, ...) can be deleted using the corresponding menu with the parameter **suppr.**



If user wants to globally delete entities by type, it has to use the following menu ..



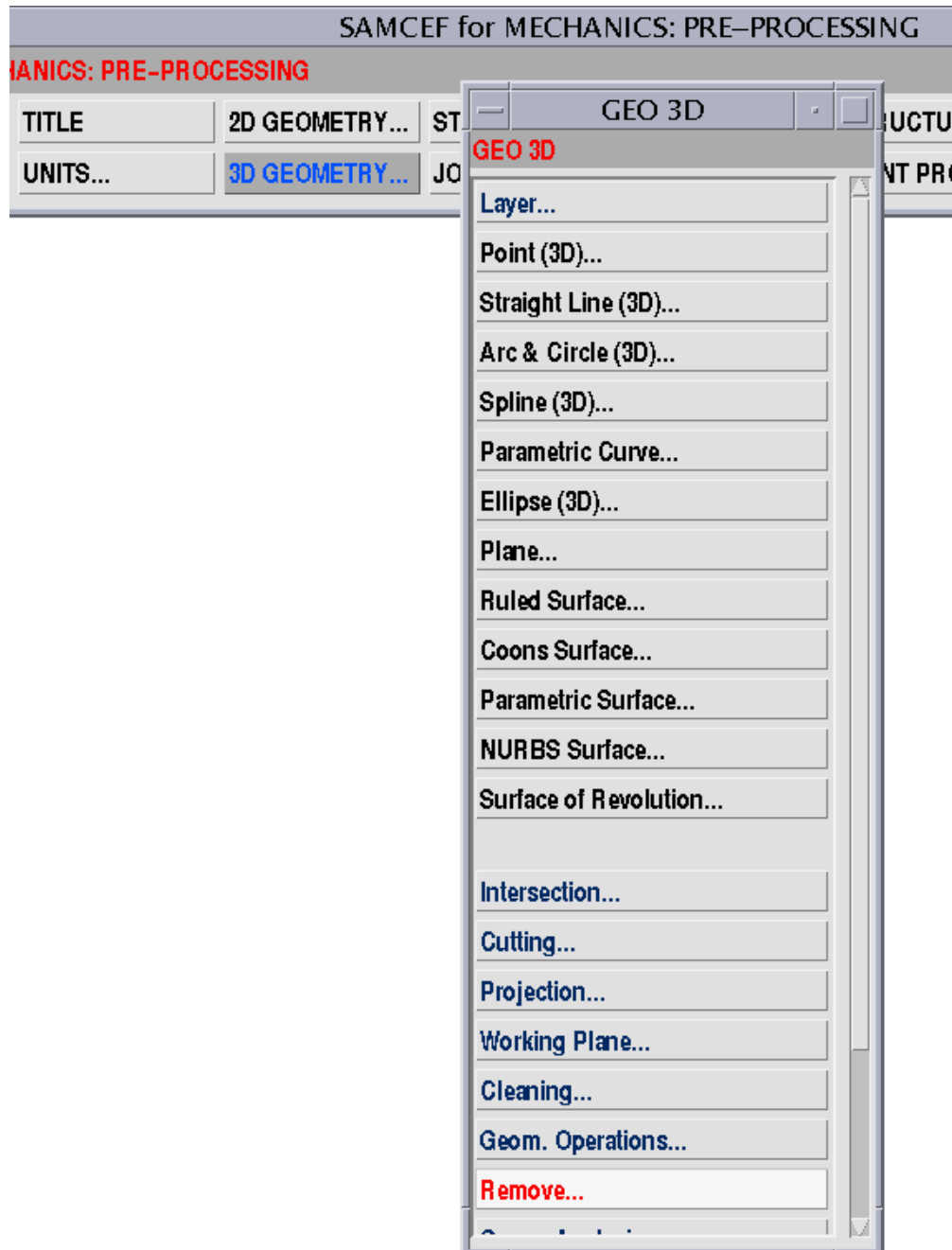
	<i>Suppress the arc number 3</i>
.arc supprime 3	
	<i>Suppression of line number 3 and surface number 6.</i>
.line supprime 3	
.surface supprime 6	

Exercise :

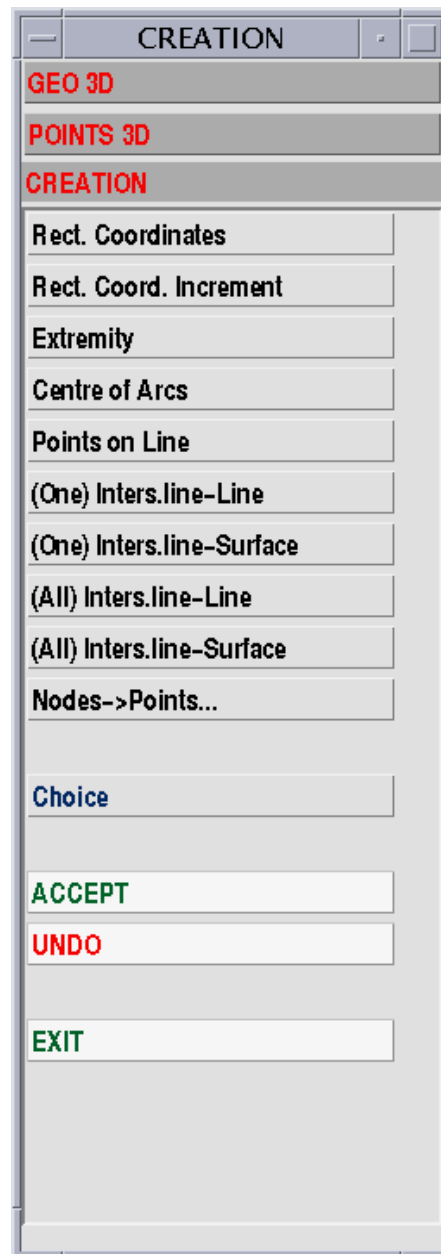
- Create 2D geometry on 2D tool (Exercise N°7)
- Create 2D Geometry of 2 materials plate (Exercise N°10)

3. 3D Geometry

The 3D geometry menu allows to create 3D entities including surfaces. There is no difference between 2D and 3D entities, both can be used in the same session.

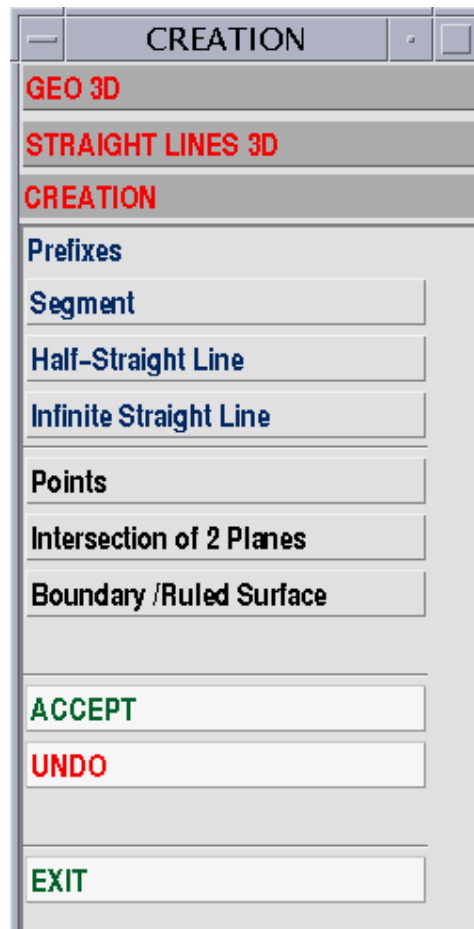


3.1. Definition of points



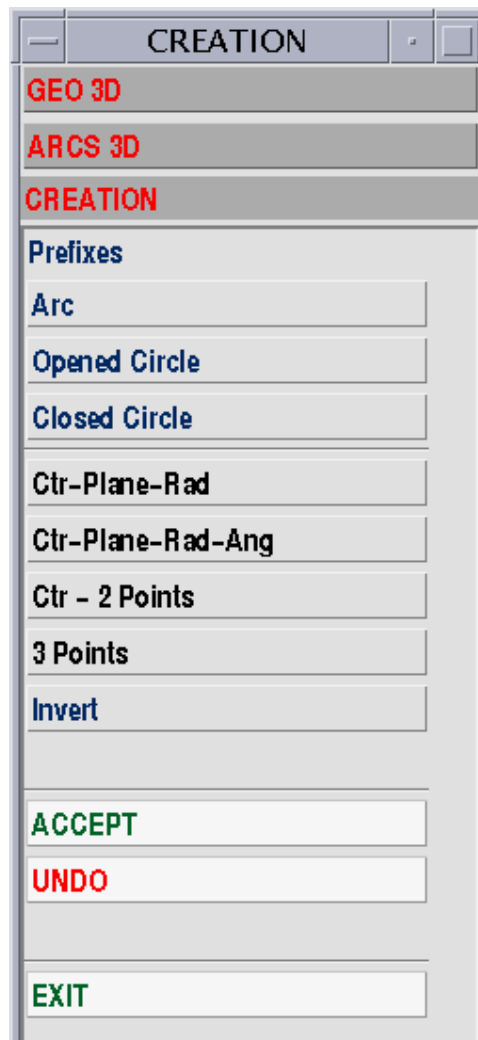
	<i>Create a point with Cartesian co-ordinates :</i>
<code>.3point I 1 x 2. Y 3. z 3.</code>	
	<i>Create points from nodes (with same numbering)</i>
<code>.3point convert noeud 10</code>	
	<i>Create points at the centre of an arc.</i>
<code>.3point centre ligne 10</code>	

3.2. Straight lines



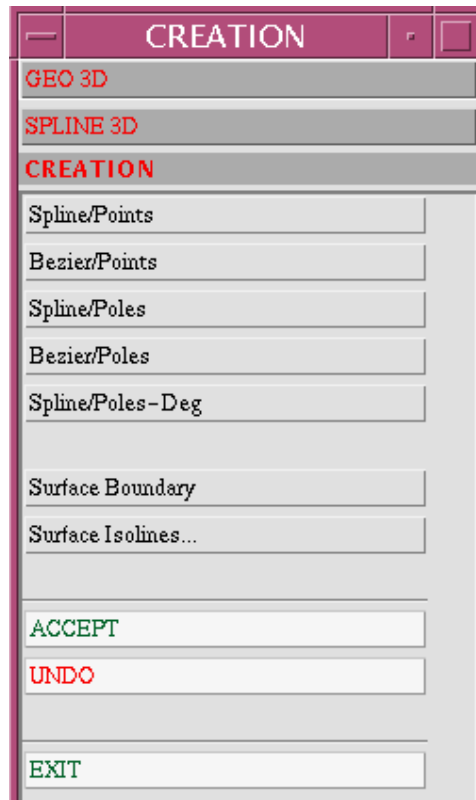
	<i>Create line passing through 2 points</i>
.3droite I 1 point 1 2	
	<i>Create lines extremities of a ruled surface.</i>
.3droite bord surface 10	
	<i>Create circle with centre, radius and plane and angles.</i>
.3arc I 10 surf 4 point 5 angle 45 90	

3.3. Circles or arcs



	<i>Create circle with 3 points.</i>
<code>.3arc I 1 point 1 2 3</code>	
	<i>Create circle with centre, radius and plane.</i>
<code>.3arc I 3 centre 1 rayon 10 surface 1</code>	
	<i>Create circle on a plane with centre, radius and angles.</i>
<code>.3arc I 10 surf 4 centre 5 angle 45 90 rayon 10</code>	

3.4. Splines

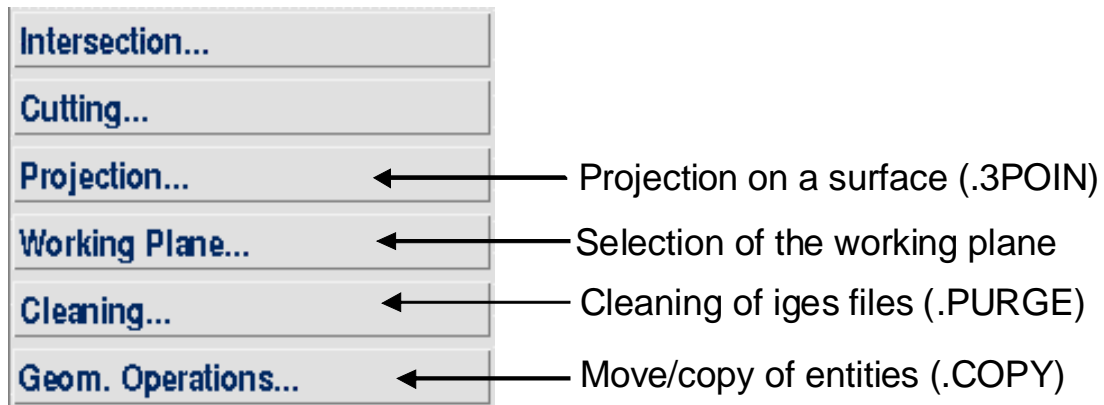


	<i>Create a spline with 5 points.</i>
<code>.3spline I 1 point 1 2 3 4 5</code>	
	<i>Create splines for all borders of surface 1.</i>
<code>.3spline I 3 bord surface 1</code>	

Degree = poles number - 1

3.6. Other commands

It is also possible to operate on geometric entities.



For other commands, see user's manual.

3.7. Work in a plane

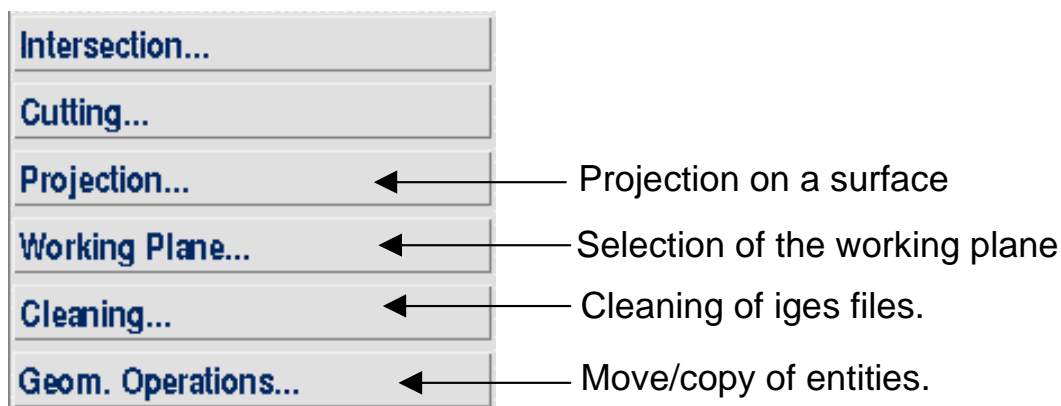
It is possible to work in a predefined plane. In this case, the 2D menu is automatically activated within a 3D menu box.

It follows 3 steps:

1. Define the plane.

The plane is created taking care of its origin because it will be the 0,0 coordinate of the origin point. If not specified, the origin will be created at the boundary of the design box.

2. Activate the created plane.



3. If you want to have it parallel to the screen, use the "Set Plane view" option and display.