Grid*Pro* Utilities Manual

Version 9.0

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CONTENTS:

1. asciiToBinary

Usage: *"asciiToBinary"*

Syntax:

*"**gp_utilities** asciiToBinary <Input Grid File Name> <Output Grid File Name>"*

Purpose:

Converts a ascii format grid to binary format.

Example:

COMMAND USED: *gp_utilities asciiToBinary blk.tmp binary.grd*

Note:

1. This command works only for Grid*Pro* grid format.
2. The respective '*.conn' file is needed to execute this command.

2. autofix

Usage: *"autofix [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-g	Group Id	Retain the singularities in the group.	None
-cid	Concave Edges Group Id	Append all the concave mildly severe edges to this group.	None
-t	Type	Eliminate singularities of type Very, Mediumly and Mildly. • Type & (1 << 0) => eliminate very severe singularities. • Type & (1 << 1) => eliminate mediumly severe singularities. • Type & (1 << 2) => eliminate mildly severe singularities.	3
-eb	Ensure Buffer Layer	Buffer layer is created.	-
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities autofix –fn <input file name> -t <type of singularity to be eliminated> -g <group_id> -cid <concave edges group id> -eb –ofn <output file name>"

Purpose:

Solve all the Mildly, Medium and Very severe singularity automatically.

Note:

1. The tool solves all the 3 singularities by picking appropriate sheets. The condition for the code to run is that the input topology given should have a buffer layer of topology.

IMPORTANT:

The code solves mildly severe singularity only at the topology level; it cannot build the right surfaces.

However the code creates some fictitious surfaces to check whether the topology is a valid one. The surfaces are created with a prefix "_ _new_surfXX.quad", where the XX denotes the surface number. It is highly recommended to delete the surfaces with the prefixes from the working directory and create new surfaces which would align the grid in a smooth pattern.

After the deletion of the surfaces with the prefix, the solved topology remains a mildly severe topology with the right sheets to be assigned to the surface.

2. To resolve the mildly severe singularity in the concave region, group the mildly severe edges of the concave region and use the option '-cid'. Since the concave regions can be easily captured by the surface by surface wrap, there is no necessity for the internal surface. This '-cid' option will ensure that a surface by surface wrap is done on the respective corner group.

3. The value for –t depends on the singularity that has to be solved. Each singularity has a value, for very severe the value of –t is 1, for medium its 2 and mildly its 4. To solve two singularities together, sum up their values and input. For e.g. to solve medium and very severe together, the value of –t is 3. Similarly to solve all the 3 singularities, the –t value is 7 (1+2+4).

Example:

Mildly severe singularity: A box inside a circle

COMMAND USED: *gp_utilities* autofix –fn mildly_severe.fra –t 4 –eb –ofn mildly_severe_out.fra

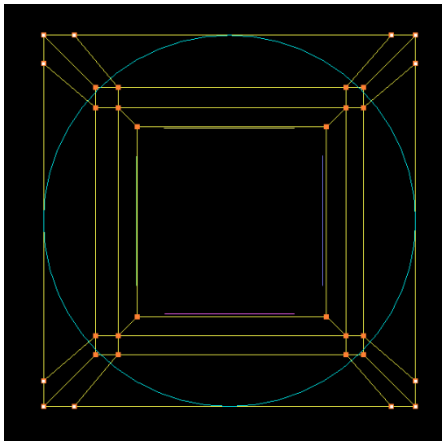


Fig: Topology with Mildly severe singularity

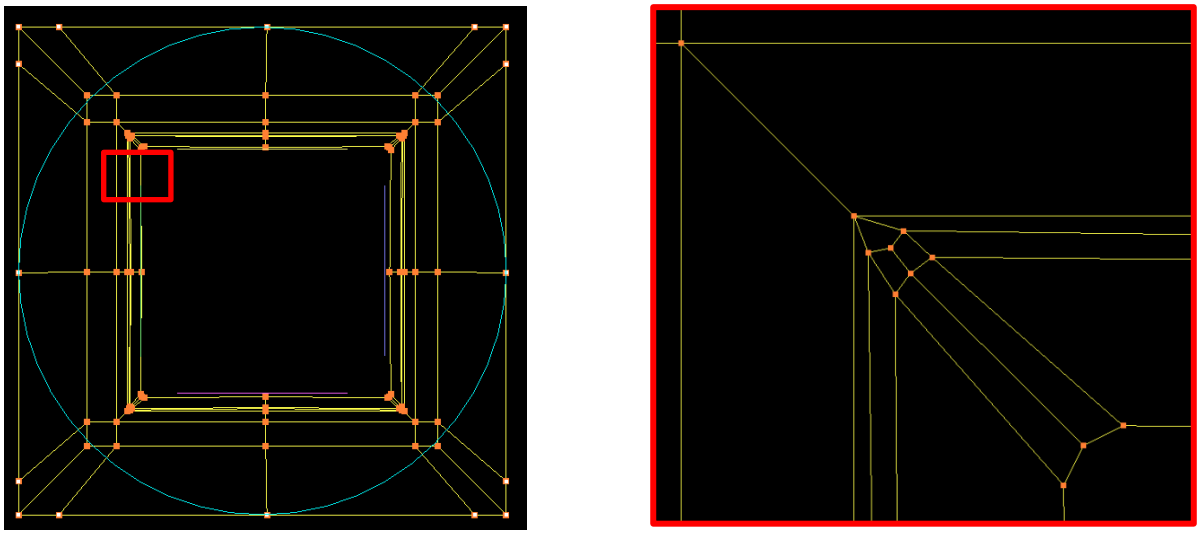


Fig: After using autofix

Mediumly severe singularity: A circle inside a box

COMMAND USED: *gp_utilities* autofix –fn medium_severe.fra –t 2 –eb 3 –ofn medium_severe_out.fra

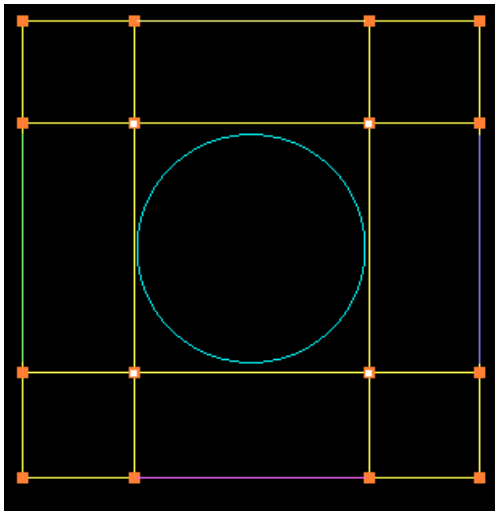


Fig: Topology with Mediumly severe singularity

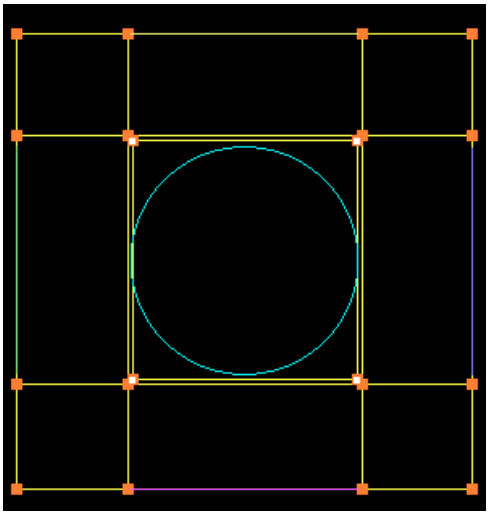


Fig: After using autofix

Very severe singularity: A circle inside a circle

COMMAND USED: *gp_utilities* autofix –fn very_severe.fra –t 1 –eb 3 –ofn very_severe_out.fra

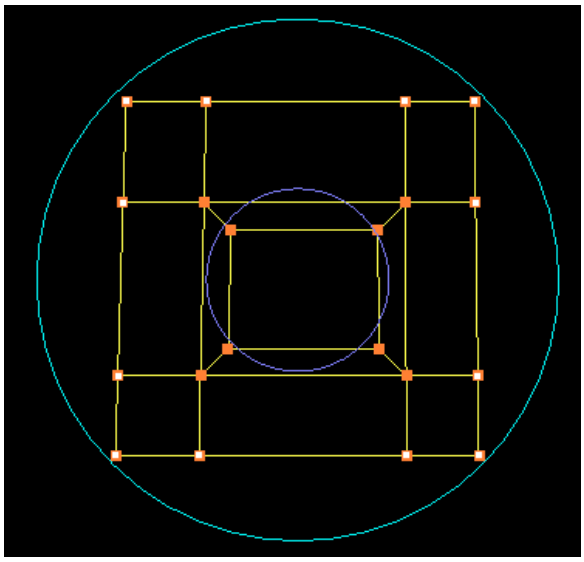


Fig: Topology with Very severe singularity

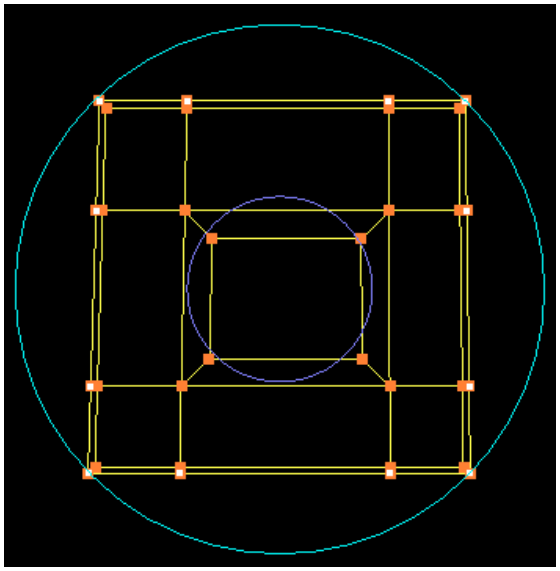


Fig: After using autofix

3. auto_trim_surface_group

Usage: ***"auto_trim_surface_group [Options]"***

Options	Expansion	Description	Default value
-fn	Input topology file	The input topology file with extension '.fra'	-
-ofn	Output topology file	The output topology file with extension '.fra'	-
-s	Surface IDs	List of surface ID's	None
-sg	Surface Group	A surface group containing the surfaces to be used	None
-ni	Number of inserts	Number of inserts to be added uniformly, to create the initial cartesian topology	None
-ui	Uniform Inserts	To add inserts uniformly	-
-gc	Generate Cartesian	Generate a cartesian topology initially	-
-p	Project	Project trimmed corners onto surface	-

Syntax:

"gp_utilities auto_trim_surface_group -s <sid1> -sg <Surfaecegroup_id> -ni<NumInserts> -ui<UniformInserts> -gc<GenerateCartesian>.

Purpose:

To trim the topology with respect to a surface or surface group.

Example: *gp_utilities auto_trim_surface_group -fn step1.fra -ofn output.fra -s 3*

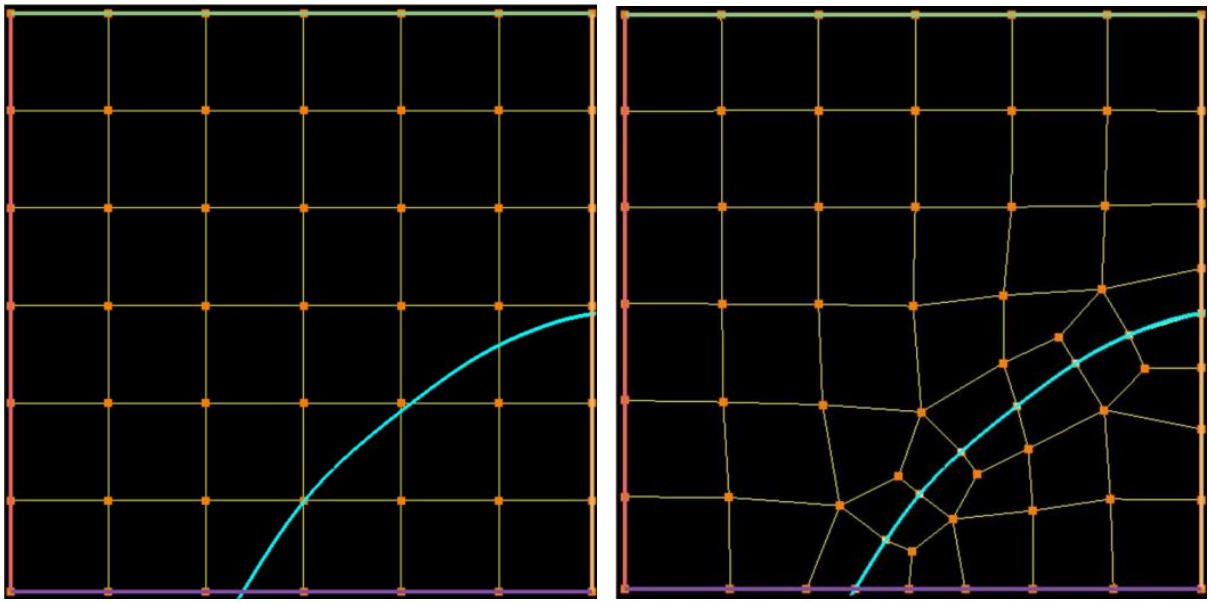


Fig. Before and after trimming the surface

4. binaryToAscii

Usage: *"binaryToAscii"*

Syntax:

"gp_utilities binaryToAscii <Input Grid File Name> <Output Grid File Name>"

Purpose:

Converts a binary format grid to ascii format.

Example:

COMMAND USED: *gp_utilities binaryToAscii binary.grd ascii.grd*

Note:

1. This command works only for Grid*Pro* grid format.
2. The respective '*.conn' file is needed to execute this command.

5. block_labels_to_3d_properties

Usage: ***"block_labels_to_3d_properties [Options]"***

Options	Expansion	Description	Default value
-ifn	File Name	Input grid file with block labels.	-
-ln	Label Name	The label name to be converted to property. It should be followed by "-p" option.	None
-p	Property id	The property index range: [1, 64]. Note: 1 => interblk, 2 => wall...	None
-outfn	Output File Name	Output grid file name.	-

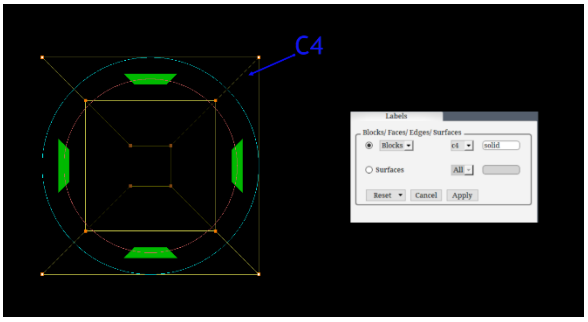
Syntax:

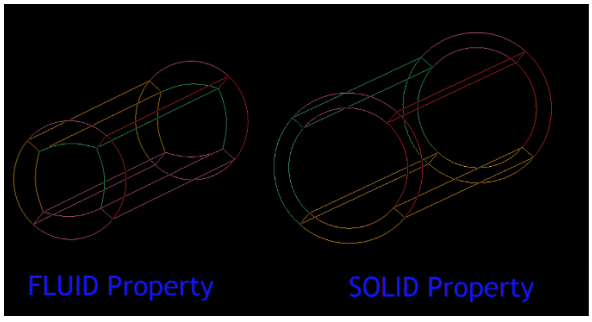
"gp_utilities block_labels_to_3d_properties -ifn <input grid file name> -ln <label name> -p <property id> -ln <label2> -p <property id2> ... -outfn <output grid file name>"

Purpose:

To convert block labels to 3D properties (block properties).

Example: *gp_utilities block_labels_to_3d_properties -ifn blk.tmp -ln geometry -p 2 -ln plane1 -p 3 -outfn gridwitpty.grd*





6. cap_tube

Usage: ***"cap_tube [Options]"***

Options	Expansion	Description	Default value
-ifn	Input File Name	The name of the input tube file with an extension '*.tube'.	-
-ofn	Output File Name	The name of the output tube file with an extension '*.tube'.	-

Syntax:

"gp_utilities cap_tube –ifn <input file> -ofn <output file>"

Purpose:

Close the tube on both sides.

Example:

COMMAND USED: *gp_utilities* cap_tube –ifn open.tube –ofn closed.tube

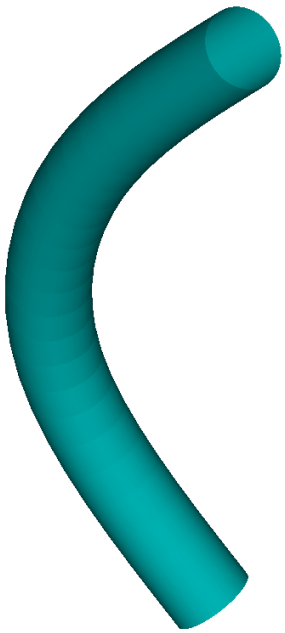


Fig: Open tube

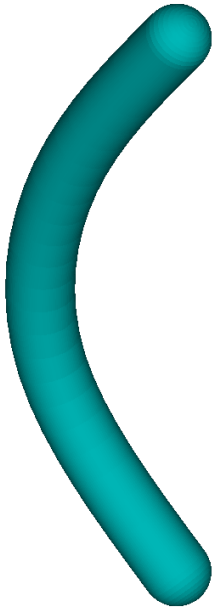


Fig: Closed tube

Note:

1. It is the utility that can be used to close both the open ends of the tube. It works only on surfaces that are created using 'make tube' command.
2. Closing only one end of the tube is not possible.

7. cart_prod

Usage: *"cart_prod [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'	-

-mg	Master Group Id	The group id consists of the corners to which the topology has to be duplicated.	None
-sg	Slave Group Id	The group id consists of the topology which is to be duplicated.	None
-ofn	Output File Name	Output file name with extension '*.fra'	-

Syntax:

"gp_utilities cart_prod –fn <input file name> -mg <master group id> -sg <slave group id> -ofn <output file name>"

Purpose:

Duplicate a topology to a given location.

Note:

The utility is used to duplicate the topology at desired locations, the duplicated topologies will be individual instances which need to be merged or linked by the user. The process is executed using two different groups 1. Master Group, 2. Slave Group. The master group contains the topology corners which define the locations where it has to be duplicated and the slave group contains the topology to be duplicated.

IMPORTANT:

1. Once the slave corners are duplicated to the master corner's position, the master corners should be deleted manually by the user.
2. The topology will be duplicated, such that the center of the slave corner group merges with the master corners

Example:

COMMAND USED: *gp_utilities* cart_prod –fn cartesian.fra –mg 2 –sg 1 –ofn cartesian_out.fra

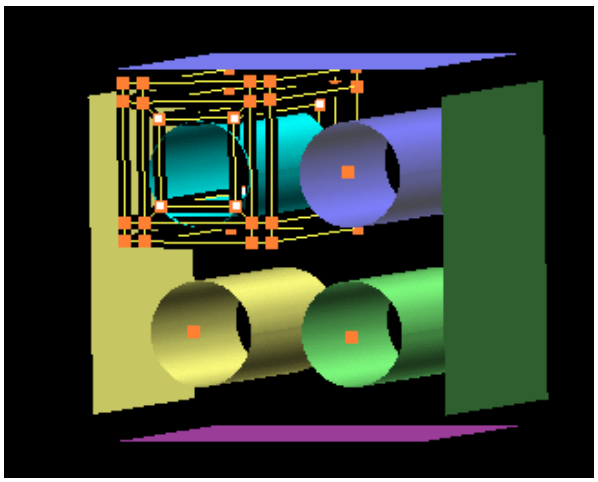


Fig: Showing the topology and corners to which the topology should be duplicated.

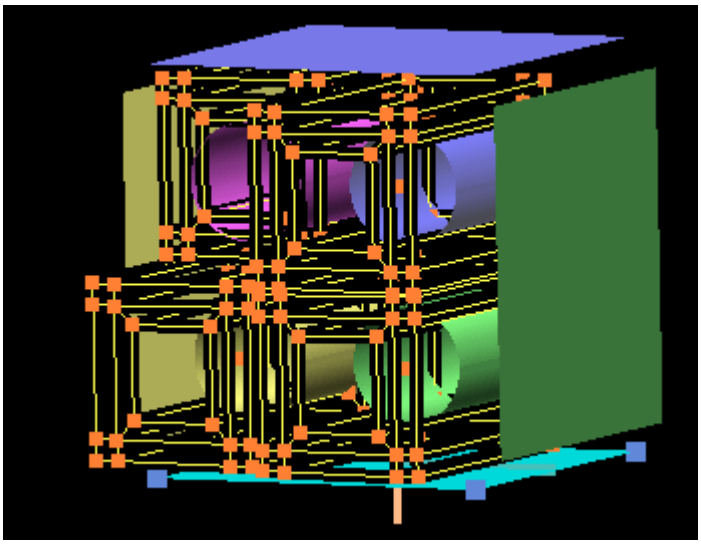
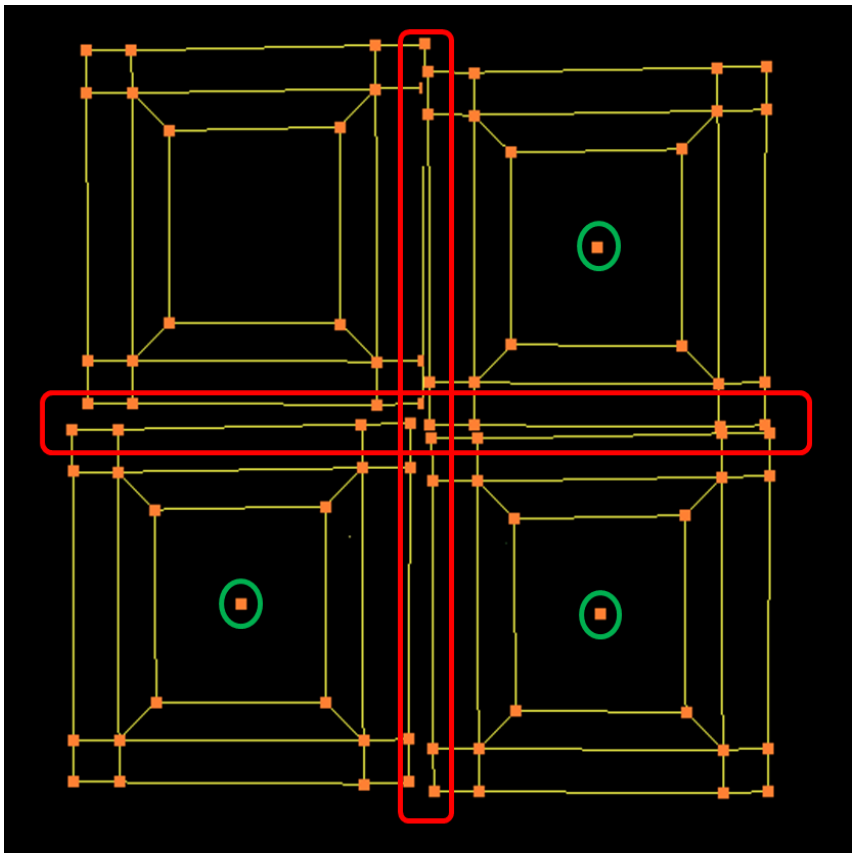


Fig: Showing the topology after the duplication.



- It created a separate topology; the necessary merging should be done by the user.

- The corners which are marked in green are called master corners to which the slave corners are duplicated. These corners should also be deleted manually by the user.

Fig: Front view of the topology after the duplication.

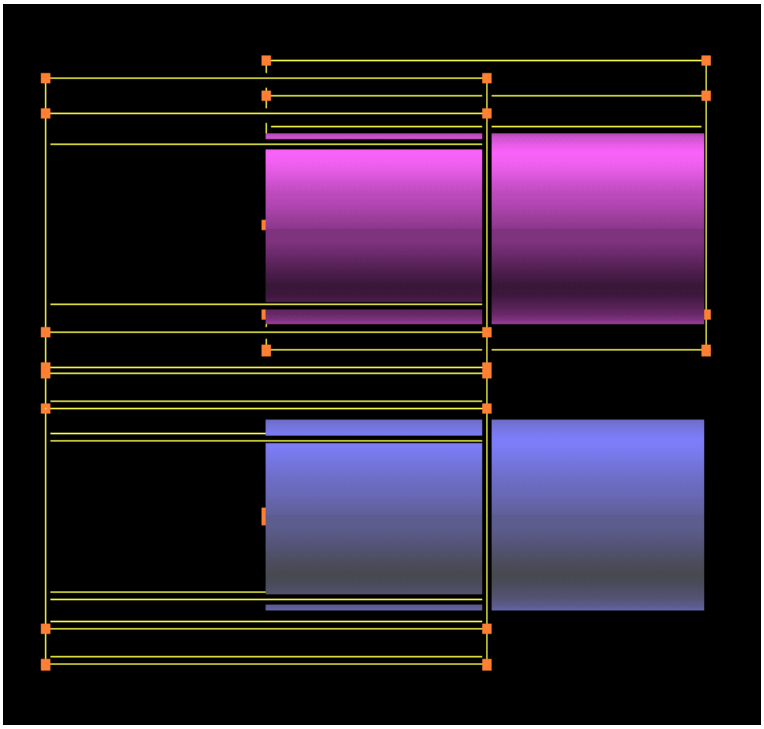


Fig: Side view of the topology after the duplication.

- Here the master corners are placed at the front side of the cylinders.

- The topology is duplicated, such that the center of the slave corner group merges with the master corners.

- So the master corners should be placed approximately at the center of the cylinders in order to get the topology at the right location.

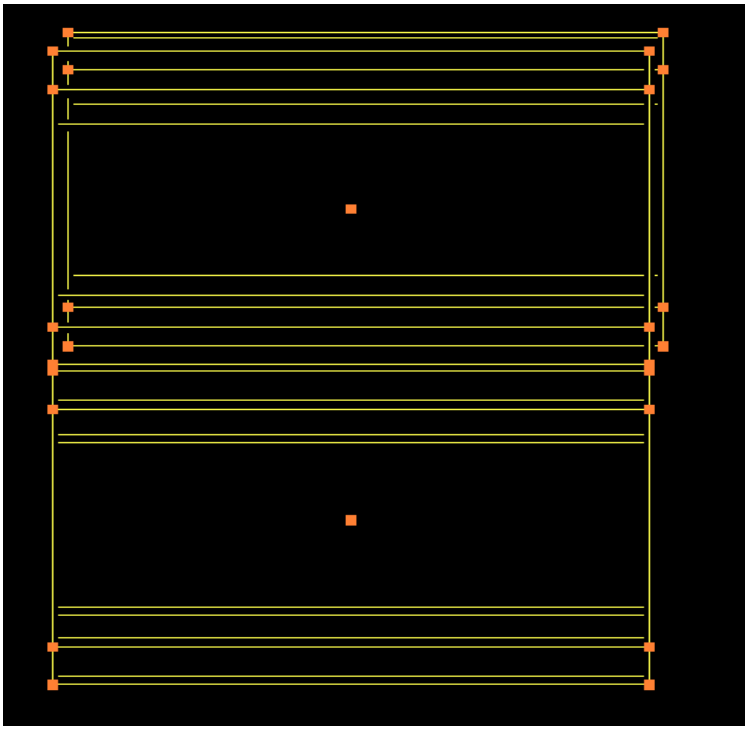


Fig: Side view of the topology after the duplication with master corners placed at the center of cylinder.

- The master corners are placed at the center of cylinders.

- So the duplicated topology is approximately at the right location.

8. change_format

Usage: *"change_format [Options]"*

Options	Expansion	Description	Default value
-ifn	File Name	Name of the input file with its extension	-
-outfn	Output File Name	Name of the output file with its extension	-
-ogf	Old Grid Format	Converts the new GridPro pty file to Old pty file format	FALSE
-csp	Create Surface Property	Creates pty file using the surface labels from the *.conn file	FALSE
-hoe	Higher order element	Converts the given grid to CGNS higher order element	-
-iif	Ignore interior faces	Applies only for openfoam conversion. Ignores "interior" faces while exporting	FALSE

Syntax:

"gp_utilities change_format -ifn <input file name> -outfn <output file name>"

Purpose:

Change one file format to another format. The following formats are supported by this command. For more conversion formats, please refer chFmt command.

INPUT FORMAT	OUTPUT FORMAT	SYNTAX
Grid*Pro* multi block grid	PLOT3d	change_format -ifn <Grid*Pro* grid format> -outfn <*.plot3d>
	CFL3d	change_format -ifn <Grid*Pro* grid format> -outfn <*.cfl3d>
	NSU3d	change_format -ifn <Grid*Pro* grid format> -outfn <*.nsu3d>
	OpenFOAM	change_format -ifn <Grid*Pro* grid format> -outfn <*.foam> -dn <directory name> -iif
	CGNS	change_format -ifn <Grid*Pro* grid format> -outfn <*.cgns> -hoe <higher order no.>
	FLUENT	change_format -ifn <Grid*Pro* grid format> -outfn <*.msh>
	CFD++	change_format -ifn <Grid*Pro* grid format> -outfn <*.cfdpp>
	Leslie	change_format -ifn <Grid*Pro* grid format> -outfn <*.leslie>
	Kiva	change_format -ifn <Grid*Pro* grid format> -outfn <*.kiva>
IGES, STEP	IGES, STEP, STL, Tria, lin	change_format -ifn <*.iges/step> -outfn <*.respective extension>
Quad	Tria, STL, lin	change_format -ifn <*.quad> -outfn <*.respective extension>

Tria	STL	change_format -ifn <*.tria> -outfn <*.stl>
Tube	Tria, Quad, STL, lin	change_format -ifn <*.tube> -outfn <*.respective extension>
STL Binary	STL Ascii	change_format -ifn <*.stl> -outfn <*.stl>

Example: To convert a Grid*Pro* grid to Open Foam

gp_utilities change_format -ifn blk.tmp -outfn grid.foam -dn polyMesh -iif

Note:

1. Extension should be used for both input & output file to determine the format.
2. While using -csp and -ogf, the extension for the output file name must be *.grd.
3. 2D IGES file can be converted to *.lin (linear file) in order to work in GridPro 2D as curves.
4. CGNS higher order elements conversion (-hoe) takes 1, 2, 3, or 4 as input values; where 1 is linear, 2 is quadratic, 3 is cubic and 4 is quartic.

9. chden

Usage: *"chden [Options]"*

Options	Expansion	Description	Default value
-r	Ratio	Ratio to which the density of the grid should be increased.	None
-o	Output Grid File Name	Output file name with extension '*.grd'.	-

Syntax:

"gp_utilities chden <input grid file name> -r <ratio> -o <output grid file name>"

Purpose:

Change the density of the grid without running the gridding process again.

Example:

COMMAND USED: *gp_utilities* chden blk.tmp -r 2 -o transform_out.grd

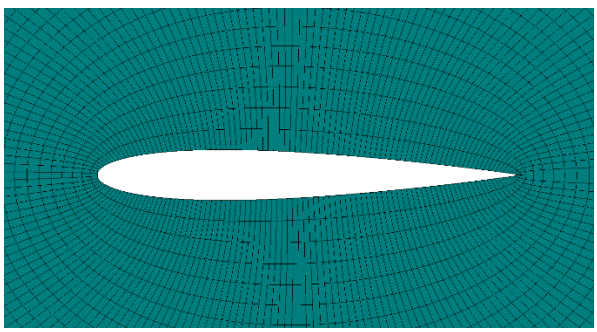


Fig: Before Transform

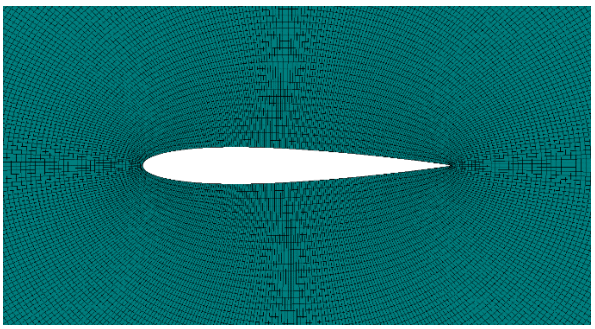


Fig: After Transform

Note:

1. The tool can be used only on Grid*Pro* generated grids.

10. convert_to_periodic

Usage: *"convert_to_periodic [Options]"*

Options	Expansion	Description	Default value
-ifn	Input File Name	Input grid file name with extension '*.tmp' or '*.grd'.	-
-s1	Surface id 1	Index of the first surface at the boundary	-
-s2	Surface id 2	Index of the second surface at the boundary	-
-outfn	Output File Name	Output grid file name with extension '*.tmp' or '*.grd'.	-

Syntax:

"gp_utilities convert_to_periodic -ifn <input grid file name> -s1 <surf id 1> -s2 <surf id 2> -outfn <output grid file name>"

Purpose:

Converts the given grid to periodic. Rewrite the conn and pty file such that the grid is a periodic grid with the given grid sheet ids as periodic boundaries.

Example:

COMMAND USED: *gp_utilities convert_to_periodic -ifn blk.tmp -outfn periodic.grd -s1 6 -s2 9*

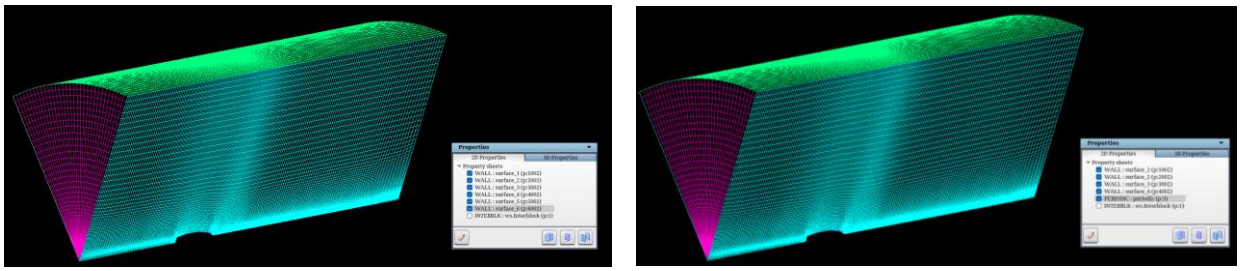


Fig: Grid with show/hide section before and after converting it to periodic

Note:

1) The density and block pattern should match for the given surface grid sheet ids.

2) Surface grid sheet id start from 1.

11. curve_redistribution

Usage: *"curve_redistribution [Options]"*

Options	Expansion	Description	Default value
-ifn	Input File Name	Input linear curve file with extension '.lin'.	-
-outfn	Output File Name	Output linear curve file with extension '.lin'	-
-a	Alpha	Numeric constant used for clustering nodes. Range is 0 to 10000.	100
-n	Number of nodes	Number of nodes on the output curve.	Same as input

Syntax:

ws curve_redistribution -ifn <input lin> -outfn <output lin> -a <alpha> -n <num nodes

Purpose:

Redistribute nodes on a curve.

Example:

COMMAND USED: *ws curve_redistribution -ifn curve.linear -outfn curve_out.linear -n 1000*

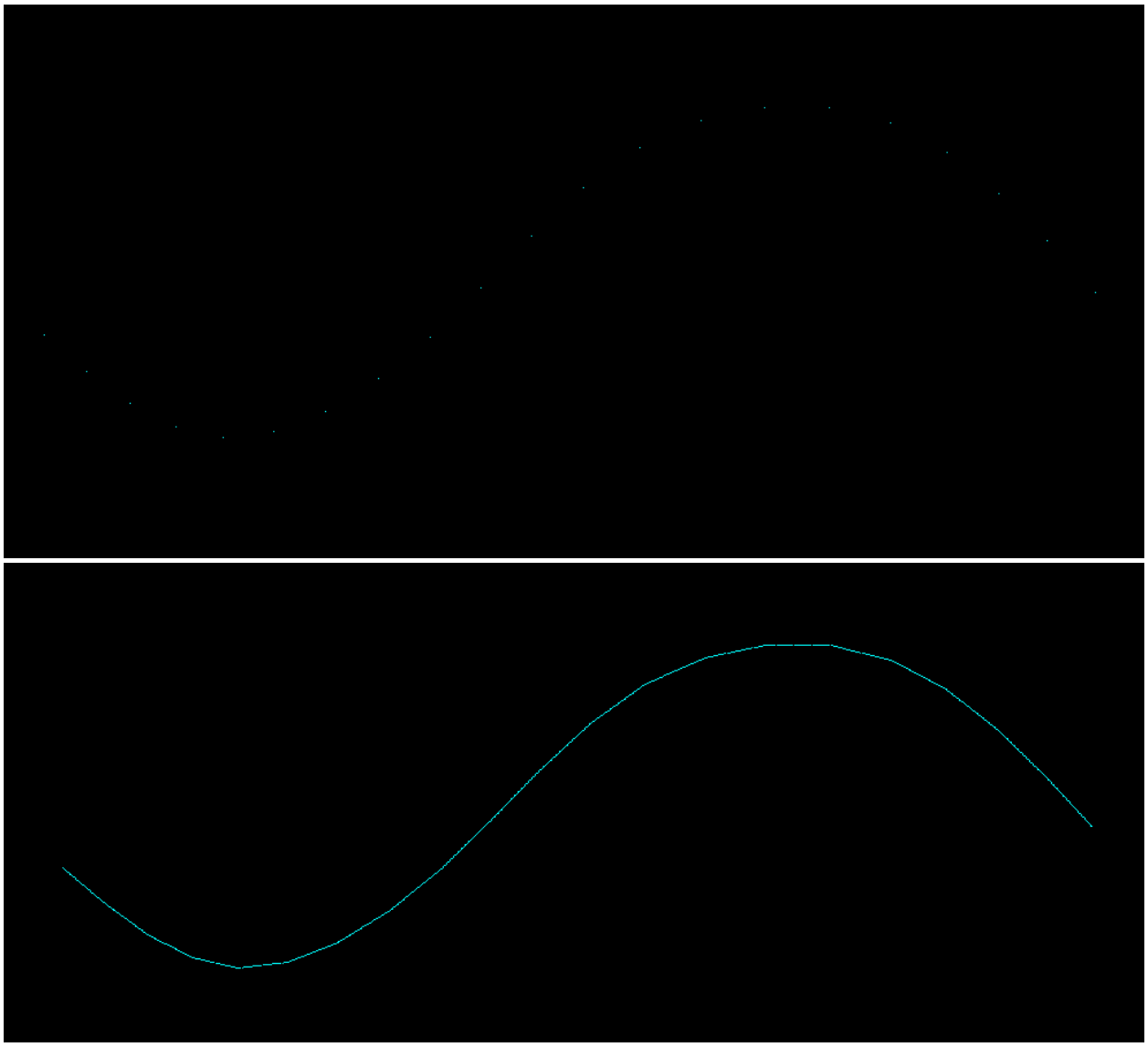


Fig: Before and after redistributing the nodes on a curve.

12. density_balance

Usage: ***"density_balance [Options]"***

Options	Expansion	Description	Default value
-fn	Input File Name	Input topology file name with the extension .fra	-
-ofn	Output File Name	Output topology file name with the extension .fra..	-
-c	Corners	The corners of the edge which is used as a base.	None

-d	Density	The density to be set to the input edge.	8
-md	Max Density	The limit on the maximum density.	128
-g	Corner group	Only the edge groups with atleast one edge in this group are considered.	All
-fg	Frozen Corner Group	The edges (and the edge groups) in this corner group are untouched.	None
-l	Length type	Length type is used for finding relative size of the edge groups. 0 – Minimum 1 – Maximum 2 – Average edge length in a given edge group	2

Syntax:

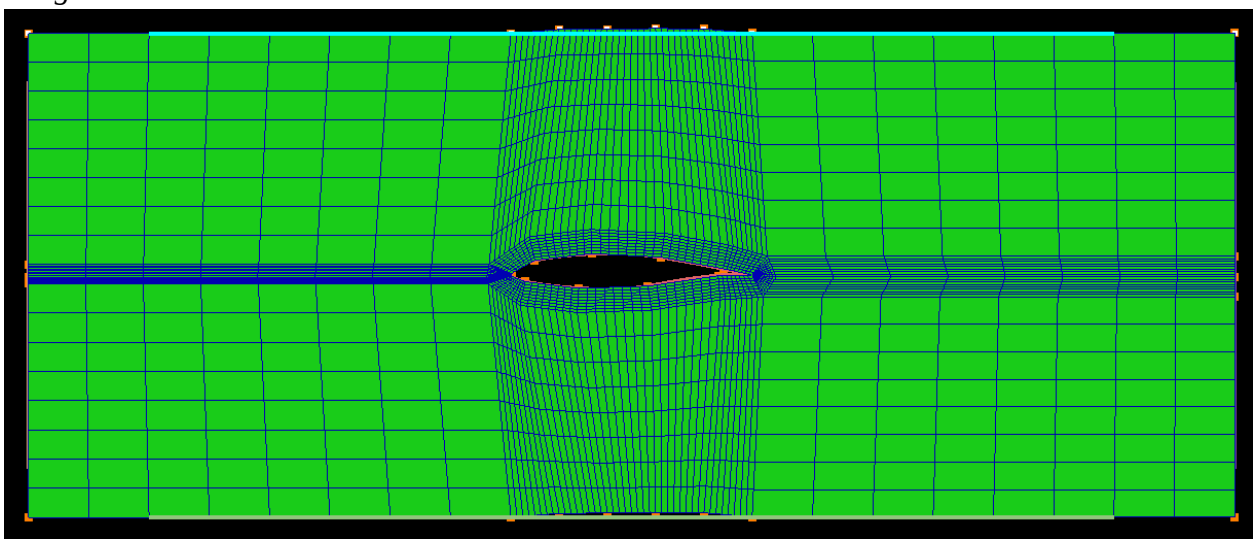
"gp_ density_balance -fn <input file name> -ofn <output file name> -c <corner_id1 corner_id2> -d <density of input edge> -md <maximum density limit> -g <corner group id> -l <length type>

Purpose:

To balance the densities so that the cell lengths are uniform all over the input group/region, based on the density of a reference edge.

Example:

COMMAND USED: *gp_utilities density_balance -fn input.fra -ofn output.fra -c 40 28 -d 24 -md 64 -g 0 -l 2*



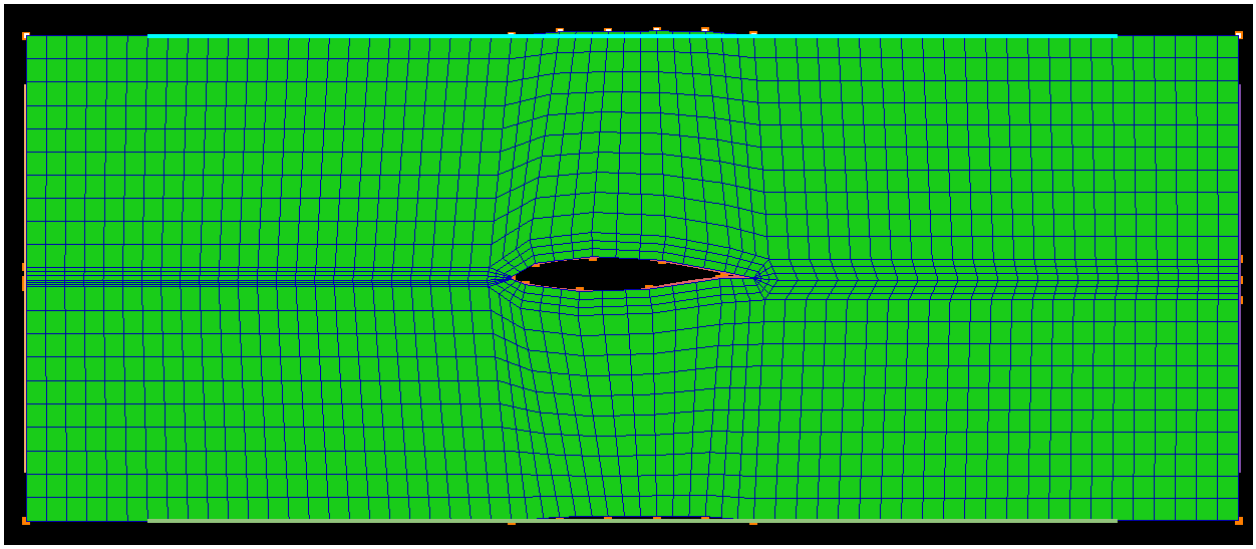


Fig: Before and after using density balancing on the topology

13. disjoint_grid

Usage: *"disjoint_grid [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-ns	Num sweeps	Number of sweeps.	1000
-ogn	Output Grid File Name	Output grid file name with extension '*.tmp'. Connectivity file is auto generated.	-

Syntax:

"gp_utilities disjoint_grid -fn <input file name> -ns <num of sweeps> -ogn <output grid file name>"

Purpose:

Run two distinct valid topologies as a single file and output as a single grid.

Example:

COMMAND USED: *gp_utilities disjoint_grid -fn disjoint.fra -ns 2000 -ogn blk.tmp*

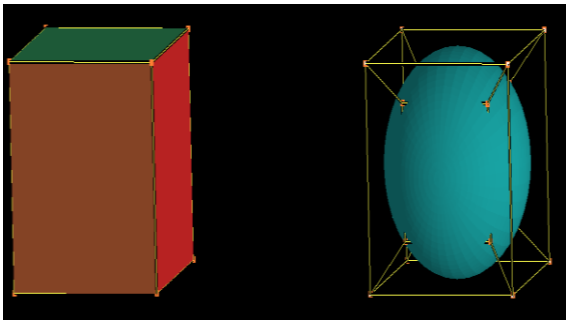


Fig: Two disjoint valid topology in the same window

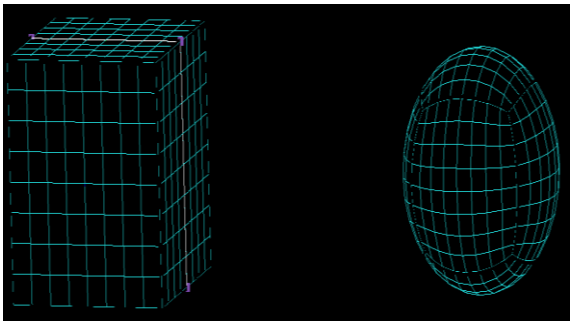


Fig: Two disjoint grid in the same window

Note:

3) The individual topologies should be valid topologies. The two files have to be loaded into az and saved as a single file. The resultant disjoint file should be run with this tool in order to obtain a single grid file.

4) The ‘number of sweeps’ option should be a multiple of 1000.

14. enrich

Usage: *"enrich [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'	-
-or	Offset Ratio	Offset Ratio	0.01
-fg	Feature Group	Feature corners of the surfaces	None
-ofn	Output File Name	Output file name with extension '*.fra'	-

Syntax:

"gp_utilities enrich -fn <input file name> -or <offset_ratio> -fg <feature group> -ofn <output file name>"

Purpose:

Refine the grid in a particular area by modifying the topology.

Example:

COMMAND USED: *gp_utilities enrich -fn car.fra -or 0.01 -ofn car_out.fra*

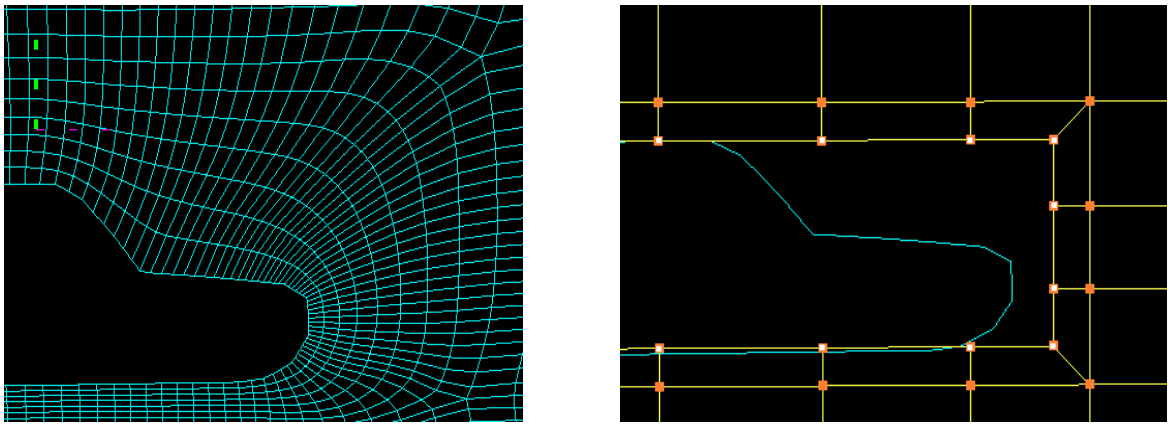


Fig: Topology and grid before compact enrichment

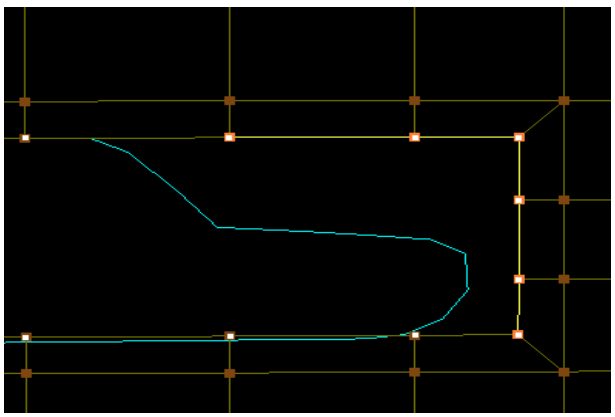


Fig: Corner group used for compact enrichment

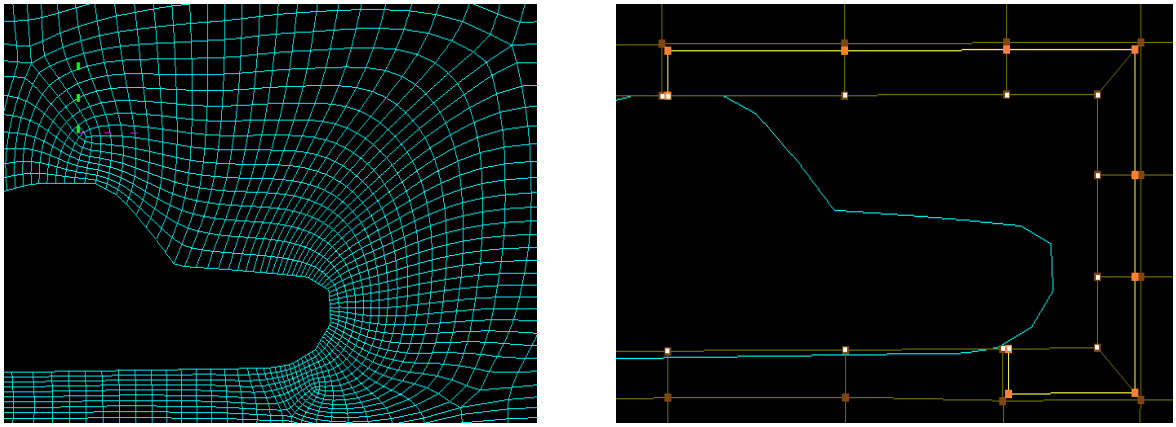


Fig: Topology and grid after compact enrichment

Note:

1) This tool is a powerful tool due to its flexibility; it can create compact enrichment by doing internal wraps on the topology sheets provided.

15. extconn_topology

Usage: ***"extconn_topology [Options]"***

Options	Expansion	Description	Default value
-fn	File Name	Input file name with the extension '*.fra'	-
-g	Group ID	Corner group to be copied	-
-sg	Surface Group	Surface group to be copied	-
-csg	Common Surface Group	Surface group to be ignored from copying	-
-dim	Dimension	Dimension. i.e In which direction it has to be copied. Where, 1 - Linear. X, Y or Z 2 - X*Y or Y*Z or Z*X 3 - X*Y*Z	2
-dirn	Direction	Directional axis. Depends on the dimension input. For e.g X and -Y is represented as 1 0 0 0 -1 0	1 0 0 0 -1 0
-nc	Num copies	Number of times to be copied. Input required for each direction.	3 3
-t	Type	Type. Where, 0 - Cartesian topology. 1 - Polar topology(Not yet implemented)	0
-i	Inheritance	Specifies the corner assignment inheritance. 0 – Smart inheritance 1 – Inherit all 2 – Do not inherit	0

-m	Merge	If enabled, Merges the copies at the interface. Suitable topology face pairs should be provided.	Disable
-l	Link	If enabled, Link the copies at the interface. Suitable topology face pairs should be provided.	Disabled
-pairs	Pairs	Pairs that should be merged or linked. For E.g. If corner group 2 of newly copied face group should be merged to corner group 3 current topology, then the input is 2 3. Similarly if the dimension is 2, then you need to provide another set of pairs to link top and bottom faces of newly created copies.	2 3 4 5
-offset	Offset distance	Distance between each copy. It should be calculated from the centre of the input geometry.	-
-ofn	Output File Name	Output file name with the extension '*.fra'	-

Syntax:

"gp_utilities extconn_topology -fn <fra file> -g <corner group> -sg <surface group>-csg <surface group> -dim <dimension> -dirn <direction>-nc <num of copies in x and y direction> -t <type> -i<inheritance flag> -m -offset <offset distance>-ofn <output fra file> -pairs <pair of corner groups>"

Purpose:

This tool is helpful in copying the topology in multiple directions if the geometry has similar pattern across any/all directions.

Example:

COMMAND USED: gp_utilities extconn_topology -fn step1.fra -g 1 -sg 1 -i 0 -dim 2 -dirn 1 0 0 0 -1 0 -nc 4 4 -t 0 0 -m -pairs 3 2 4 5 -offset 4 4 -ofn step2.fra

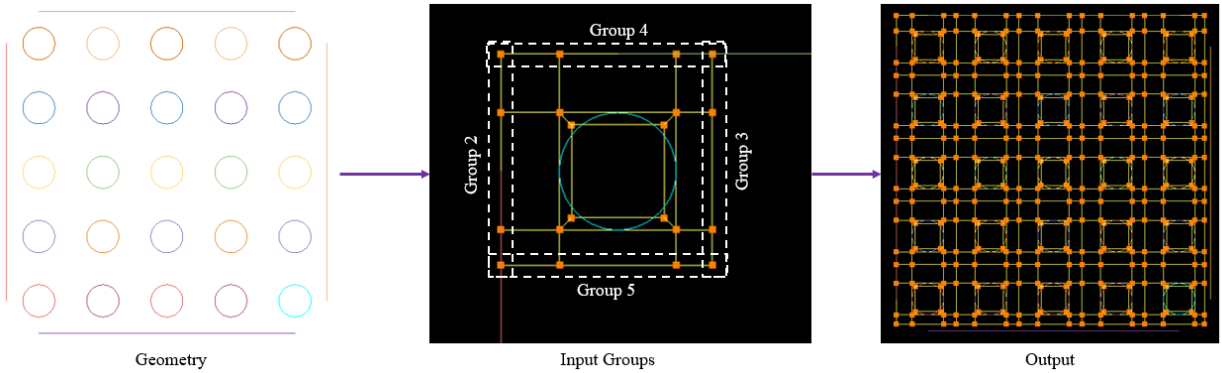


Fig: Topology and surface copied in both X and Y directions

16. extend_surface

Usage: ***"extend_surface [Options]"***

Options	Expansion	Description	Default value
-fn	File Name	Input file name with the extension '*.fra'	-
-e	Extrude Surface	Id of the surface to be extruded	-
-p	Project Onto Surface	Id of the surface onto which the given surface should be projected	-
-r	Ratio	The ratio used to extend the surface beyond the intersection	1.1
-sr	Step Ratio	A ratio used for extrusion length at each step. If step ratio is 0, min edge length at the front is used. If sr is 1, max edge length is used.	0.5
-mr	Magnification Ratio	Ratio used to make internal surfaces bulge out	1
-os	Other Surfaces	The extrusion normal at the front is evaluated using these surfaces. If this is empty, the surface is extruded tangentially	-
-is	Inverted Surface	Surfaces whose normals should be inverted	-
-f	Save Full Surface	Save the full surface	Only the extruded part is saved
-ofn	Output File Name	Output file name with the extension '*.fra'	-

Syntax:

"gp_utilities extend_surface -fn <input file name> -e <surface_id> -p <surface id>-r <ratio> -sr <step ratio> -mr <magnification ratio>-os <surface ids> -is <inverted surf id> -f -ofn <output file name>"

Purpose:

This tool is helpful in extending a surface to create a ribbon like internal surface. Given surface (e) is extended so that it intersects another surface (p).

Example:

COMMAND USED: *gp_utilities extend_surface -fn <input fra> -e 0 -p 1 -r 1.2 -sr 0.3 -mr 0.4 -os 2 3 -is 3 -f -outfn extruded.tria*

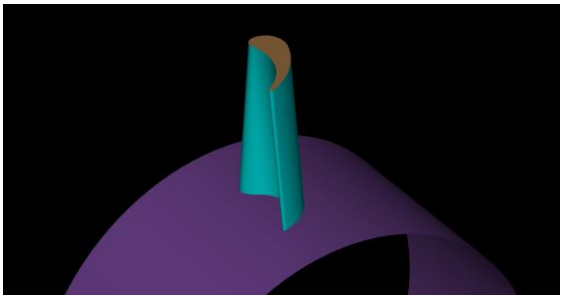


Fig: Blade surface with tip

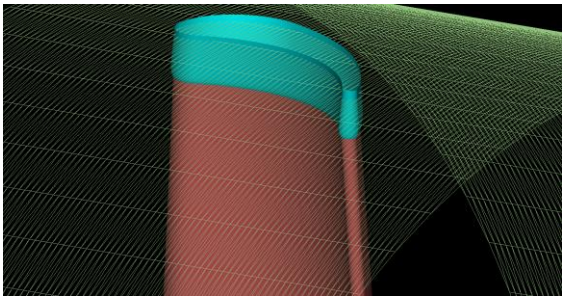


Fig: With extend surface shown in sea blue

17. first_cell_spacing

Usage: *"first_cell_spacing [Options]"*

Options	Expansion	Description	Default value
-ifn	File Name	Input grid file name.	-
-s	Surface Id	List of surface ids.	None

Syntax:

"gp_utilities first_cell_spacing -ifn <input grid file name> -s <surface_id 1><surface_id 2>…."

Purpose:

Reports min, max and avg first cell spacing of the grid for the given surface ids.

Example:

COMMAND USED: *gp_utilities first_cell_spacing -ifn blk.tmp.tmp -s 4 5*

```
first_cell_spacing -ifn .\blk.tmp.tmp -s 4 5
        +-----------------first_cell_spacing ------------------+
        |          !!! For Authorized Use Only !!!
        |
        | (c)Copyright 1993-2019,    Program Development Comp.
        |      ----    Licensed Materials, All Rights Reserved.
        | 300 Hamilton Ave.,Suite 409, White Plains, NY 10601
        | Tel: (914) 761-9152              Fax: (914) 761-1735
        +-----------------------------------------------------+

reading Block : 2000 (13 13 9)
min spacing at surface 4 : 0.000100000000
max spacing at surface 4 : 0.000101580335
avg spacing at surface 4 : 0.000100219639
min spacing at surface 5 : 0.000099692185
max spacing at surface 5 : 0.000104047438
avg spacing at surface 5 : 0.000100060431
```

Fig: First Cell Spacing

18. feature_edge

Usage: *"feature_edge [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with the extension '*.fra'.	-
-s	Surface Id	List of surface ids.	None
-ta	Threshold Angle	The threshold angle for feature edges.	30
-ib	Include Boundary	On the boundary of the surface, it links the corners and forms an edge.	FALSE
-ofn	Output File Name	Output file name with the extension '*.fra'.	-

Syntax:

"gp_utilities feature_edge –fn <input file name> -s <surface_id> -ta <angle> -ib -ofn <output file name>"

Purpose:

Create corners on the surface based on the feature angle.

Example:

COMMAND USED: *gp_utilities feature_edge –fn wing.fra –s 1 –ta 40 –ib –ofn wing.feature_out.fra*

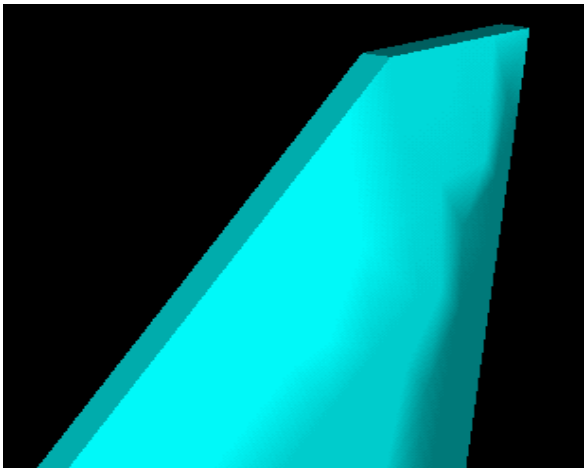


Fig: A wing surface with sharp edges

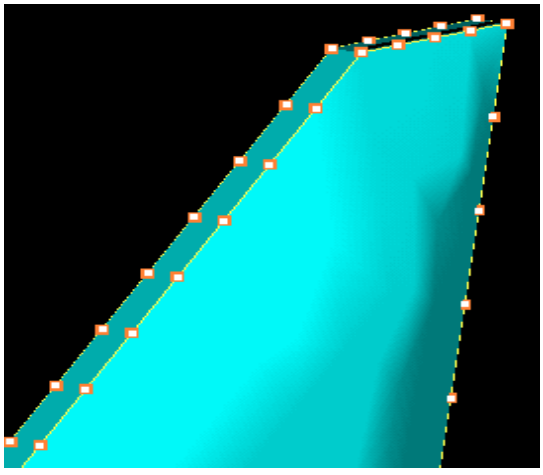


Fig: Corners created on the wing's sharp edges

Note:

1. It calculates the feature angle of each node on the surface and creates corners at the nodes wherever it exceeds the given feature angle.

19. gen_curve

Usage: *"gen_curve [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with the extension '*.fra'.	-
-rg	Reference Group Id	The reference corner group id.	None
-g	Group Id	The corner group from which the curve has to be generated.	None
-p	Prefix	Prefix to the newly created curves. i.e. Surface label	__new_surf_
-ui	Use Interpolation	Use interpolating scheme. This makes the curve to pass through all the corners.	Approximating scheme
-nr	Num Refinements	The number of refinements.	4
-rt	Remove topology	The topology used for generating the curves will be removed after the curve creation.	False

Syntax:

"gp_utilities gen_curve –fn <input file name> -rg <reference group id> -g <gid> -p <prefix> -ui –nr <num of refinements> -rt"

Purpose:

Create linear curves from the given topology.

Example:

COMMAND USED: *gp_utilities gen_curve –fn curve.fra –g 1 –p curve –nr 3 –rt*

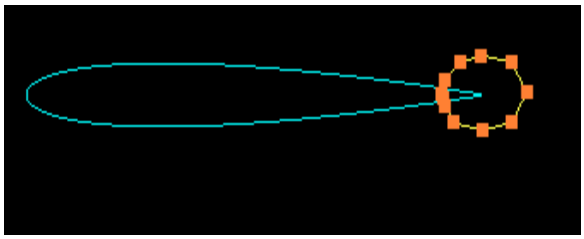


Fig: Corner group used for generating linear curve

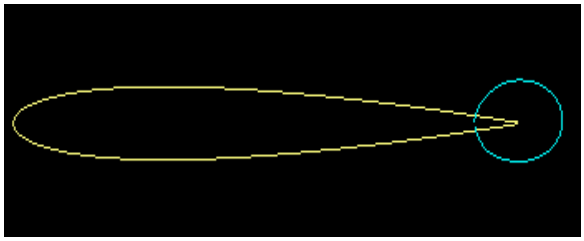


Fig: Curve generated from the corner group

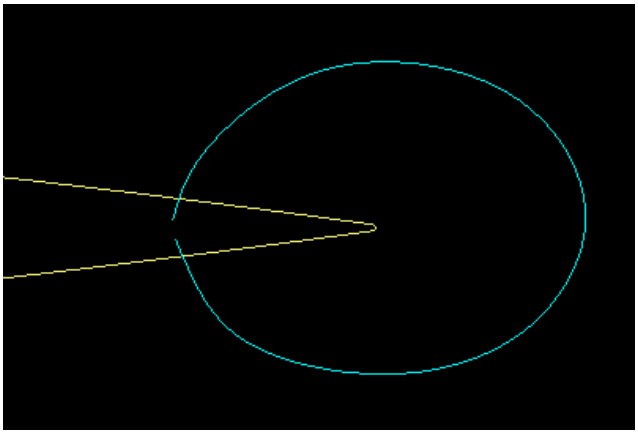


Fig: Curve generated from the corner group

Note:

This tool is used to create surfaces based on the input topology corners and edges.

20. has_mismatched_interface

Usage: *"has_mismatched_interface [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with the extension '*.fra'.	-
-ifn	Input File Name	Input grid file name with extension '*.tmp' or '*.grd'.	-
-a	Angle	Periodicity of the given grid.	-
-ax	Axis	The coordinates of the center followed by axis direction.	0 0 0 0 0 1

Syntax:

"gp_utilities has_mismatched_interface –fn <input file name> -ifn <input grid file name> -a <periodicity> -ax <center and normal>"

Purpose:

Evaluates if the given periodic grid has mismatched interface. i.e. if one side of periodic faces are in sync with the other.

Example:

COMMAND USED*: gp_utilities has_mismatched_interface –fn step1.valid.fra –ifn blk.tmp -a 45 -ax 0 0 0 1 0 0*

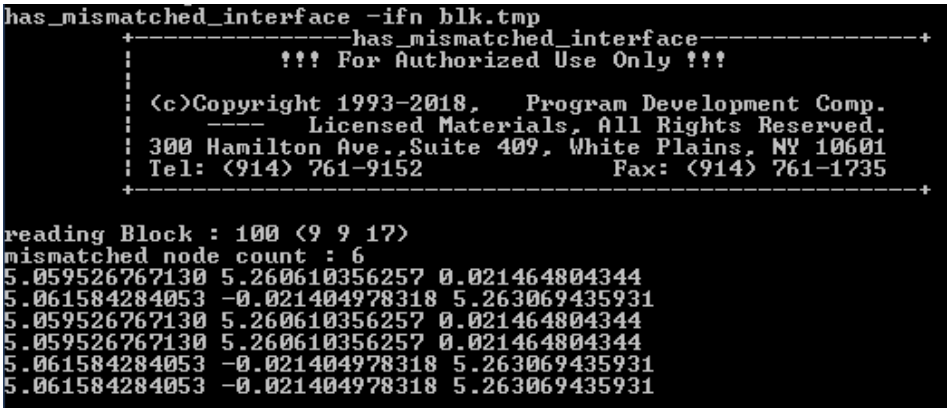


Fig: Mismatch node count

21. hex2emb

Usage: ***"hex2emb [Options]"***

Options	Expansion	Description	Default value
-ifn	Input File Name	Input grid file name	-
-p2d	Property 2D	Do not merge blocks with faces having the property name specified with another block with a different property. Note: Use '-p2d 0' to respect all 2D properties.	-
-p3d	Property 3D	Do not merge blocks with faces having the property name specified with another block with a different property. Note: Use '-p3d 0' to respect all 3D properties.	-
-s	Surface Id	Do not merge blocks with faces assigned to the specified surface to another block whose face has been assigned to a different surface. Note: This is different from '-is' option. This ensures that surface assignments are not lost on the boundary.	-
-is	Internal Surface Id	Do not merge blocks which are separated by internal surface. Note: Use '-is 0' to respect all internal surfaces.	-
-sl	Surface Labels	Do not merge blocks which have different surface labels. Note: This is similar to –s, but labels are used instead of surface ids. Use '-sl 0' to respect all surface labels.	-
-bl	Block Labels	Do not merge blocks which have different labels.	-
-djsp	Don't Jump Sheet Pty	This option ensures that all the 2D properties are retained. This is similar to '-s 0' option but the 2D properties are considered here.	-
-djsl	Don't Jump Surface Labels	This option ensures that all the surface labels are retained. This is similar to '-s 0' option but the surface labels are considered here.	-
-mg	Multi-Block Grid	Assume that the input file is a Multi-Block Grid.	-

-ug	Unstructured Grid	Assume that the input file is an Unstructured Hex Grid.	-
-outfn	Output File Name	Output file name with extension '*.grd'.	-

Syntax:

"gp_utilities hex2emb –ifn <Input Grid file name> -p2d <Property name> -p3d <Property name> -s <Surface ids> -is <Internal surface ids> -sl <Surf Labels> -bl <Block Labels> -djsp –djsl –mg –ug –outfn <Output file name>"

Purpose:

Convert a hex grid or multi block grid into a multi block grid composed of minimum number of elementary blocks.

Example:

COMMAND USED: *gp_utilities hex2emb –ifn blk.tmp –djsp –mg –outfn output.grd*

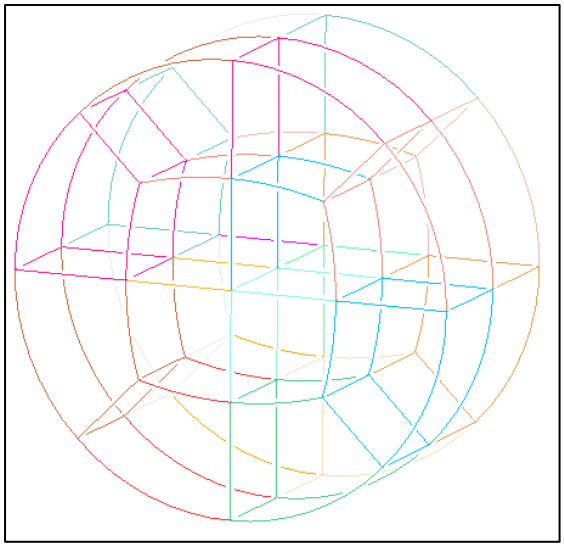


Fig: Multiblock grid contains 24 blocks

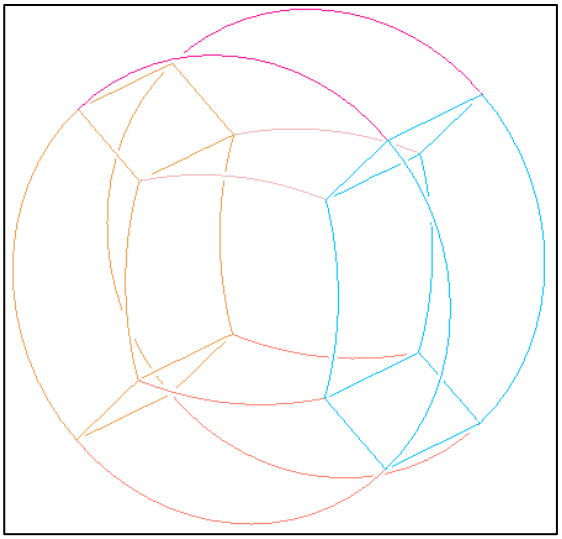


Fig: Multiblock grid reduced to 5 blocks

Note:

1. The user has to explicitly specify whether the input grid is a multi-block hex or an unstructured hex using the options "-ug" or "-mg".

22. hole_topology

Usage: *"hole_topology [Options]"*

Options	Expansion	Description	Default value
General Options			
-fn	File Name	Input topology file name	-
-sg	Surface Group	A surface group containing all the hole (typically cylindrical in shape) surfaces	-
-ts	Top Surface	Id of the surface bounding the holes at one end. Use –tsg option to use multiple top surfaces	-
-bs	Bottom Surface	Id of the surface bounding the holes at the other end. Use '-bsg' option to use multiple bottom surfaces	-
-tsg	Top Surface Group	A surface group containing all the top surfaces	-
-bsg	Bottom Surface Group	A surface group containing all the bottom surfaces	-
-ofn	Output File Name	Output topology file name	-
Linking Options			
-wl	With Links	The outermost corners of each hole, are linked with the adjacent holes using the pattern provided (or evaluated). By default, the hole topologies are not interlinked.	-
-og	Outer Group	The outermost corners are added to this corner group. It is useful to link them manually.	-
Pattern Evaluation Options			
-ep	Evaluate Pattern	Use this option to evaluate the pattern, using '-p' and '-nah' options. Note that the pattern can be evaluated beforehand and it need not be clubbed with the hole generation process. Many times, there is a need to modify the pattern manually.	-
-p	Pattern Type	Flag to specify pattern type. 0 => Holes arranged in a row. 1 => Arranged in a pattern (like honeycomb, See –nah option). 4 => Generic pattern (Triangulation is used here).	-
-nah	Num Adjacent Holes	When PatternType is 1, the number of adjacent holes should be specified.	-
-mg	Master Group	The master group containing corners which define the pattern. If the pattern is evaluated using '-ep' option, the new corners are added to this group. Else, it is assumed to be containing the pattern to be used.	-
-dp	Delete Pattern	Use this option to delete the corners defining the pattern. It is provided for convenience sake and is equivalent to deleting corners in the master group.	-
Internal Surface Options			
-hr	Height Ratio	Height of the internal surfaces w.r.t. the size of the hole	0.3
-ns	Num Smooth	Smoothing to be applied to the 32ormal at hole intersection	10
-m	Method	Method used for internal surface generation	4

		BEZIER_CURVE = 0, BSPLINE_CURVE = 1, BEZIER_SURF = 2, BLENDED_BEZIER_SURF = 3, BSPLINE_SURF = 4, CONTROLNET_ON_BSPLINE = 5, CONTROLNET = 6, BEZIER_SURF_WITH_INT_POINTS = 7	
-np	Num Points	Used to add more nodes on the internal surface	40
-mr	Magnification Ratio	Magnification ratio used to make the internal surfaces bulge out	1
Advanced Options			
-fs	Flat Surface	Id of surface to bottom surface where the internal surfaces should be flattened. Use '-fsg' option to use multiple surfaces.	-
-fsg	Flat Surface Group	A surface group containing multiple bottom surfaces where the internal surfaces should be flattened	-
-sf	Scaling Factor	The scaling factor used to position the corners of a given hole	1
-nts	Normal To Surface	This makes the internal surfaces normal to top and bottom surfaces. Like a Cup shaped surface	-
-cb	Create Base	If the bottom surfaces are not provided, this option can be used to create a mushroom kind of topology	-
-ub	Use Bottom	Surface group contains the flattened internal surfaces as a part of geometry itself. Instead of using –fsg, -ub can be used to avoid re-creating the surfaces.	
-thmr	Topology Height Magnification Ratio	Ratio used to position the outermost topology corners.	3
-due	Do not Use Ellipse Directions	Do not use the axes of ellipse. Uses the link directions (if available) instead.	-
-rwp	Replace With Planes	If the top/bottom surface intersection curve is not complete, the bounding surface (top/bottom) can be replaced with a plane.	-
-i	Insert Type	To add inserts to the hole macro. Can be 0,1,2 or 3. 0 → No inserts (default) 1 → Insert on the longest edge 2 → Insert on the shortest edge 3 → Insert on both the edges. Note that, there may be extra inserts when '1' or '2' is used, due to insert propagation	-
-ig	Insert Groups	To add different insert types, use -ig <sg1> <insert type 1> <sg2> <insert type 2> ...	-

Syntax:

"gp_utilities hole_topology -fn <Input file name> -sg <holes surf group> -tsg <top surf group> -bsg <bottom surf group> -wl -og <Outer corner group> -outfn <Output file name>"

Purpose:

Hole topology command helps in identifying the holes in the geometry and create an internal surface and its corresponding topology automatically. General options listed above will help in achieving the hole topology easily without much effort. But these are topologies built individually for each hole which are disjoint. If you want to link them together, then the other options come into the picture. In such scenarios, it is a two-step process, first, you evaluate the pattern in which it has to be linked, then generate the hole topology for the same. From v8.1, you can generate hole topology even for a half or quarter holes(i.e. a sector of the entire hole).

For more information on execution, please refer to Hole_Topology.pptx

23. intersection

Usage: *"intersection [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-is	Intersecting Surfaces	Specify the ids of the surfaces whose intersection have to be captured. Intersecting surfaces are automatically evaluated.	None
-sp	Surface Pairs	Pairs of intersecting surfaces. E.g. **1 3** *2 3 2 4*	None
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities intersection -fn <input file name> -is <sid1> <sid2> ... -sp <sp1_1> <sp1_2> <sp2_1> <sp2_2> ... -ofn <output file name>"

Purpose:

Create corners on the intersection of the given surfaces. If there are multiple intersections for the given two surfaces, it creates corners on all possible intersections only on 3D(Multiple intersections do not work on 2D cases).

Example:

COMMAND USED: *gp_utilities intersection -fn sphere.fra -is 0 1 2 3 -sp 1 3 0 1 0 2 0 3 -ofn sphere_out.fra*

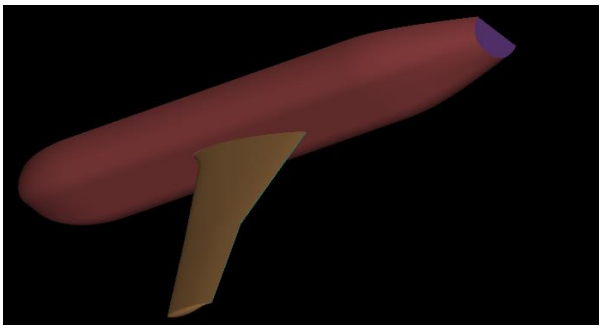


Fig: Two intersecting surfaces

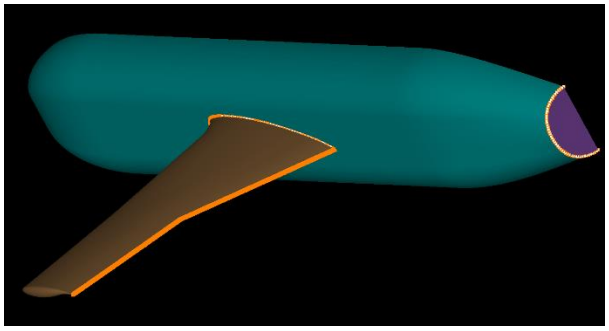


Fig: Corners created on the intersection

24. iwrap

Usage: *"iwrap [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-g	Group Id	The corner group id to be wrapped.	None
-r	Ratio	Used for positioning of the corners.	0.05
-di	Disable Inserts	Disables insert on the inner buffer layer.	False
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities iwrap -fn <input file name> -g <group id> -r <ratio> -di -ofn <output file name>"

Purpose:

1. Create a buffer layer adjacent to the given topology sheet.
2. It is used to remove the singularities and also for clustering.

Example:

COMMAND USED: *gp_utilities iwrap -fn for_wrap.fra -g 2 -r 0.2 -ofn wrap_out.fra*

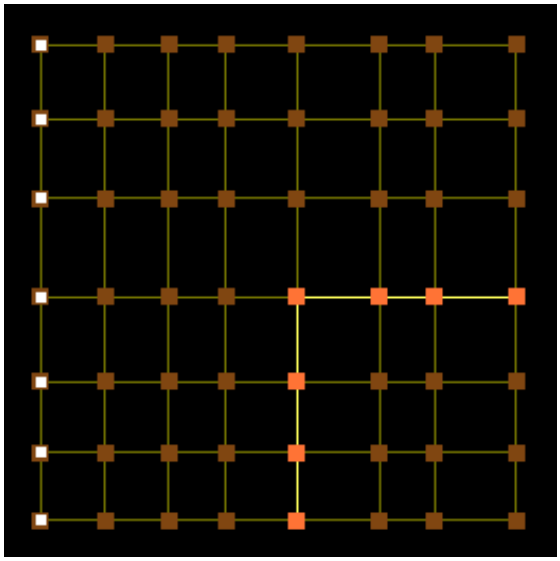


Fig: Corner group for internal wrap

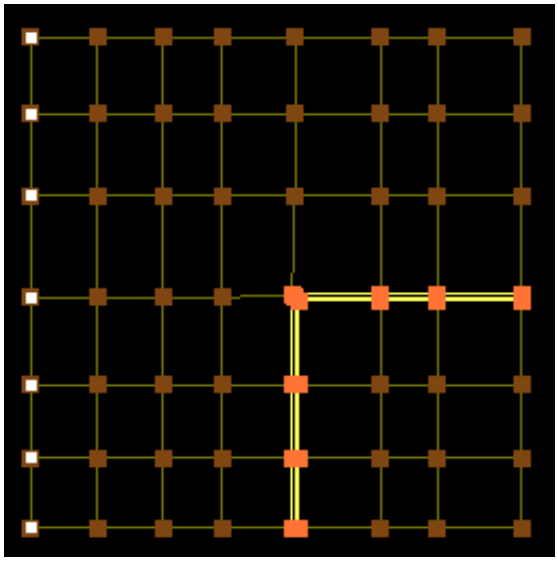


Fig: After internal wrap

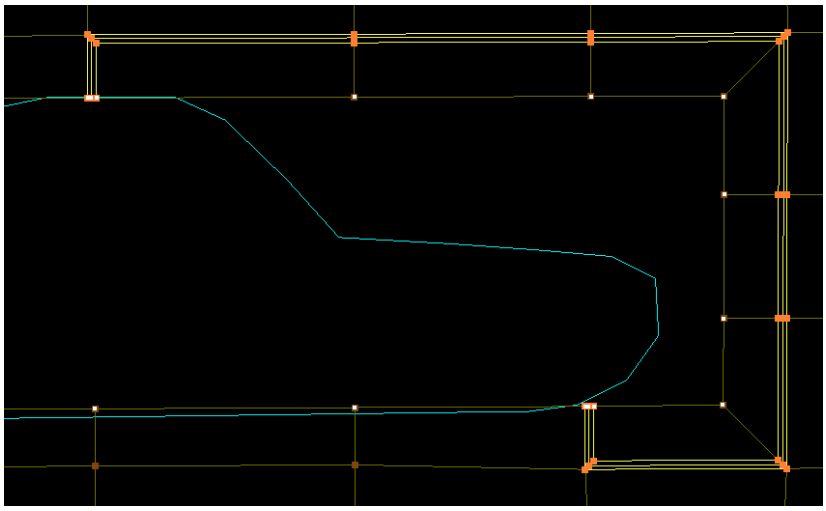


Fig: Internal wrap is used for refining an area of the grid without affecting the far field.

Notes:

1. The sheet selected for internal wrap should divide the topology into two pieces.
2. Internal wrap will take care of all assignments and the final topology will be a valid topology if the input topology is a valid one.

25. label_entities

Usage: *"label_entities [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-bg	Block Group Id	The block group id.	None

-fg	Face Group Id	The face group id.	None
-s	Surface Id	The surface id.	None
-ln	Label Name	The name of the label.	None
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities label_entities -fn <input file name> -bg <block group id> -ln <label name> -fg <face group id> -ln <label name> -s <surface id> -ln <label name> -ofn <output file name>"

Purpose:

Label the grouped corners, faces, blocks and surfaces.

Example: *gp_utilities label_entities -fn step1.fra -s 2 5 6 -ln int_surf -ofn step2.fra*

26. mildclu

Usage: *"mildclu [Options]"*

Options	Expansion	Description	Default value
-s	Surface Id	Used to specify the surface number and the off-wall spacing for that surface. "surfnum" is non-zero integer. The sign of "surfnum" indicates the direction of desired clustering for an internal surface. "spacing" is a positive real number which specifies the desired off wall spacing.	None
-ns	No. of cells of Surface	Specify if the desired number of offwall cells in the block is different from the default. The default is the number in the original grid. "num" (a positive integer) is the required number of offwall cells. NOTE: The no. of cells = no. of points - 1.	No of cells in the original grid
-fix	Fix Number	To specify the number of off-wall layers that has the same spacings. Similar to the fix parameter in clu.	None
-ng	Node Gap	Do not do post process step to fix possible node gaps at mild_block boundaries. If this option is not specified, chfmt will be used to sync node gaps.	None

Syntax:

"gp_utilities mildclu <Input Grid File Name> -s <surfnum> <spacing> -ns <surfnum> <num> -fix <surfnum> <num> -ng <node gap>"

Purpose:

Mildclu is an alternative to "clu" to control the off-wall spacing from specified surfaces.

Example: *gp_utilities* mildclu blk.tmp -s 1 0.01 -ns 1 24 -fix 1 4

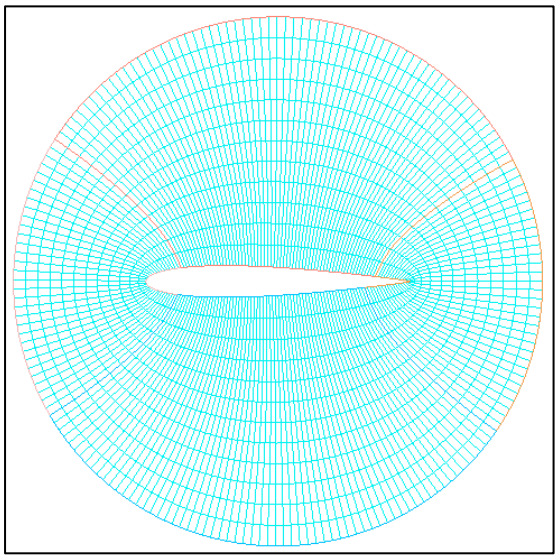


Fig: Before Clustering

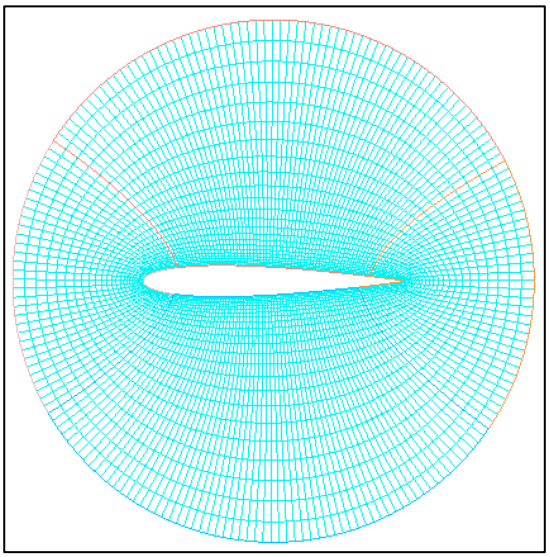


Fig: After Clustering

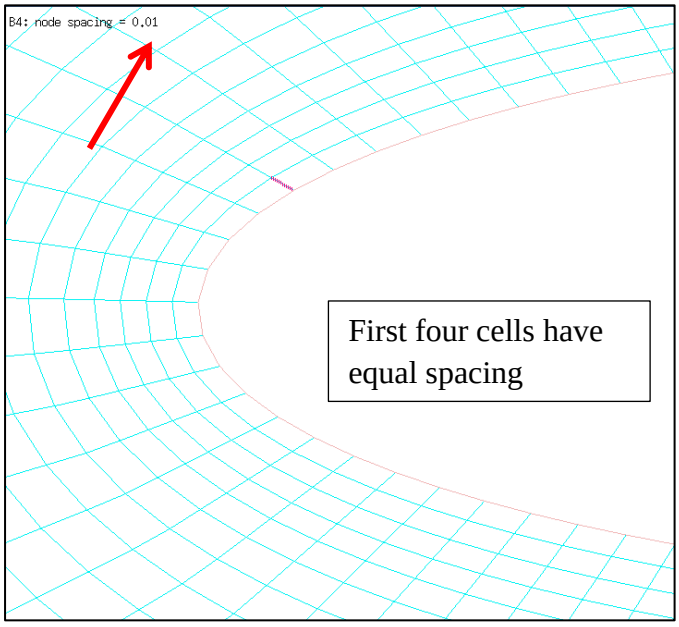


Fig: Clustered grid with the given spacing.

Notes:

1. The sign of "surfnum" indicates the direction of desired clustering for an internal surface.

27. merge_groups

Usage: ***"merge_groups [Options]"***

Options	Expansion	Description	Default value
-fn	Input File Name	Input file name with the extension '*.fra'.	-
-g	Group	Corner groups to be merged	-
-mf	Merge Flag	Merge flap for positioning of corners after merge 0 – To the center of both groups 1 – To group 1 2 – To group 2	-
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities merge_groups -fn <input file name> -g <group1><group2>-mf <merge flag> -ofn <output file name>"

Purpose:

Merges the given two group of corners if the number of corners and block pattern matches.

Example: *gp_utilities merge_groups -fn step1.fra -g 4 6 -mf 2 -ofn merged.fra*

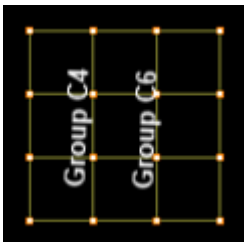


Fig: Input groups

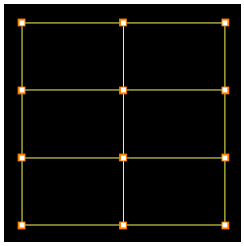


Fig: Merged to center

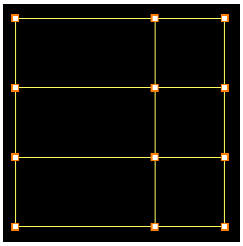


Fig: Merged to c6

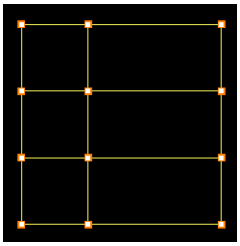


Fig: Merged to c4

28. move_surfaces

Usage: ***"move_surfaces [Options]"***

Options	Expansion	Description	Default value
-fn	Input File Name	Input file name with the extension '*.fra'.	-
-dn	Directory Name	The name of the directory to which the surfaces and topology should be moved.	-
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities move_surfaces -fn <input file name> -dn <directory_name> -ofn <output file name>"

Purpose:

Move the surfaces and the topology of a given file to a different directory.

Example: *gp_utilities move_surfaces -fn valid.fra -dn surface -ofn step1.fra*

29. mrgg

Usage: *"mrgg [Options]"*

Options	Expansion	Description	Default value
-ifn	Input File Name	List of surfaces to be merged.	-
-outfn	Output File Name	Output surface file name.	-

Syntax:

"gp_utilities mrgg -ifn <surface file name1> <surface filename 2> -outfn <output filename>

Purpose:

Concatenate multiple surfaces into a single file. The surfaces need not have matching triangulations.

Example:

COMMAND USED: *gp_utilities mrgg -ifn merged_seg_0.tria merged_seg_2.tria surface1.tria -outfn merged.tria*

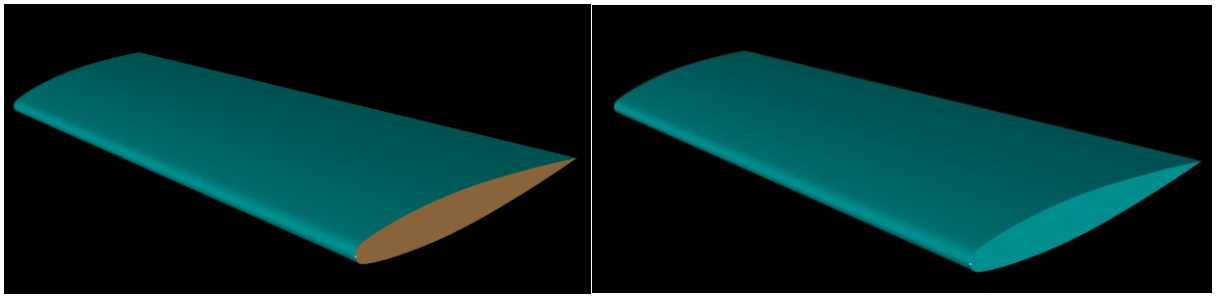


Fig: Before and after using mrgg on the surfaces

30. offset

Usage: *"offset [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-s	Surface Id	List of surface ids.	None
-sg	Surface Group	Surface group.	None
-or	Offset Ratio	Offset ratio.	0.1
-ns	Num Smoothings	Number of normal smoothings.	10
-fg	Feature Group	Feature corners of the surfaces.	None
-frg	Frozen Group	Frozen corners of the surfaces.	None
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities offset -fn <input file name> -s <sid1> <sid2> ... -sg <surface group> -or <offset_ratio> -ns <num smooths> -fg <feature group> -frg <frozen group> -ofn <output file name>"

Purpose:

Create an offset of the given surface.

Example: *gp_utilities offset -fn airfoil.fra -s 1 -or 0.1 -ns 4 -ofn offset_out.fra*

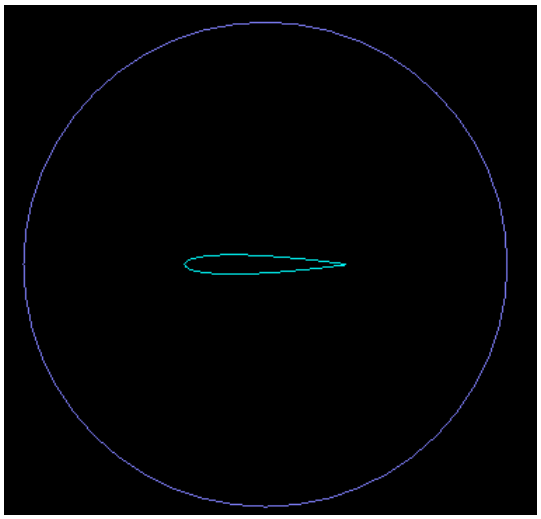


Fig: Surface used for offset.

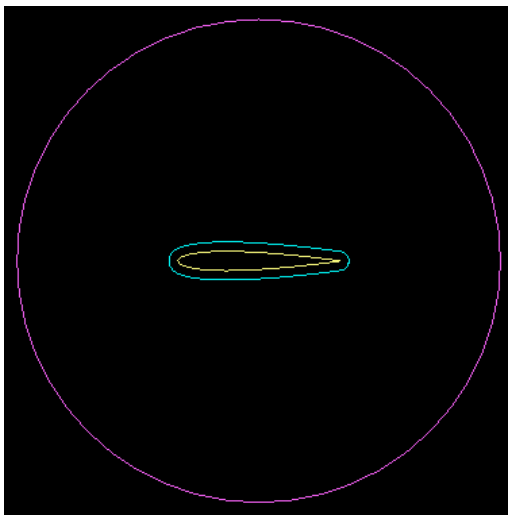


Fig: After offsetting the surface with a ratio 0.1

31. orient_axes

Usage: ***"orient_axes [Options]"***

Options	Expansion	Description	Default value
-btrf	Block Transform	Changes the orientation of a particular block id. The block id starts from 1. This option should not be used along with '-mvar' option.	-
-mvar	Minimize variation	Align the axes of all blocks as much as possible.	-
-l	Left hand	Changes all the block orientation to left handed	-
-r	Right hand	Changes all the block orientation to right handed	-
-o	Output file name	Output grid file name with extension '*.tmp' or '*.grd'.	-

Syntax:

"gp_utilities orient_axes <Grid File Name> -btrf <Block id> <New Orientation (1-6)> -o <Output Grid File Name> -mvar -l -r

Purpose:

Minimizes the variations of block orientations or changes the orientation of a particular block to a given orientation.

Example: *gp_utilities* orient_axes blk.tmp -o output.tmp -mvar

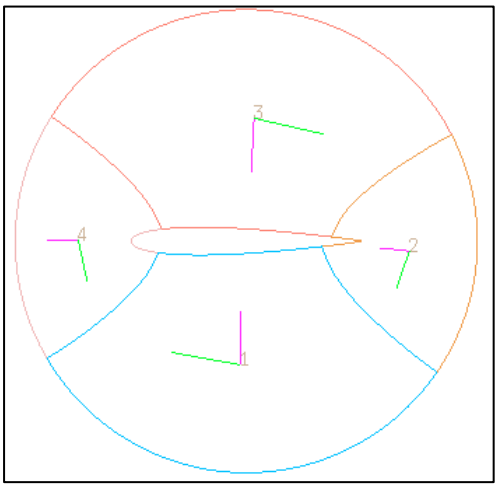


Fig: Before orienting the grid axes

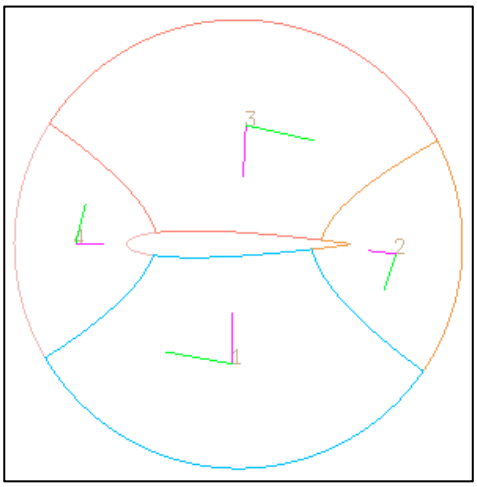


Fig: Oriented the grid axes using the '-mvar' option

NOTE: '-mvar' option tries to reduce the variations of all blocks orientation.

Applying on a particular block: gp_utilities orient_axes blk.tmp -btrf 3 426 -o output.tmp

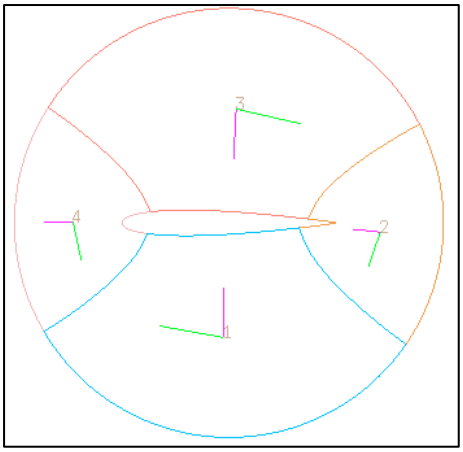


Fig: Before orienting the grid axes

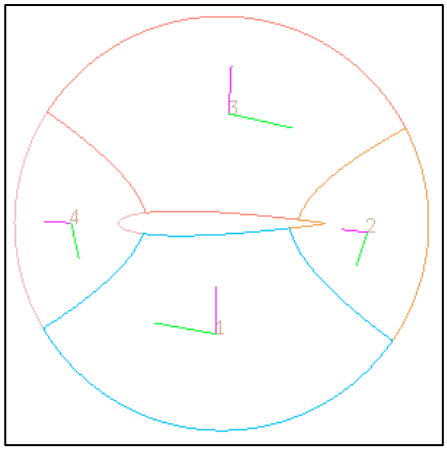


Fig: Oriented the grid axes of block 3

The value ‘426’ denotes that the -x axis should be aligned to current x axis, y axis should be aligned to current y-axis and -z axis should be aligned to current z axis.

In general terms, the 3 digit number explains that the first digit determines the new axis and aligns it to the current x-axis and second one aligns it to the current y-axis, similarly the third one aligns it to the current z-axis. The new axis is determined from the 3 digit number which varies from 1-6 where 1, 2, 3, 4, 5 and 6 denotes the x, y, z, -x, -y and -z axis respectively.

Left handed orientation: gp_utilities orient_axes blk.tmp -o output.tmp -l

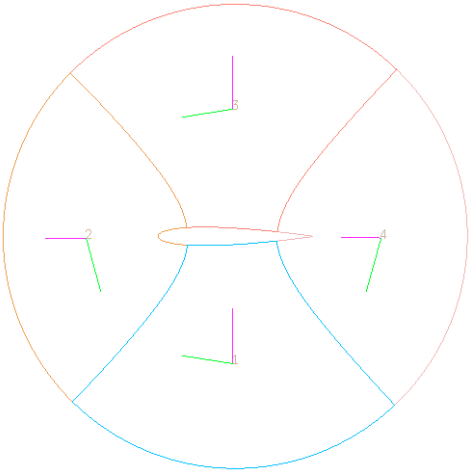


Fig: Before orienting the grid axes

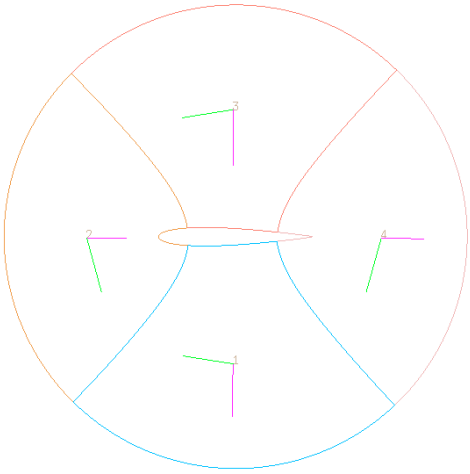


Fig: All blocks with left handed orientation

32. periodic2complete

Usage: *“periodic2complete [Options]”*

Syntax:

“gp_utilities periodic2complete -fn <input file name> -ofn <output file name> -bc”

Purpose:

Duplicate the periodic topology using the given periodicity and outputs a full valid topology. If -bc is enabled, it automatically builds the topology for the core instead of creating singularity at the center.

Example: *gp_utilities periodic2complete -fn periodic.fra -ofn periodic_out.fra -bc*

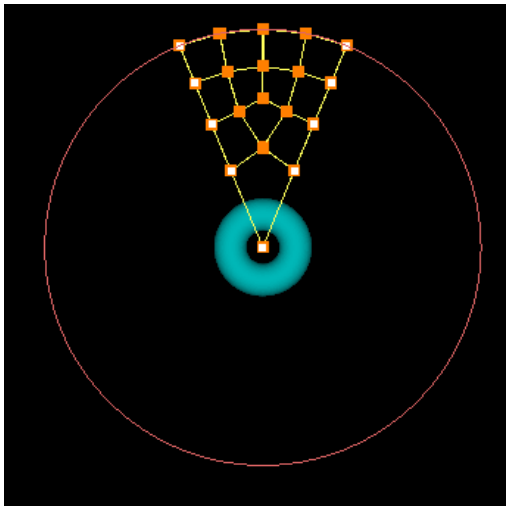


Fig: Periodic topology with periodicity 45

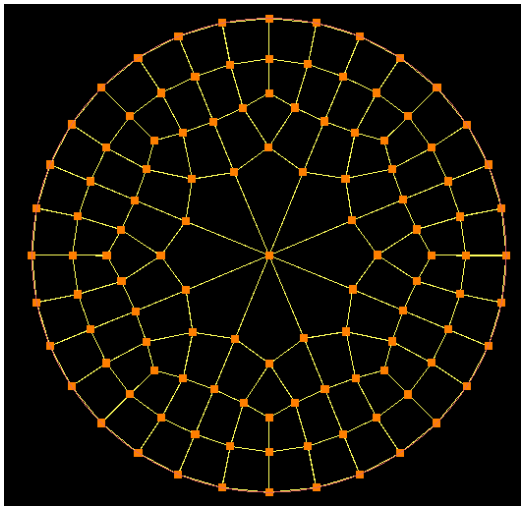


Fig: Regular topology derived from the periodic topology without build core

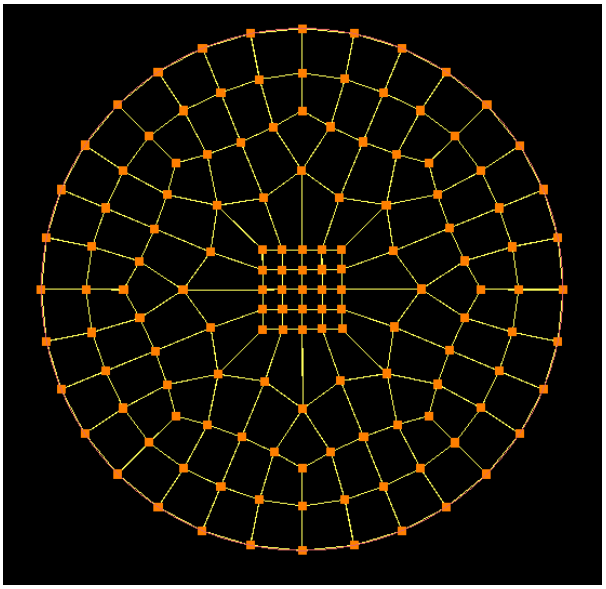


Fig: Regular topology derived from the periodic topology with build core

33. project_grid_nodes

Usage: ***"project_grid_nodes [Options]"***

Options	Expansion	Description	Default value
-fn	File name	Input Topology file name	-

-ifn	File name	Input grid file name with extension ‘*.tmp’ or ‘*.grd’	-
-outfn	Output file name	Output file name with extension ‘*.tmp’ or ‘*.grd’	-
-s	Surface grid sheet id	Surface grid sheet id’s on which the nodes of the blocks to be projected	-
-p	Property sheet id	Property sheet id’s on which the nodes of the blocks to be projected	-
-sp	Sync Periodic	Sync nodes on periodic interface	-
-dp	Do not Project	Do not project grid nodes. This should be used along with -sp	-
-r	Report	Reports the max offset found	-

Syntax:

“gp_utilities project_grid_nodes -fn <input topology file>-ifn <input grid file name> -outfn <output grid file name> -s <sid1><sid2> -p <pty1><pty2> -sp -dp -r”

Purpose:

To project all grid nodes with the given properties or surface ids. This tool is useful when the grid nodes which should ideally lie on a surface, are slightly displaced. The block faces are first identified using the input property (-p option) and the surface(s) to which these faces are assigned, are automatically evaluated from the conn file. The grid nodes on these block faces are then projected to the corresponding surfaces.

It can also sync the nodes in a periodic grid. If a grid node and it's "paired" node are not in sync; this tool can be used to sync them. Please use -sp and -dp options together.

Example: *gp_utilities project_grid_nodes –fn step1.valid.fra -ifn sphere.grd -outfn sphere_projected.grd -s 2 -r*

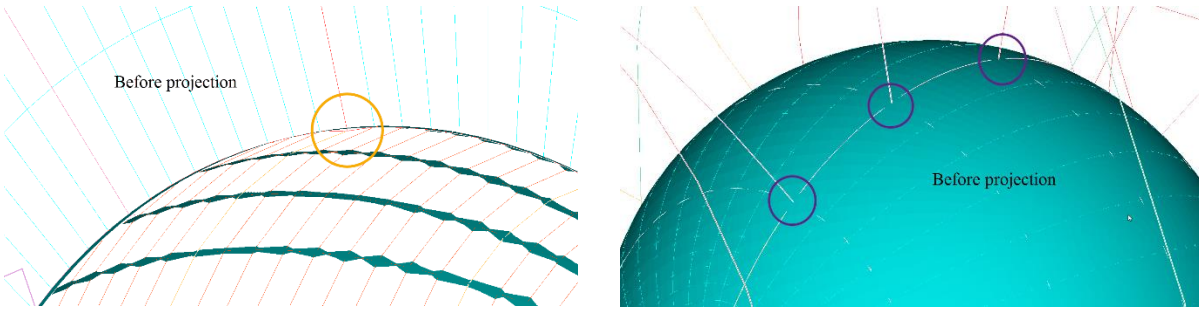


Fig: Before Projection

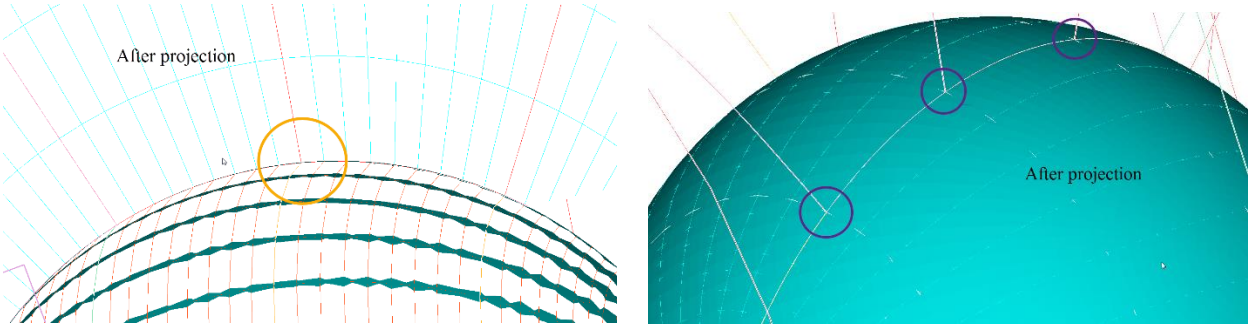


Fig: After Projection

34. pty_to_surface

Usage: ***"pty_to_surface [Options]"***

Options	Expansion	Description	Default value
-ifn	File name	Input grid file name with extension '*.tmp' or '*.grd'	-
-outfn	Output file name	Output file name with extension '*.tmp' or '*.grd'	-
-p2s	Property to surface	Sets a new surface id for the given property id.	-

Syntax:

"gp_utilities pty_to_surface -ifn <input grid file name> -outfn <output grid file name>-p2s <pty 1><surf 1> <pty 2><surf 2>"

Purpose:

Set a new surface id for the given property id. It will be helpful to run tools which takes surface id as input such as CLU, Welding partial grids, etc.

Example: *gp_utilities* pty_to_surface -ifn weld.tmp -outfn newgrid.tmp -p2s 6 10

Application: For welding periodic grids with an angle lesser than 90degree. After welding first two grids of 30 degree each, you will have a grid of 60degree. To weld the same with another 30 degree grid,

1. Open the welded grid in the UI and set two distinct properties to the welded sheets.
2. Run pty_to_surface and assign different surface ids to both.
3. Run weld command on the new 60 degree and 30 degree grid.

It can also be used for welding partial grid faces.

35. qchk

Usage: *"qchk"*

Syntax:

"gp_utilities qchk <Minimum no. of bad volumes(0 to 11)> <Aspect ratio threshold (1 to Inf)> <Skewness threshold(0 to 1)> <Warpage Threshold(0 to 180)>"

Purpose:

Check the quality parameters of the given grid for the defined values.

Example: *gp_utilities qchk wing.grd 0 200 0.15 75*

36. refine

Usage: *"refine"*

Syntax:

"gp_utilities refine <input tria file name> <number of refinements> <output tria file name>"

Purpose:

Refine the triangulation of a '*.tria' file.

Example:

COMMAND USED: *gp_utilities refine wing_tip.tria 5 wing_tip_refine.tria*

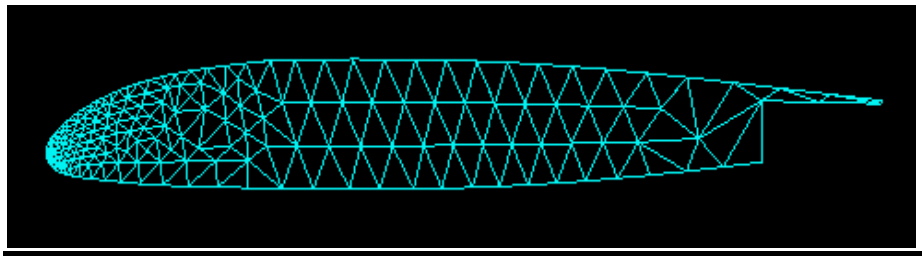


Fig: Before refinement

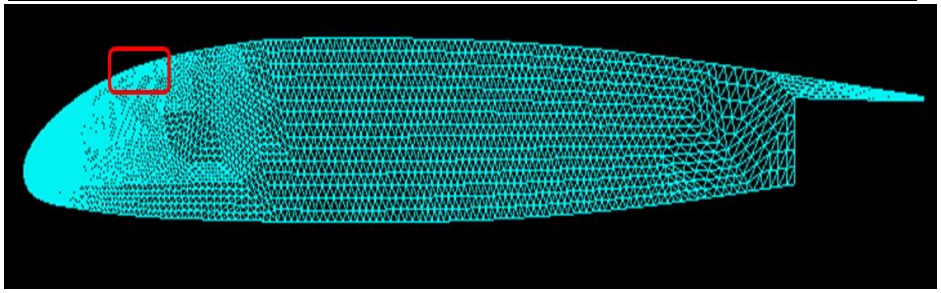


Fig: After refinement

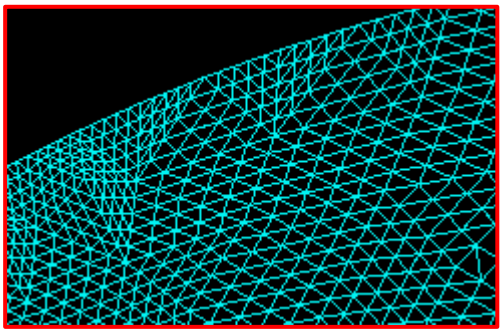


Fig: Zoomed image

37. replace_surfaces

Usage: ***"replace_surfaces [Options]"***

Options	Expansion	Description	Default value
-fn	Input File Name	Input file name with the extension '*.fra'.	-
-in	Surface Index to Name	Mapping from surface indices to newer surface names.	None
-nn	Surface Name to Name	Mapping from old surface names to new surface names.	None
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities replace_surfaces -fn <input file name> -in <index1><file1> -nn <old file name> <new_file_name> -ofn <output file name>"

Purpose:

Simultaneously replace multiple surfaces in a topology using surface id's and/or names. Both old and new surfaces should exist in the working directory.

Example: *gp_utilities replace_surfaces -fn input.fra -ofn output.fra -in 0 surf0.tria 10 surf10.tria -nn surf1.tria surf11.tria*

Note: Combination of '-in' and '-nn' is also allowed, as long as they don't conflict.

38. replace_surfaces_text_processing

Usage: ***"replace_surfaces_text_processing [Options]"***

Options	Expansion	Description	Default value

-fn	Input File Name	Input file name with the extension '*.fra'.	-
-in	Surface Index to Name	Replacing surface indices with newer surface names.	None
-nn	Surface Name to Name	Replacing old surface names with new surface names.	None
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities replace_surfaces_text_processing -fn <input file name> -in <index1><file1> -nn <old file name> <new_file_name> -ofn <output file name>"

Purpose:

Simultaneously replace multiple surfaces in a topology using surface id's and/or names. The advantage of this command over replace_surfaces is that you don't need to have the surfaces in the working directory to execute this command.

Example: *gp_utilities replace_surfaces_text_processing -fn input.fra -ofn output.fra -in 0 surf0.tria 10 surf10.tria -nn surf1.tria surf11.tria*

Note: Combination of '-in' and '-nn' is also allowed, as long as they don't conflict.

39. reverse_nest

Usage: ***"reverse_nest [Options]"***

Options	Expansion	Description	Default value
-fn	Input File Name	Input file name with the extension '*.fra'.	-
-all	All Group	The group id which contains the topology to be nested.	None
-sg	Special Group Id	The group id which contains the topology to be wrapped out without nesting.	None
-ne	Num Extrusions	The number of extrusion of reverse nesting. If it is zero, topology is extruded to the maximum extent possible.	0
-r	Ratio	The ratio of extrusion. Used for positioning of nested corners.	0.1
-es	Extrude Spherically	Assumes that the outer topology is assigned to sphere and extrude in its normal direction.	False
-ofn	Output File Name	Output file name with extension '*.fra'.	-

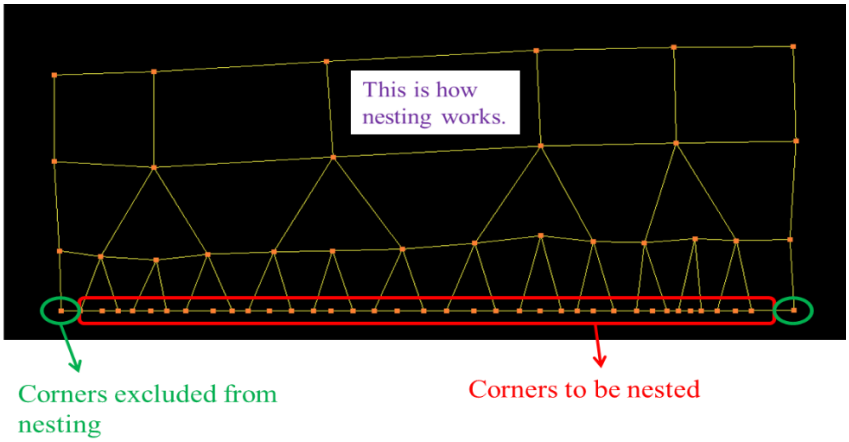
Syntax:

"gp_utilities reverse_nest -fn <input file name> -ag <all group> -sg <special group id> -ne <num extrusions> -r <ratio of extrusion> -es -ofn <output file name>"

Purpose:

Reduce the number of corners in the topology as it moves away from the geometry.

Example: *gp_utilities reverse_nest -fn reverse_nest.fra -ag 2 -sg 3 -ne 4 -r 0.5 -ofn reverese_nest_out.fra*



- It is similar to reverse nest1d which is used for 2D nesting while reverse nest is used for 3D nesting.

Note: It helps in refine the grid near the geometry without affecting the far field. The grid near the geometry is fine and coarse in the far field.

40. ribbon

Usage: ***"ribbon [Options]"***

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-pg	Path Group	The corners in the group should be assigned to at least one polysurface.	None
-sg	Special Group	The corners in the group retain their normal orientation.	None
-isg	Invert Surface Group	The corners in the group invert their normal orientation.	None
-w	Width	Ribbon Width.	0.01
-ns	Num Smooths	Number of levels of Laplace smoothing.	1000
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities ribbon -fn <input file name> -pg <path group> -sg <special group> -isg <invert surface group> -w <width> -ns <num smooths> -ofn <output file name>"

Purpose:

Create a layer of corners either normally inwards or normally outwards to the given set of corners with the given width, based on the given corners and its assignments.

Example: *gp_utilities ribbon -fn wing_ribbon.fra -pg 1 -w 0.2 -ns 1000 -ofn wing_ribbon_out.fra*

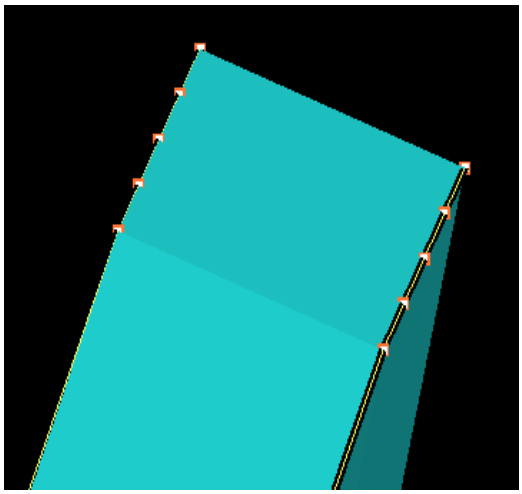


Fig: Surface with feature corners

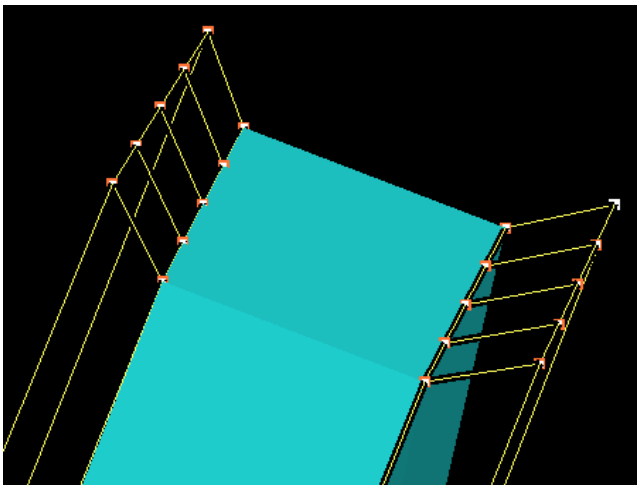


Fig: Surface with ribbon corners

41. ribbon_nest

Usage: *"ribbon_nest [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-ng	Nest Group	The group_id which contains the topology to be nested.	None
-sg	Special group	The corners in this group are simply wrapped out without nesting.	None
-rg	Ribbon Group	The group id which contains the ribbon.	None
-nr	Num Refinements	The number of levels of refinement.	0 (Max possible)
-r	Ratio	The ratio of extrusion. This is calculated using the ribbon width.	1
-og	Outer Group	The outer corners are added to the group.	None
-lg	Length Group	The corners in this group will have fixed length.	None
-nls	Num Length Smooths	The number of length smoothings.	1000
-awl	Add Wrap Layer	Add a wrap layer at the end.	False
ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities ribbon_nest -fn <input file name> -ng <nest group id> -sg <spl group id> -rg <ribbon group id> -nr <num refinements> -r <ratio> -og <outer group id> -lg <length group id> -nls <num length smoothings> -awl -ofn <output file name>"

Purpose:

If the number of corners on the surface is more, it will consume more amount of time to build the wireframe for the internal surface. In such cases, reverse nest can be used and reduce the number of corners. It creates given number of layer of corners. The number of corners reduces with each layer.

Example: *gp_utilities ribbon_nest -fn wing_nest.fra -ng 1 -sg 3 -rg 2 -nr 2 -r 1 -nls 1000 -awl -ofn wing_nest_out.fra*

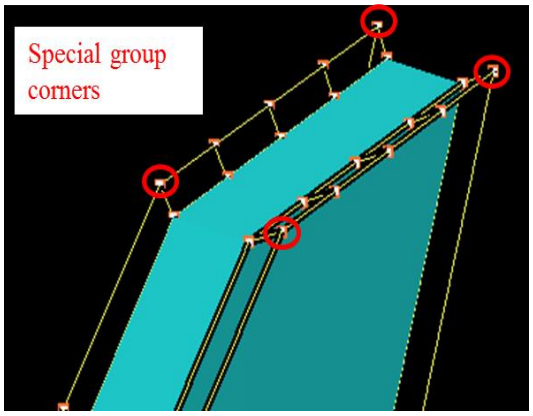


Fig: Surface with ribbon corners

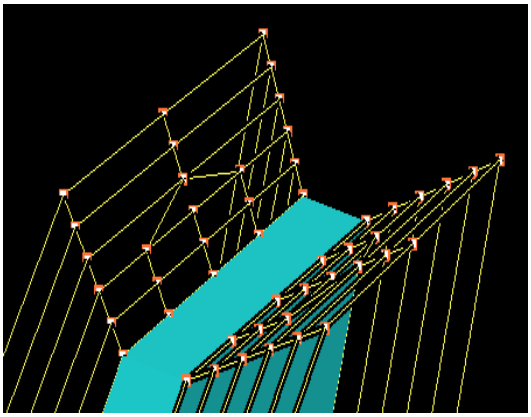


Fig: After reverse nest

1. The outer layer of corners should be given as ribbon group because from which the nesting starts.
2. All the corners should be grouped and given as nesting group.
3. Corners which are at sharp turns should be given as special group in order to avoid nesting on those corners.

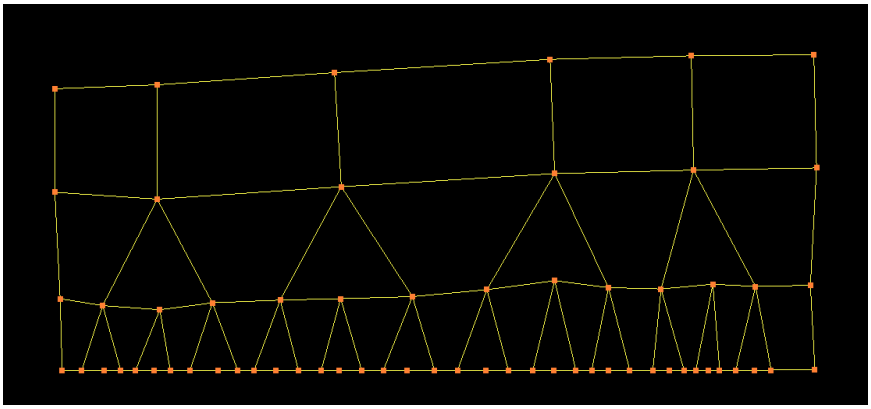


Fig: Showing how the ribbon nest works to reduce the number of corners with each layer.

42. rotate

Usage: ***"rotate [Options]"***

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-g	Group Id	The group id which contains the topology sheet to be rotated.	None
-max	Maximum Angle	The max angle of rotation.	270
-min	Minimum Angle	The min angle of rotation.	90
-ni	Num Instances	Specify the number of instances (or copies) of the topology sheet to be created. Equi-distant instances are created based on the	None

		max-min angles. Note that -i option should not be used if it is specified.	
-i	Instances	The instances. The angles (in degrees) should be specified. Note that -ni option should not be used if it is specified.	None
-sc	Self-Closed	The topology will be looped.	False
-a	Axis	The axis. The coordinates of centre followed by the axis direction.	**0 0 0** *0 0 1*
-p	Pitch	The pitch distance. If the pitch distance is given, then it forms a helix structure.	0
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities rotate -fn <input file name> -g <group id> -max <max angle> -min <min angle> -ni <num of instances> -i<instances> -sc -a <centre and normal> -p <pitch> -ofn <output file name>"

Purpose:

Create a rotated topology for the given topology using the angle, no. of instance and pitch.

Example:

Rotation without pitch: *gp_utilities rotate -fn topo.fra -g 1 -max 300 -min 0 -ni 6 -sc -a 0 0 0 0 1 0 -ofn hex_out.fra*

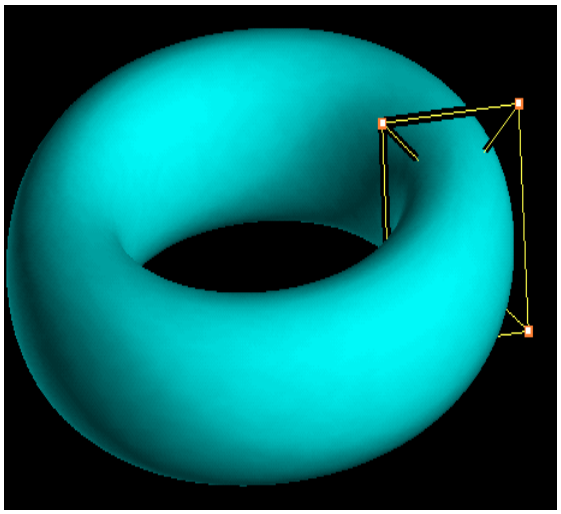


Fig: Topology for rotation

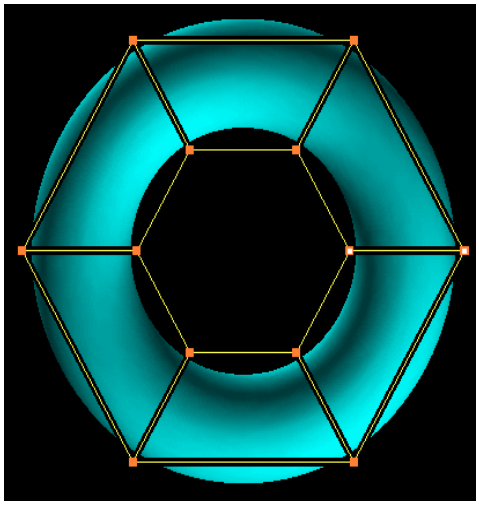


Fig: Topology after rotation

Rotation with pitch: *gp_utilities rotate -fn topo.fra -g 1 -max 300 -min 0 -ni 6 -a 0 0 0 0 1 0 -p 6 -ofn hex_out.fra*

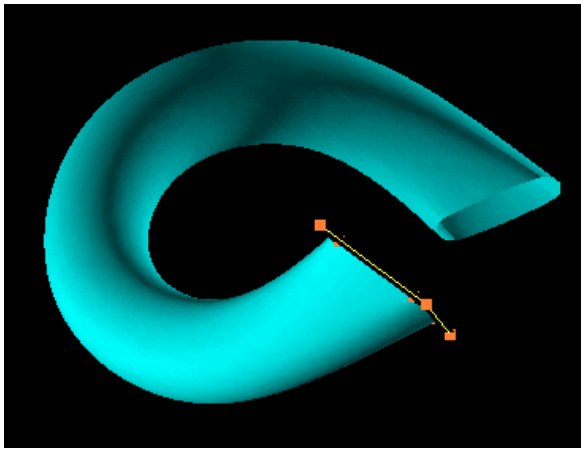


Fig: Topology for rotation

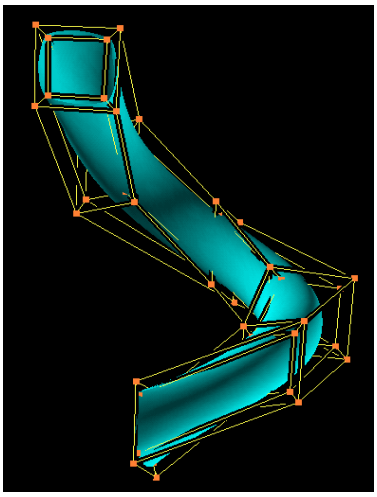


Fig: Topology after rotation

43. shuffle_corners

Usage: *"shuffle_corners [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with the extension '*.fra'.	-
-ns	Num of Shuffles	The number of shuffles.	5
-sfn	Shuffle File Name	Output file name with extension '*.fra'.	_az.out.fra

Syntax:

"gp_utilities shuffle_corners -fn <input file name> -ns <num of shuffles> -sfn <output file name>"

Purpose:

Shuffle the corner id's of the given topology.

Example: *gp_utilities shuffle_corners -fn az.fra -ns 30 -sfn shuffle_out.fra*

Application:

1. To resolve the error 'Incomplete Molecule'.

44. smooth_block_edges

Usage: *"smooth_block_edges [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-ifn	Input Grid File Name	Input grid file with an extension '*.tmp' or '*.grd'.	-
-sp	Surface Pairs	The intersecting surface ids in pairs.	All
-ibs	Ignore Built-in Surfaces	A flag to ignore built-in surfaces while evaluating intersecting surface pairs for projection purposes.	False
-outfn	Output File Name	Output grid file with an extension '*.tmp' or '*.grd'.	-

Syntax:

"gp_utilities smooth_block_edges -fn <Input file name> -ifn <input grid file name> -sp <surface ids in pairs> -ibs -outfn <output grid file name>"

Purpose:

Project the block edges of the grid to the intersection of surfaces.

Example:

COMMAND USED: *gp_utilities smooth_block_edges -fn cylinder.fra -ifn blk.tmp -outfn smooth.grd -sp 1 2 1 3*

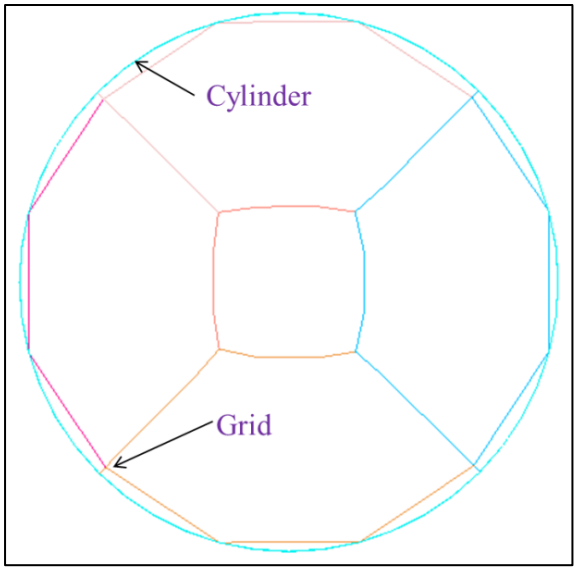


Fig: Before projection

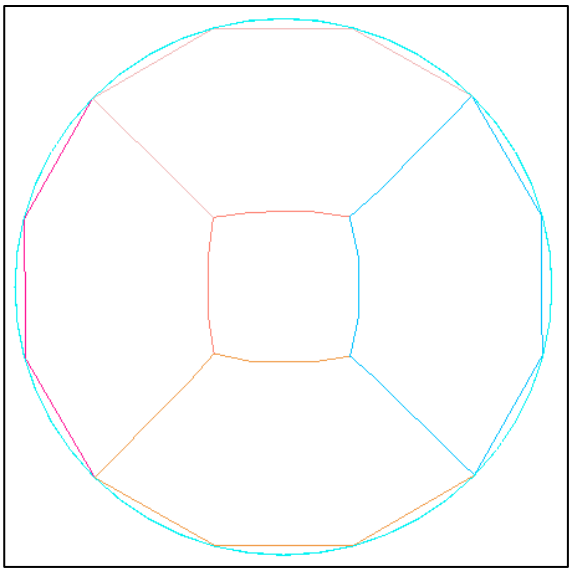


Fig: After projection

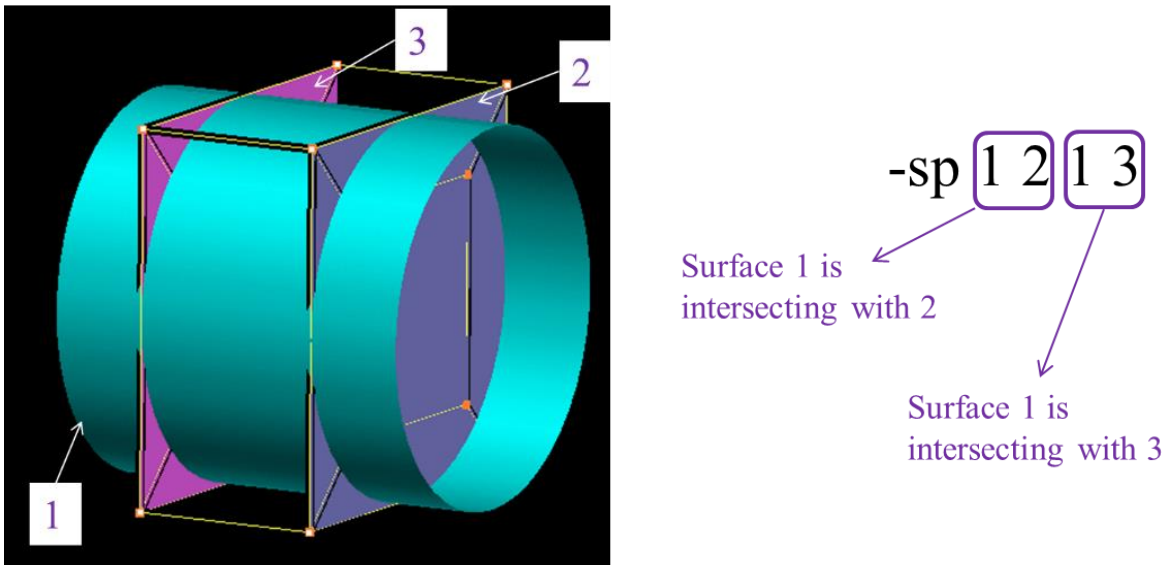


Fig: Explaining how to enter surface pairs

45. smooth_tube

Usage: *"smooth_tube"*

Syntax:

"gp_utilities smooth_tube <input file name> <output file name> <number of level of refinements>"

Purpose:

Smoothen the tube file. All the sharp features on the curved region of a tube can be smoothened using this command.

Example:

COMMAND USED: *gp_utilities smooth_tube smooth.tube smooth_out.tube 3*

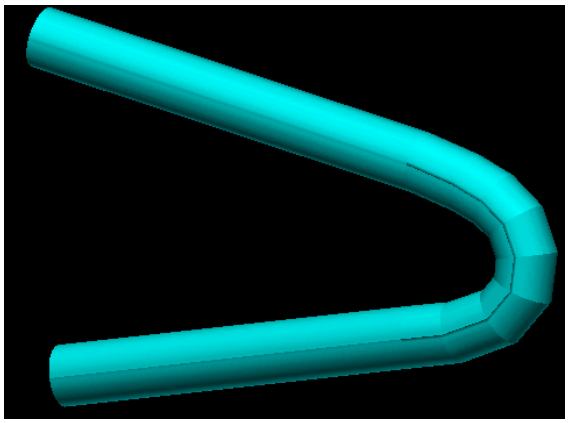


Fig: Before smoothing

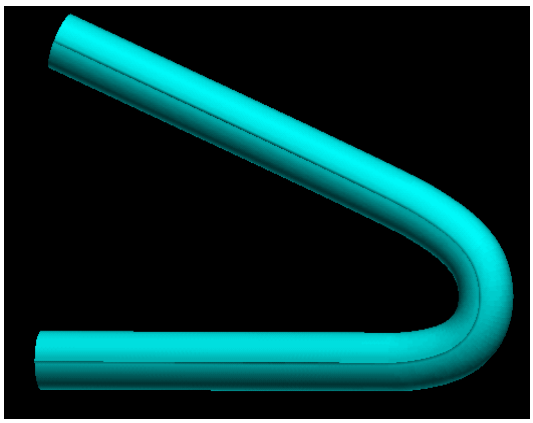


Fig: After smoothing

Note:

1. It is valid only for '*.tube' files.

46. split

Usage: *"split [Options]"*

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-
-s	Surface Id	List of surface ids.	None
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities split -fn <input file name> -s <sid1> <sid2> ... -ofn <output file name>"

Purpose:

Split the topology into pieces using the given surfaces and outputs a valid topology.

Example:

COMMAND USED: *gp_utilities split -fn topo.fra -s 6 -ofn split_out.fra*

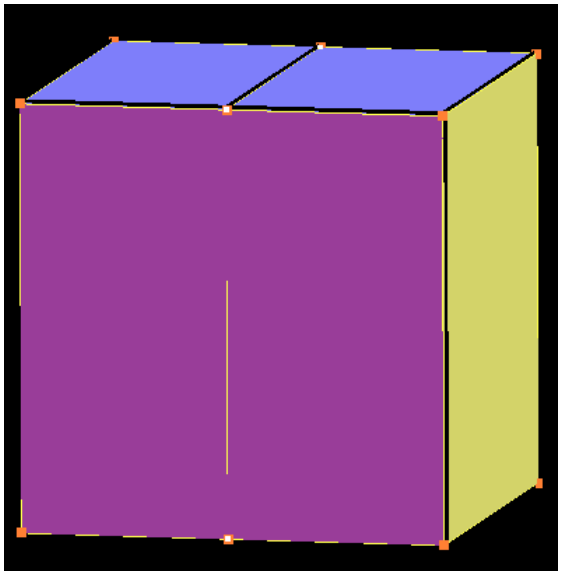


Fig: Topology before splitting

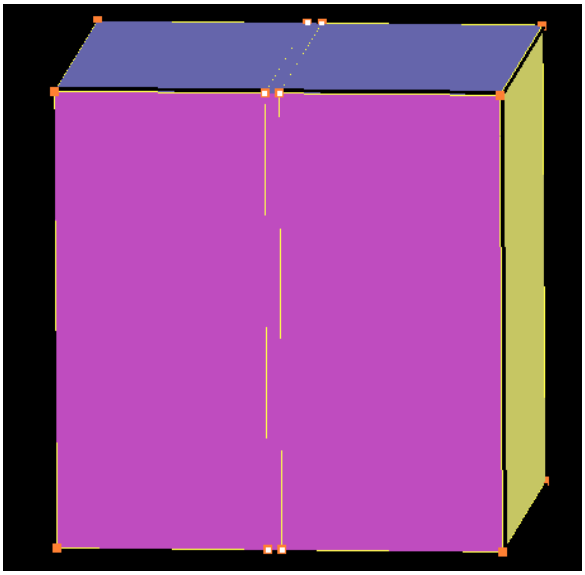


Fig: Topology after splitting

Notes:

1. This command can be used only on a valid topology.
2. The surfaces which are used for splitting should have corners assigned to it.

47. split_blocks

Usage: *"split_blocks [Options]"*

Options	Expansion	Description	Default value
-ifn	Input File Name	Input Grid File	-
-outfn	Output File Name	Output Grid File	-
-s	Split Coordinates	Index of block, followed by edge index and the node index	-

Syntax:

split_blocks -ifn <input> -s <block id> <edge id> <node id> -outfn <output>

Purpose:

Split the blocks of the grid at the selected grid sheet.

Example:

COMMAND USED: *ws split_blocks -ifn blk.tmp -outfn blk_out.tmp -s 3 1 4*

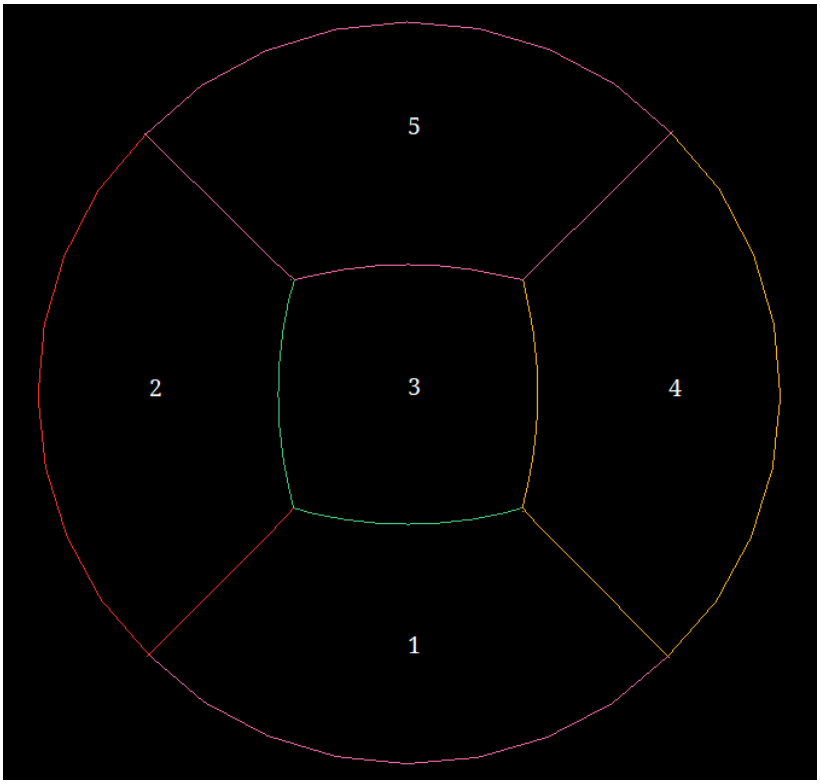


Fig: Before splitting the grid

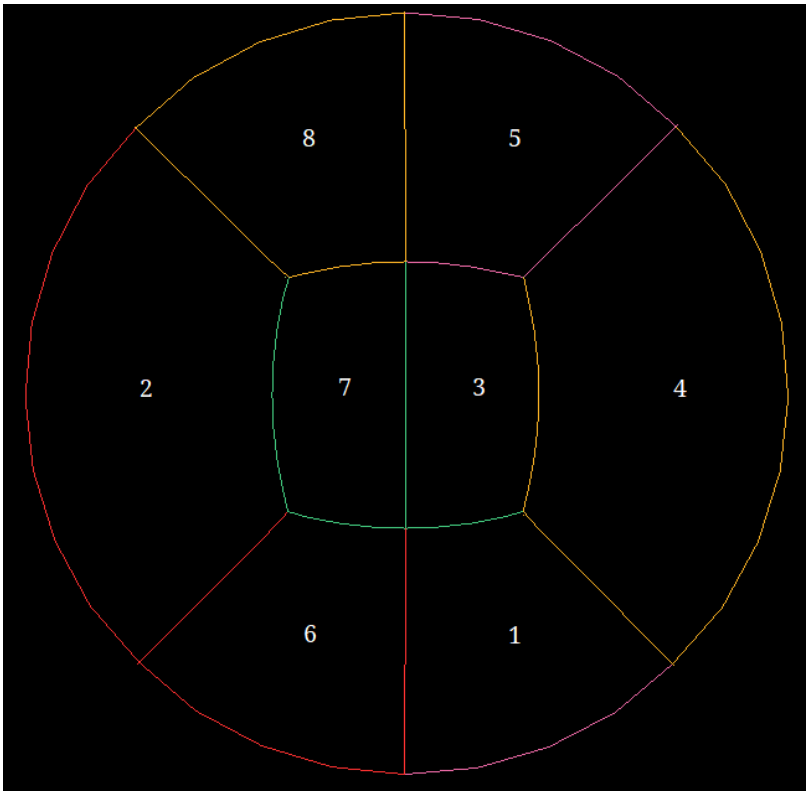


Fig: After splitting

NOTE: The block ID can be found by clicking on the view 'Block ID' toggle in the GUI. This shows the axis for the block and its orientation. The edge ID is found by looking at this same orientation – 0, 1 or 2, if it is aligned along the x, y, z axes. The node ID is just the offset from the perpendicular edge.

48. segn

Usage: *"segn [Options]"*

Syntax:

1. *gp_utilities segn -fn <input fra> -ofn <output fra> -s <sid1> <sid2>…..(When you know the list of surface id's in the *.fra file)*
2. *gp_utilities segn -fn <input fra> -ofn <output fra> -sg <surface group>(When you have the list of surfaces grouped in a surface group)*
3. *gp_utilities segn -sfn <surface file name> -ofn <output fra>(When you want to split using the surface file name)*

Purpose:

Split the disjoint geometry into separate geometry

Example:

COMMAND USED: *gp_utilities segn -sfn steam_injector.stl.tmp -ofn step1.surfs.fra*

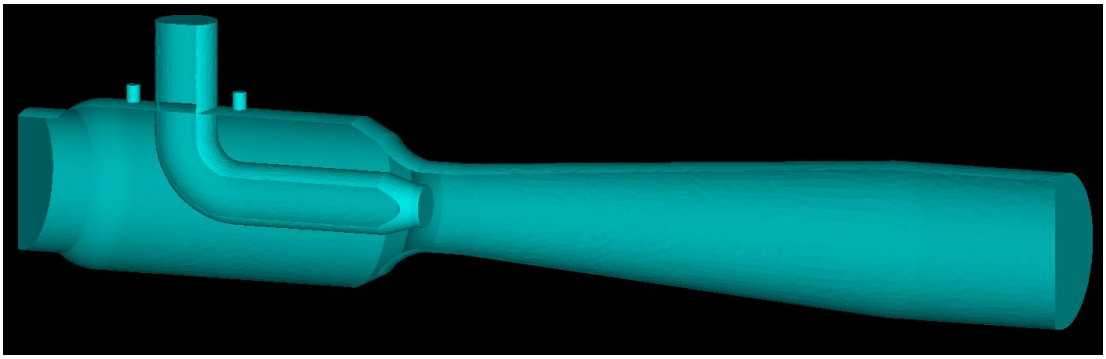


Fig: Before splitting the geometry

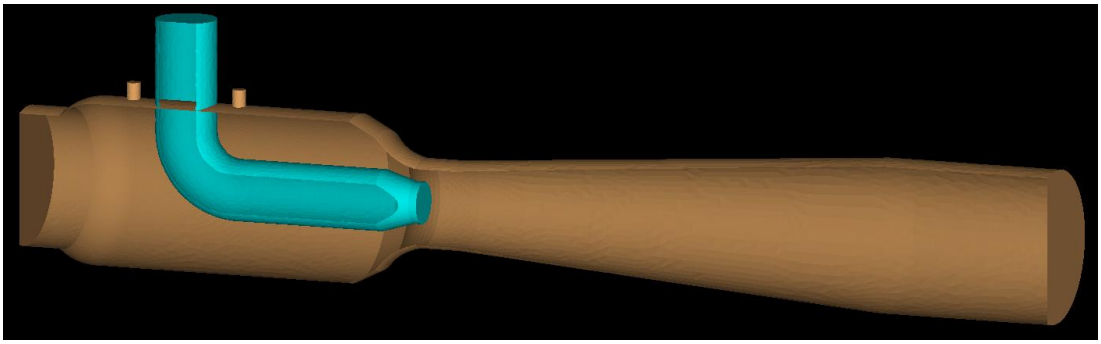


Fig: After splitting

NOTE: These commands split only the disjoint pieces. It does not split them into individual surfaces based on feature angle. To do that, use GUI→ Split command under Surface→Edit section.

49. starcdtocfdpp

Usage: *"starcdtocfdpp <Grid File Name>"*

Syntax:

1. *chfmt <Grid File Name> -f starcd*
2. *starcdtocfdpp <Grid File Name>*

Purpose:

Convert a Grid*Pro* grid file to cfd++ format file. The Grid*Pro* grid file has to be converted to starcd format first, which can only be converted to cfd++ format. So user has to execute the syntaxes in the order given above.

Example:

COMMAND USED: *chfmt **blk.tmp** -f starcd (This creates all 4 starcd files – inp, bnd, cel, vrt)*

Next execute the starcdtocfdpp command as follows:

*starcdtocfdpp **blk.tmp***

NOTE: The grid file name should be same for both the command

50. surface_folds

Usage: *"surface_folds [Options]"*

Syntax:

gp_utilities surface_folds -gfn <grid file name> -s <sheet id1> <sheet id2>

Note: Use -s 0 to list fold count on all surface grid sheets.

Purpose:

Evaluate the fold count on the given surface grid sheet id.

Example:

COMMAND USED: *gp_utilities surface_folds -gfn blk.tmp -s 1 2*

```
surface_folds -gfn blk.tmp -s 0
        +--------------------surface_folds---------------------+
        |          !!! For Authorized Use Only !!!
        |
        | (c)Copyright 1993-2018,   Program Development Comp.
        |      ----   Licensed Materials, All Rights Reserved.
        | 300 Hamilton Ave.,Suite 409, White Plains, NY 10601
        | Tel: (914) 761-9152              Fax: (914) 761-1735
        +-----------------------------------------------------+

reading Block : 4700 (7 5 9))
Folds on surface 1 : 0/7072
Folds on surface 2 : 0/1888
Folds on surface 3 : 0/14496
Folds on surface 4 : 0/26240
Folds on surface 5 : 0/54432
Folds on surface 6 : 0/11088
Folds on surface 7 : 0/7056
Folds on surface 8 : 0/15552
Folds on surface 9 : 0/3072
Folds on surface 10 : 0/47136
Folds on surface 11 : 0/27696
Folds on surface 12 : 0/17440
Folds on surface 13 : 0/17440
```

Fig: Surface folds output

51. surface_labels_to_2d_properties

Usage: ***"surface_labels_to_2d_properties [Options]"***

Options	Expansion	Description	Default value
-ifn	File Name	Input grid file with block labels.	-
-ln	Label Name	The surface label name to be converted to property. It should be followed by "-p" option.	None
-p	Property id	The property index range: [1, 64]. Note: 1 => interblk, 2 => wall...	None
-outfn	Output File Name	Output grid file name.	-

Syntax:

"gp_utilities surface_labels_to_2d_properties -ifn <input grid file name> -ln <label name> -p <property id> -ln <label2> -p <property id2> ... -outfn <output grid file name>"

Where, 2 in <-p 2> represents the property id for the 'wall' property and 5 represents the property id for the 'User 5' property

Purpose:

To convert surface labels to 2D properties. It helps in setting properties/boundary conditions faster when you have many surfaces in the fra file.

Example: *gp_utilities surface_labels_to_2d_properties -ifn blk.tmp -ln internal_sheets -p 8 -outfn gridwitpty.grd*

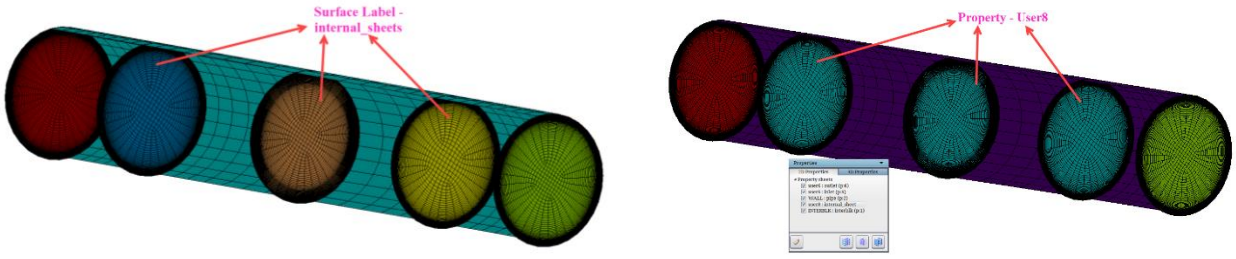


Fig: surface labels to 2d properties

52. transform_topo

Usage: ***"transform_topo [Options]"***

Options	Expansion	Description	Default value
-fn	File Name	Input file name with extension '*.fra'.	-

-g	Group Id	Corners in this group will be subjected to rigid body rotation.	None
-sg	Surface Group	Surfaces in this group will be subjected to rigid body rotation.	None
-s	Surface Id	List of surface ids. These surfaces will be subjected to rigid body rotation.	None
-t1	Translation Begin	This translation is applied before rotation.	0 0 0
-sc	Scaling	The scaling wrt origin.	1
-a	Angle	The angle of rotation.	0
-ax	Axis	The axis. The coordinates of centre followed by axis direction.	**0 0 0** *0 0 1*
-t2	Translation End	This translation is applied after rotation.	0 0 0
-m	Mirror	The mirror plane coordinates. The coordinates of a point on the plane followed by its normal.	False
-ofn	Output File Name	Output file name with extension '*.fra'.	-

Syntax:

"gp_utilities transform_topo -fn <input file name> -g <gid> -sg <surface group> -s <list of surface ids> -t1 <coordinates> -sc <scaling ratio> -a <angle> -ax <centre & normal> -t2 <coordinates> -m <centre & normal> -ofn <output file name>"

Purpose:

Rotate, transform and mirror either a given topology, surfaces or both topology and surfaces.

Example:

Before applying rigid body transformation:

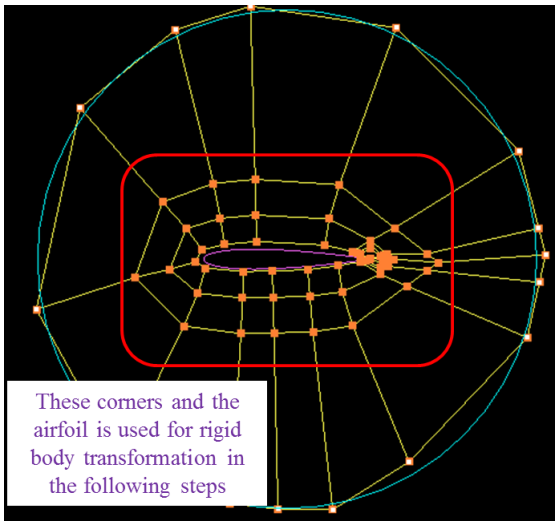


Fig: A valid Topology

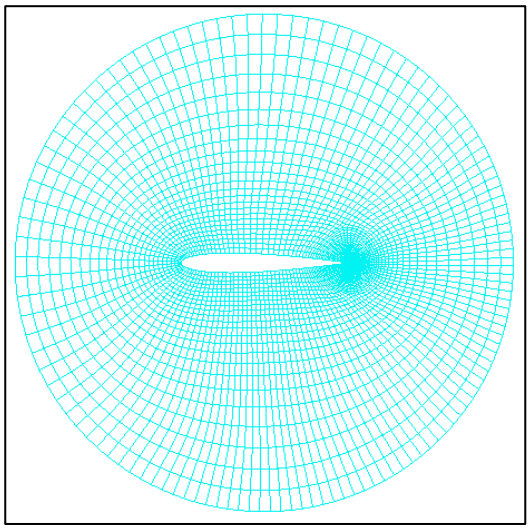


Fig: Grid for the topology

Applying Transformation: *gp_utilities transform_topo –fn airfoil.fra -g 1 -s 1 -t1 0 0.5 0 -sc 1 -ax 0 0 0 1 0 0 –ofn airfoil.transform_out.fra*

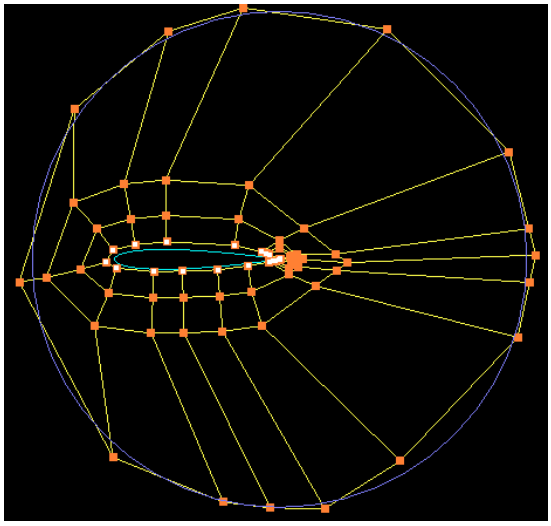


Fig: Applied Transformation (t1)

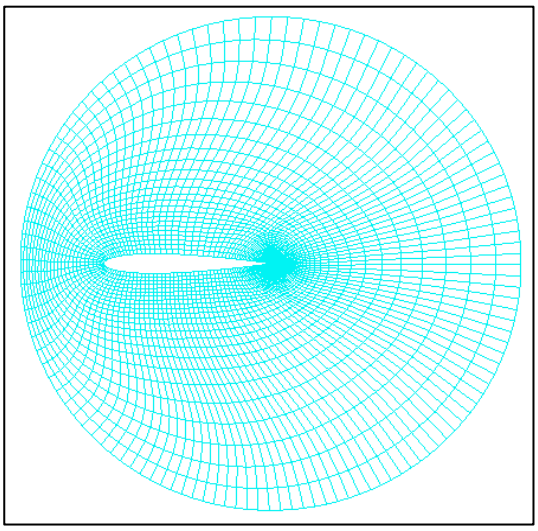


Fig: Grid for the transformed topology

Applying Rotation: *gp_utilities transform_topo -fn airfoil.fra -g 1 -s 1 -ax 0 0 0 0 0 1 -a 45 -ofn airfoil.rotate_out.fra*

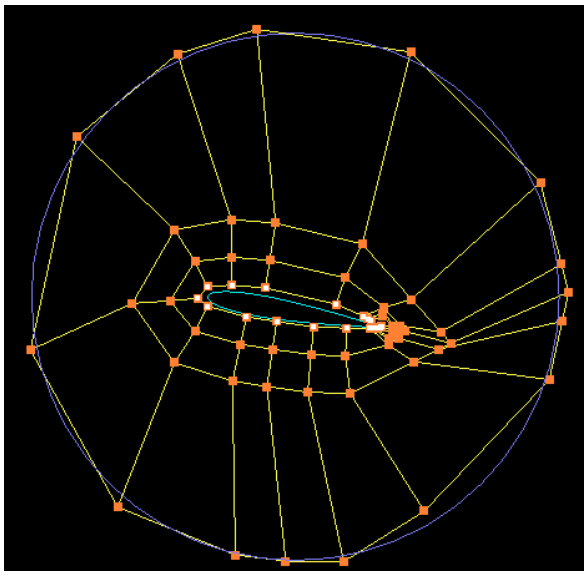


Fig: Applied rotation

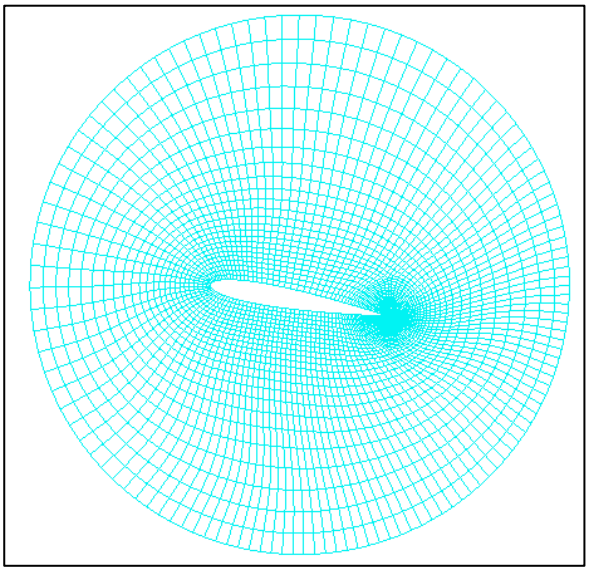


Fig: Grid for the rotated topology

Applying Mirroring: *gp_utilities transform_topo -fn airfoil.fra -g 1 -s 1 -m 0.25 0 0 1 0 0 -ofn airfoil.mirror_out.fra*

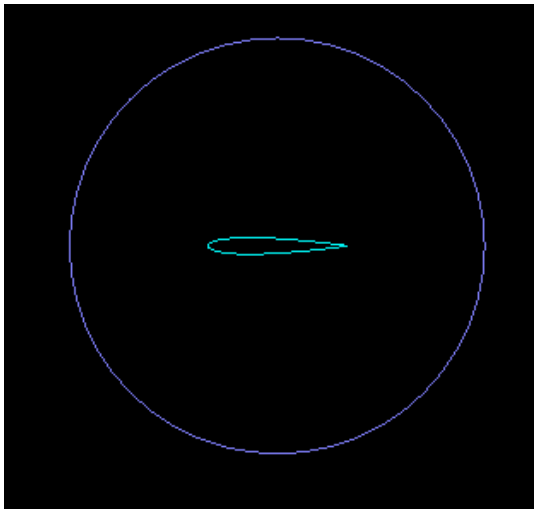


Fig: Before mirroring

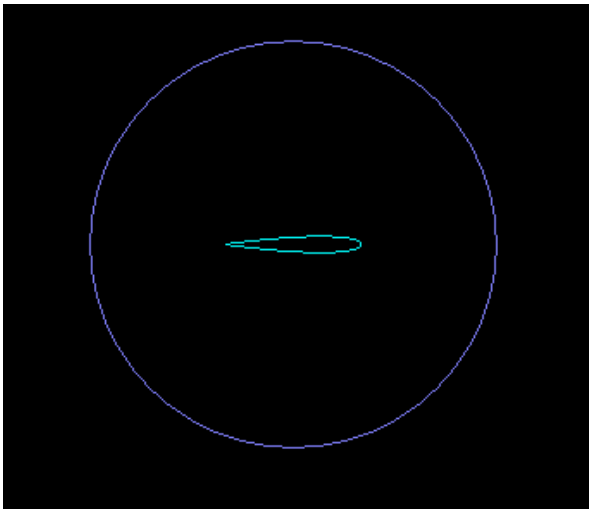


Fig: After mirroring

53. trim_grid_blocks

Usage: *"trim_grid_blocks <options>"*

Options	Expansion	Description	Default value
-ifn	File Name	Input grid file name with extension '*.grd' or '*.tmp'.	-
-s	Surface Id	List of surface ids. These surfaces will be used to identify the closed loop in the grid.	None
-p	Prefix	Prefix for the output file name.	-

Syntax:

"gp_utilities trim_grid_blocks -ifn <grid file> -s <s1> <s2> ... <sn> -p <prefix>"

Purpose:

Splits the given grid into many grids based on the input surface id's. It splits the given grid at the input surface id's location and outputs the grid.

1. The input surface id must be an *internal surface/2 sided surface*
2. If multiple surface ids are provided, then there will be n+1 grids as output. For e.g. if 3 surface id's are given, then there will be 4 output grids. Each surface id's grid will be stripped from the rest of the grid one after the other. The last grid would be the grid with the rest of the blocks.

Example:

COMMAND USED: *gp_utilities trim_grid_blocks -ifn blk.tmp -s 4 5 6 -p trim_grid*

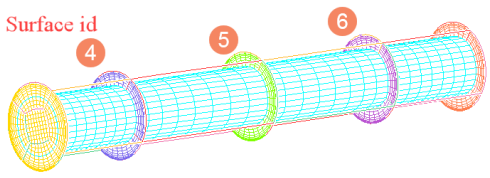


Fig: Original grid

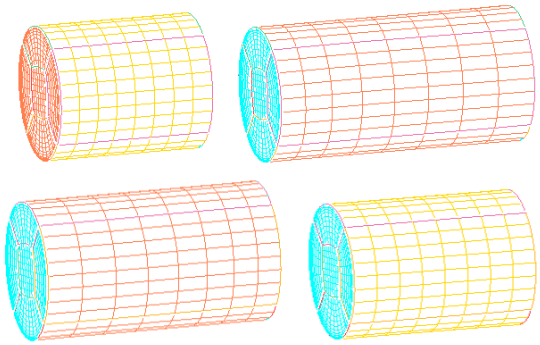


Fig: After trimming

54. tube2tria

Usage: *"tube2tria"*

Syntax:

1. *"gp_utilities tube2tria -fn <input fra file> -ofn <output fra file> -n <num nodes>"(When you have a *.fra file as input)*
2. *"gp_utilities tube2tria -ifn <tube file> -outfn <tria file> -n <num nodes>"(When you know the surface name)*

Where -n = num of nodes at each cross section

Purpose:

Convert a '*.tube' file to '*.tria' file. If a fra file is provided, it converts all the tube files used in it and output a fra with tria file names. It works only for the tube which is created using 'make tube' command.

Example:

COMMAND USED: *gp_utilities tube2tria -ifn nozzle.tube -outfn nozzle_out.tria -n 40*

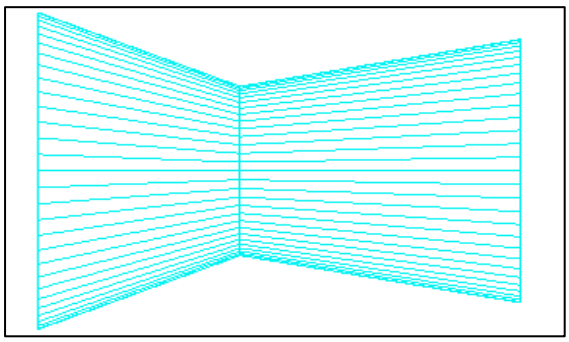


Fig: Tube file

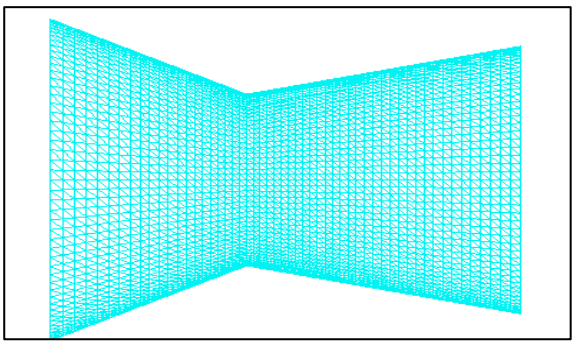


Fig: Tria file

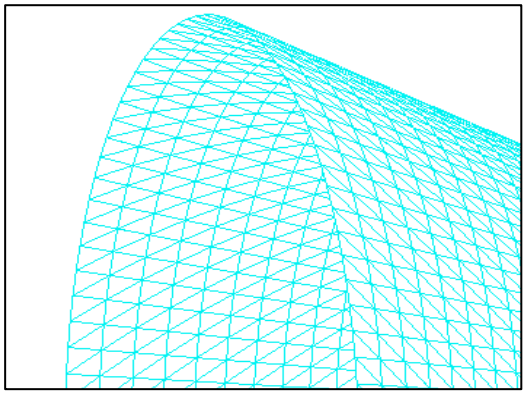


Fig: Zoomed Tria file

55. tube_from_curves

Usage: ***"tube_from_curves [Options]"***

Options	Expansion	Description	Default value
-csfn	Cross Section File Name	Input Circular path linear curve with extension '.lin'. Should be a circular arc or full circle.	-
-ifn	Profile File Name	Profile linear curve following the axis of the tube.	-
-outfn	Output File Name	Output tube surface.	-

Syntax: *ws tube_from_curves -csfn <cross sectional curve file> -ifn <input lin> -outfn <output tube>*

Purpose:

Create a tube surface from a profile curve and a cross sectional circular arc.

Example:

COMMAND USED: *ws tube_from_curves -csfn endwall_temp.lin -ifn inlet_temp.lin -outfn outlet_curve.tube*

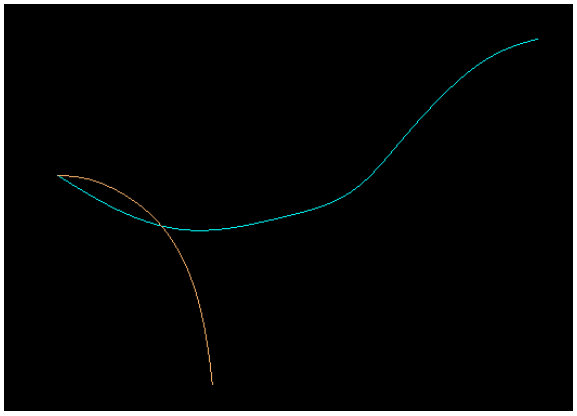


Fig: The profile curve (in blue) and circular arc (in brown)

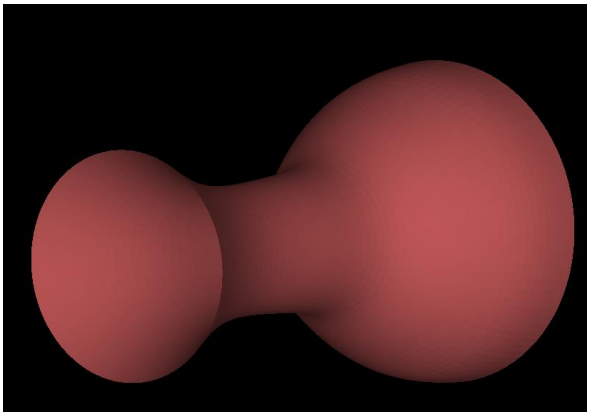


Fig. The created .tube surface

56. 2dto3d

Usage: ***"2dto3d [Options]"***

Options	Expansion	Description	Default value
-ifn	Input Grid File Name	Input grid file name with extension '*.tmp'/'*.grd'.	-
-tx	Translation along X direction	Translation distance along the X direction.	1
-ty	Translation along Y direction	Translation distance along the Y direction.	1
-tz	Translation along Z direction	Translation distance along the Z direction.	1
-ns	Number of Sections	Number of grid points needed along the protruded direction.	9
-outfn	Output Grid File Name	Output grid file name with extension '*.tmp'/'*.grd'.	-

Syntax:

"gp_utilities 2dto3d -ifn <Input Grid File name> -tx <Distance along X direction> -ty <Distance along Y direction> -tz <Distance along Z direction> -ns <Number of grid points> -outfn <Output Grid File Name>"

Purpose:

Converts a 2D grid to 3D grid for a given distance and no. of grid points.

Example:

COMMAND USED: *gp_utilities 2dto3d -ifn blk.tmp -tz 1 -ns 9 -outfn 3dgrid.grd* (Protruding along Z direction, as the grid is on XY plane.)

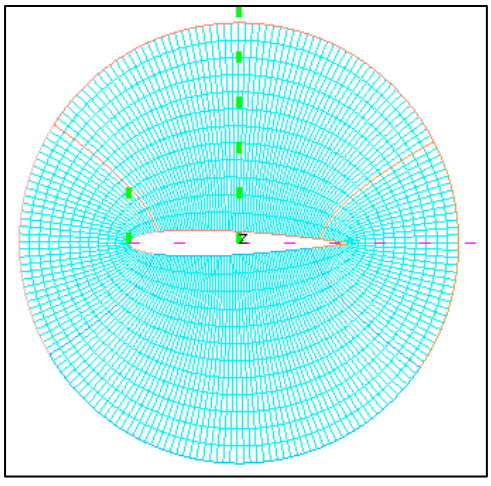


Fig: 2D grid

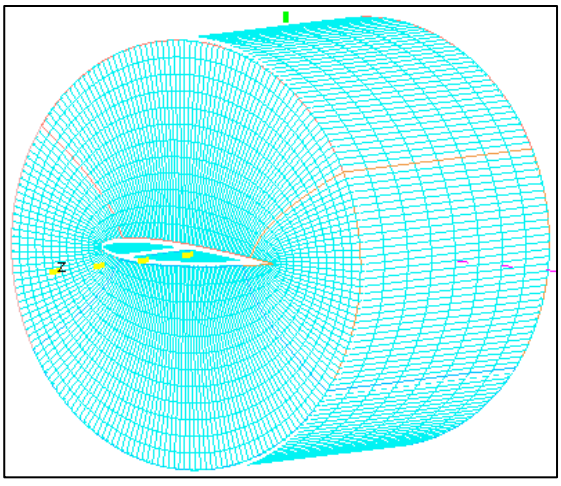


Fig: 3D grid

57. extconn

Usage: *"extconn [Options]"*

Options	Expansion	Description	Default value
-ifn	Input Grid File Name	Input grid file name with extension '*.tmp'/'*.grd'.	-
-outfn	Output Grid File Name	Output grid file name with extension '*.tmp'/'*.grd'.	-
-tol	Tolerance	Tolerance used for overlapping the periodic interfaces.	1e-6

Syntax:

"ws extconn -ifn <Input Grid File Name> -outfn <Output Grid File Name> -tol <Tolerance>

Purpose:

Generate a full grid from a periodic grid.

Example:

COMMAND USED: *ws extconn -ifn blk.tmp -outfn output.grd -tol 1e-3*

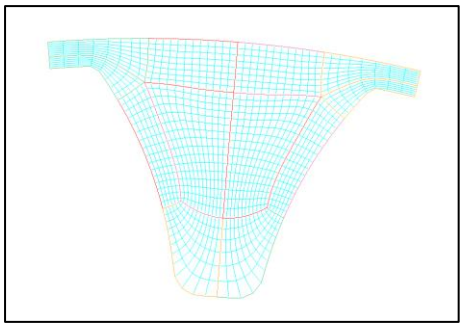


Fig: Before Transformation

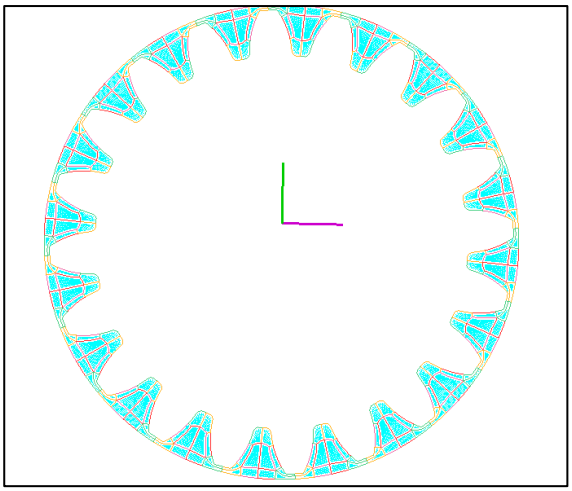


Fig: After Transformation