

GridPro Utilities Manual

Version 1.5



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1. *asciiToBinary*

Usage: “*asciiToBinary*”

Syntax:

“*gp_utilities asciiToBinary* <Input Grid File Name> <Output Grid File Name>”

NOTE: UNIX users need not type “*gp_utilities*” (highlighted in the above syntax) while executing the command.

For e.g.: “*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 *GridPro* 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. <ul style="list-style-type: none">• 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*

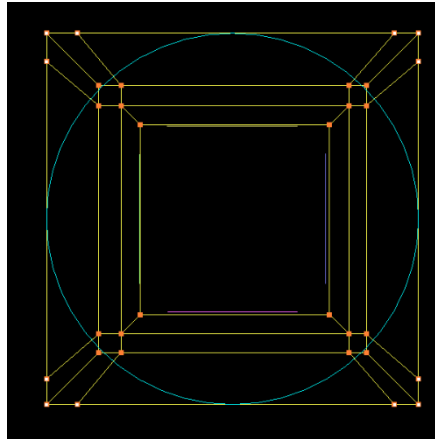


Fig: Topology with Mildly severe singularity

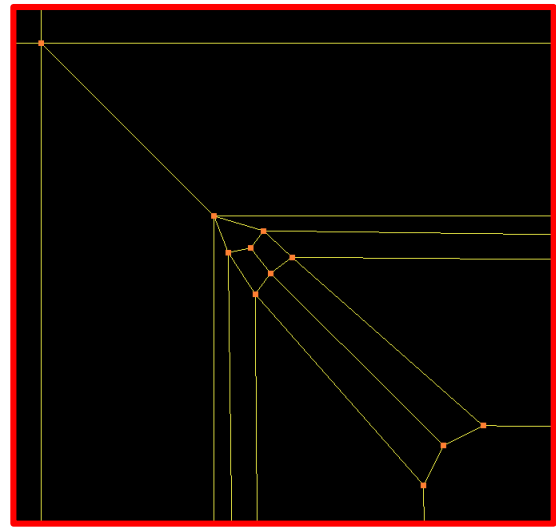
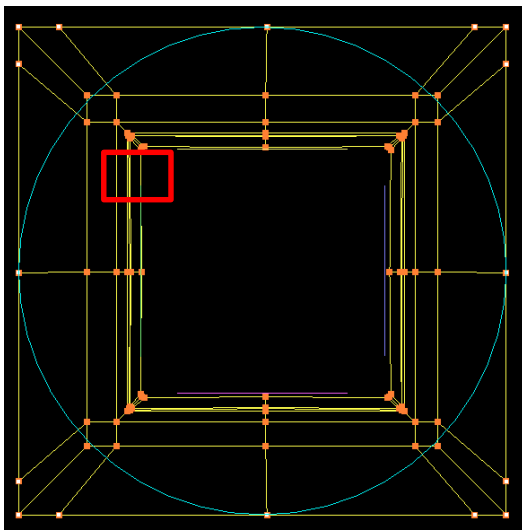


Fig: After using autofix

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`

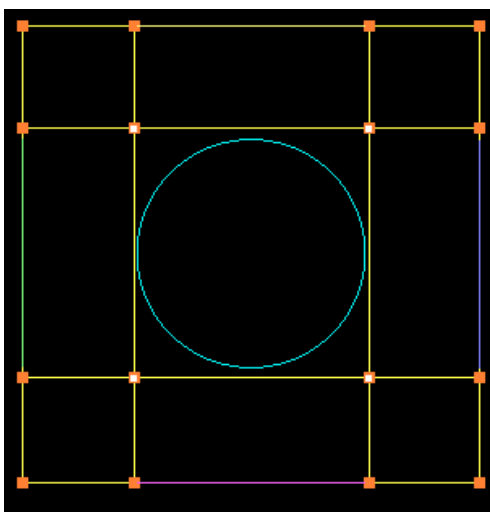


Fig: Topology with Mediumly severe singularity

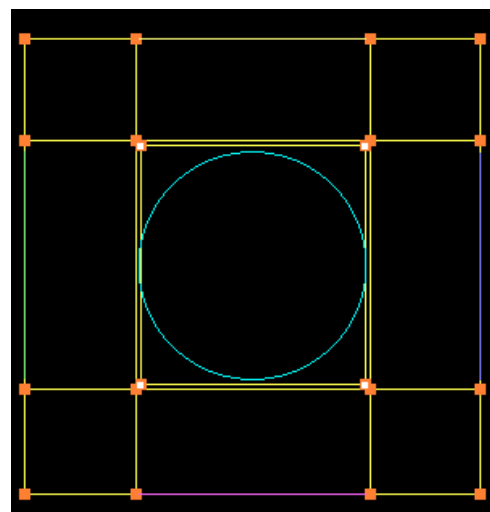


Fig: After using autofix

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`

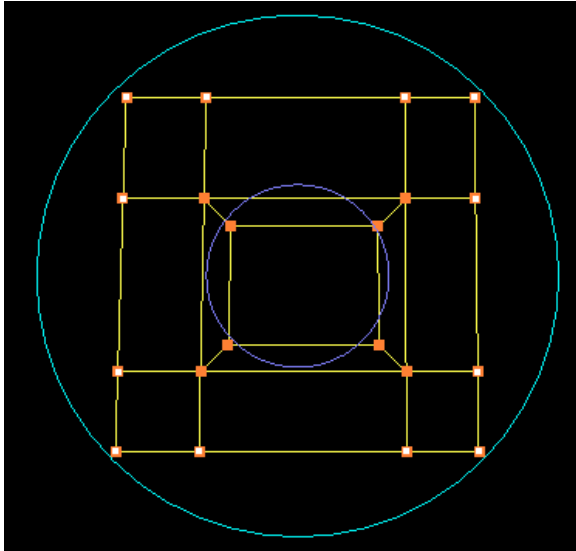


Fig: Topology with Very severe singularity

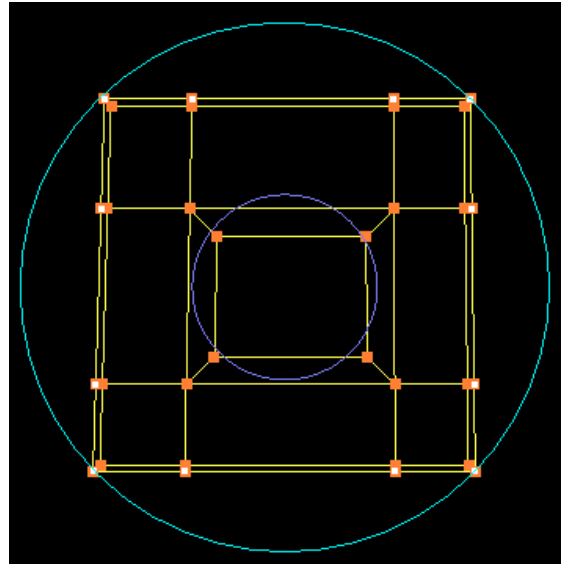


Fig: After using autofix

3. *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 *GridPro* grid format.
2. The respective ‘*.conn’ file is needed to execute this command.

4. *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*

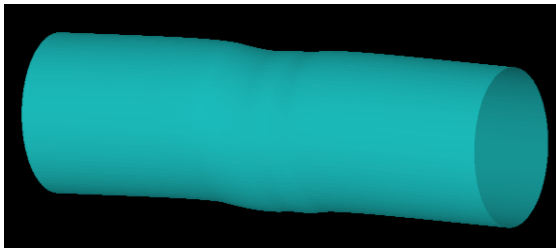


Fig: Open tube

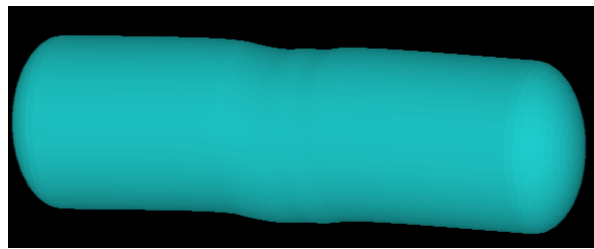


Fig: Closed tube

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.

5. *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*

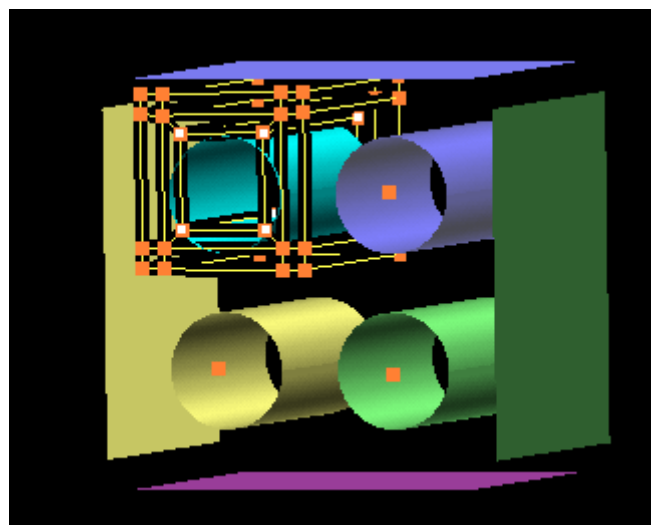


Fig: Showing the topology and corners to which the topology should be duplicated.

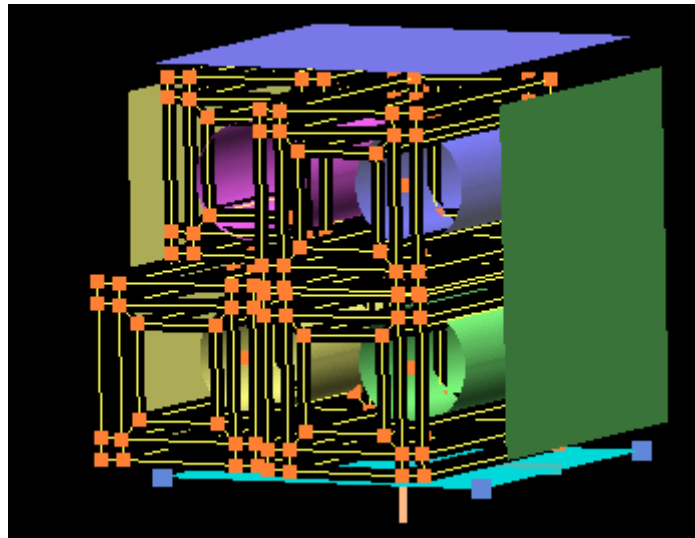


Fig: Showing the topology after the duplication.

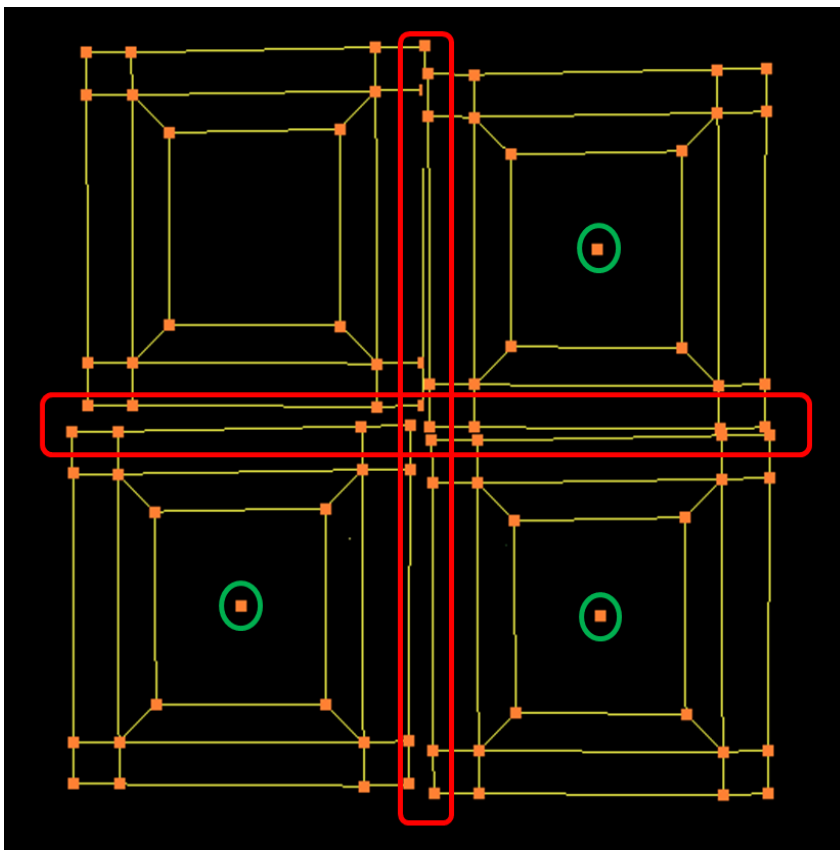
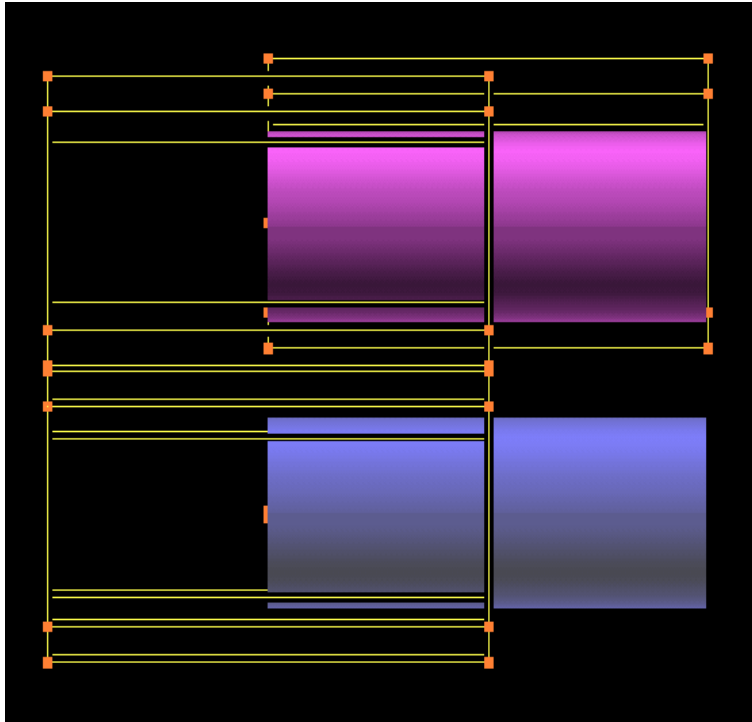


Fig: Front view of the topology after the duplication.

- 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.

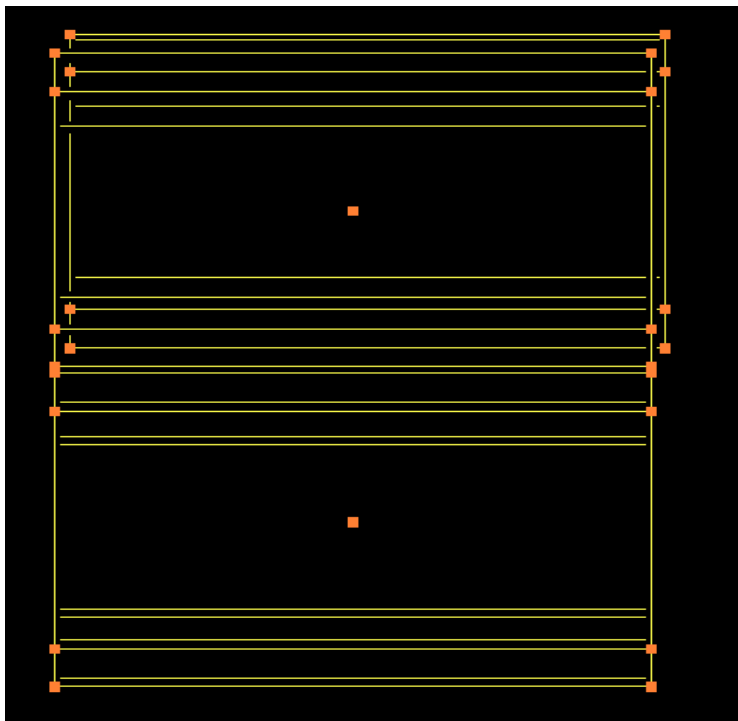


- Here the master corners are placed at the front side of the cylinders.

- 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.



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

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

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

6. *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	-

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
GridPro multi block grid	PLOT3d	<i>change_format -ifn <GridPro grid format> -outfn <*.plot3d></i>
	CFL3d	<i>change_format -ifn <GridPro grid format> -outfn <*.cfl3d></i>
	NSU3d	<i>change_format -ifn <GridPro grid format> -outfn <*.nsu3d></i>
	OpenFOAM	<i>change_format -ifn <GridPro grid format> -outfn <*.foam></i>
	CGNS	<i>change_format -ifn <GridPro grid format> -outfn <*.cgns></i>
	FLUENT	<i>change_format -ifn <GridPro grid format> -outfn <*.msh></i>
IGES	STEP	<i>change_format -ifn <*.iges> -outfn <*.step></i>
	STL	<i>change_format -ifn <*.iges> -outfn <*.stl></i>

Example: To convert a GridPro grid to Open Foam

gp_utilities change_format -ifn blk.tmp -outfn grid.foam

Note:

1. Extension should be used for both input & output file to determine the format.

7. *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

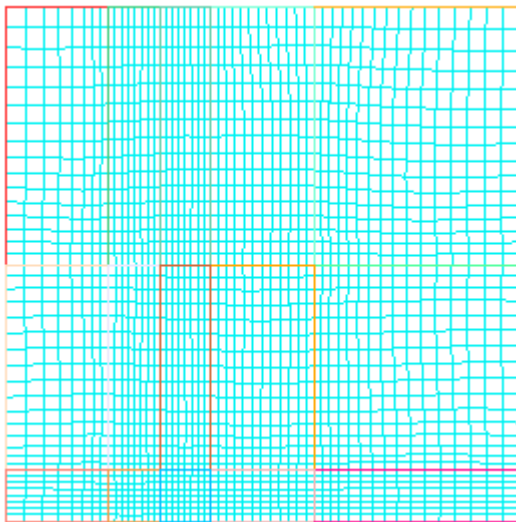


Fig: Before Transform

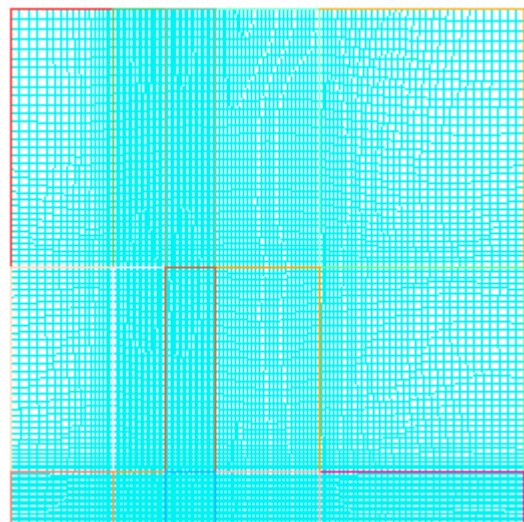


Fig: After Transform

Note:

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

8. *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*

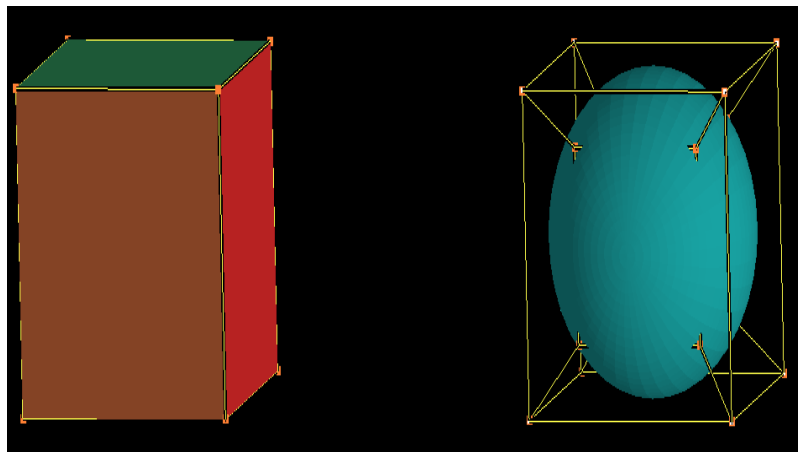


Fig: Two disjoint valid topology in the same window

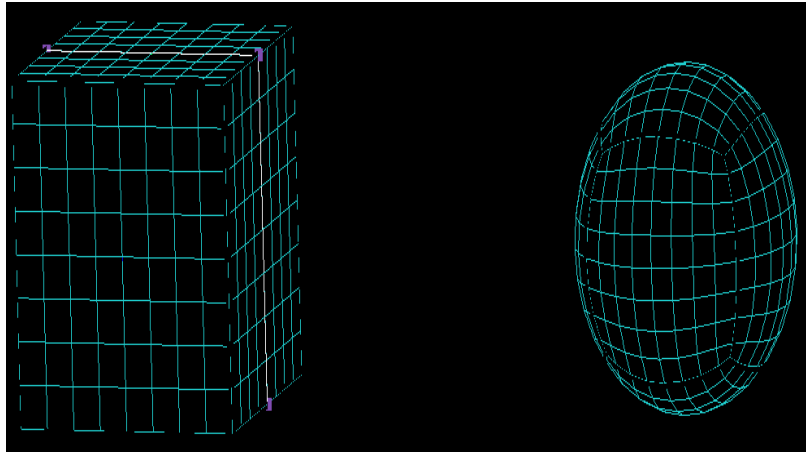


Fig: Two disjoint grid in the same window

Note:

- 1) 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.
- 2) The ‘number of sweeps’ option should be a multiple of 1000.

9. *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 -fg 1 -ofn car_out.fra`

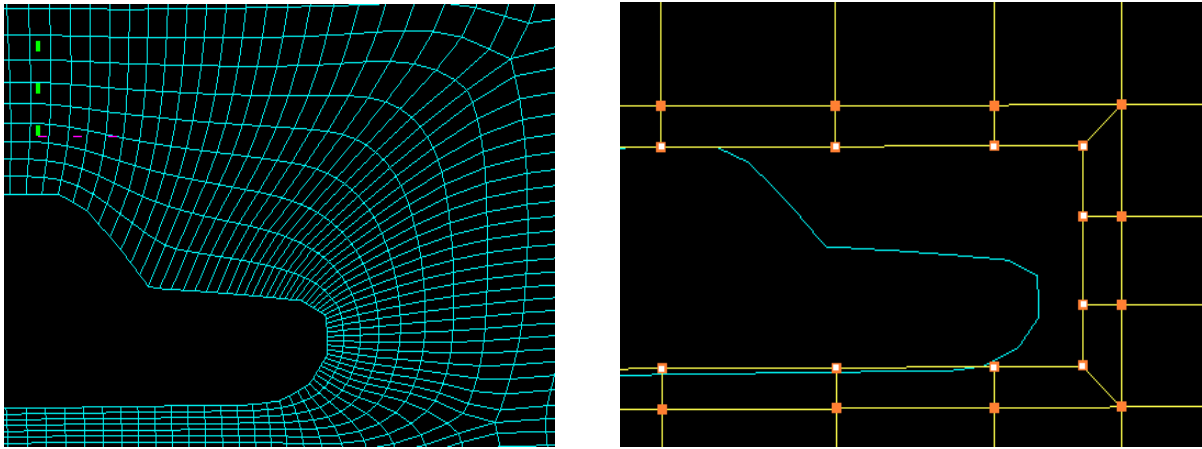


Fig: Topology and grid before compact enrichment

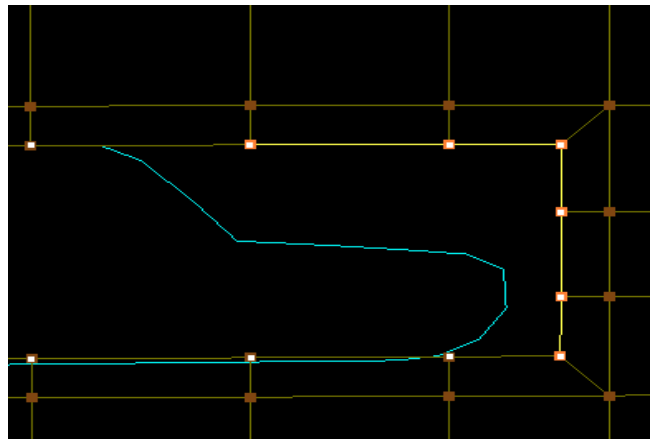


Fig: Corner group used for compact enrichment

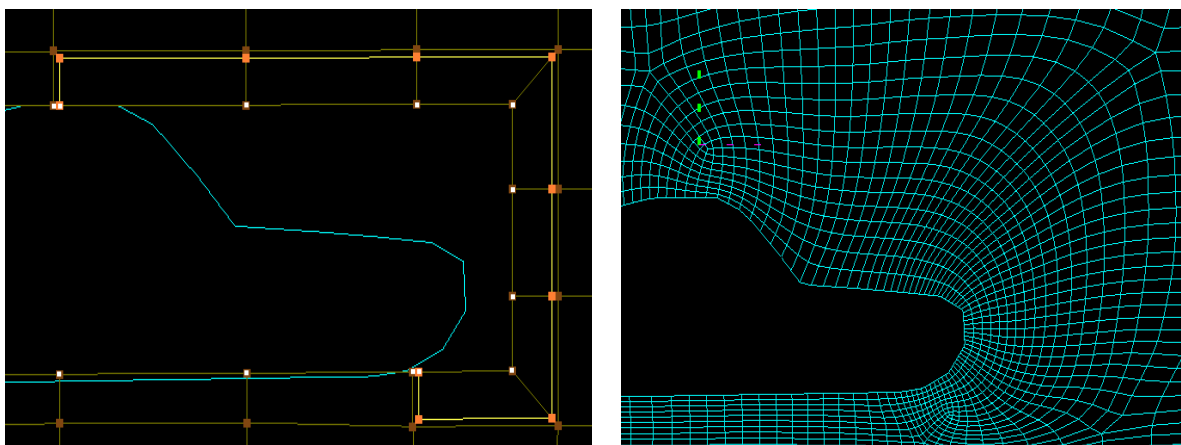


Fig: Topology and grid after compact enrichment

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.

10. *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*

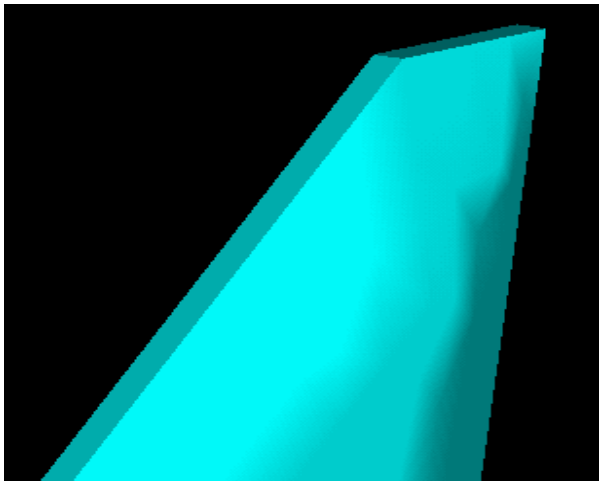


Fig: A wing surface with sharp edges

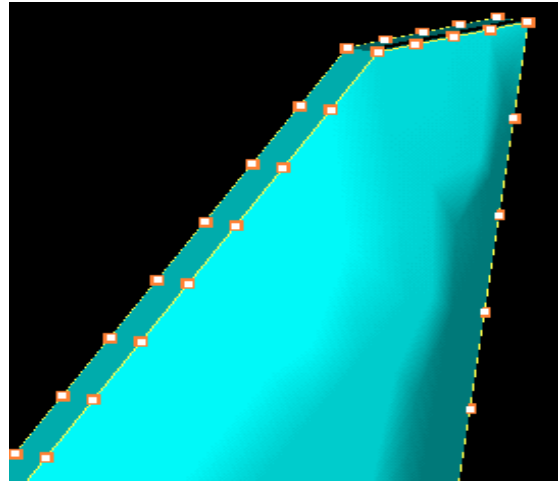


Fig: Corners created on the wing's sharp edges

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.

11. *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*

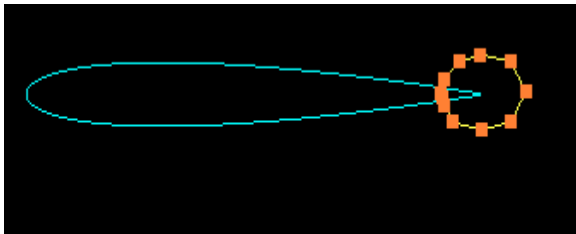


Fig: Corner group used for generating linear curve

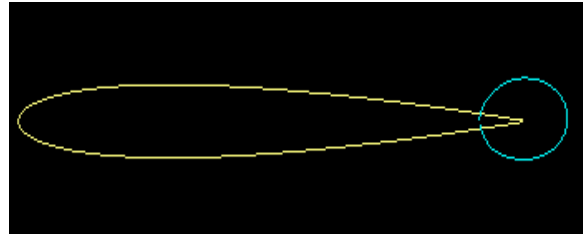


Fig: Curve generated from the corner group

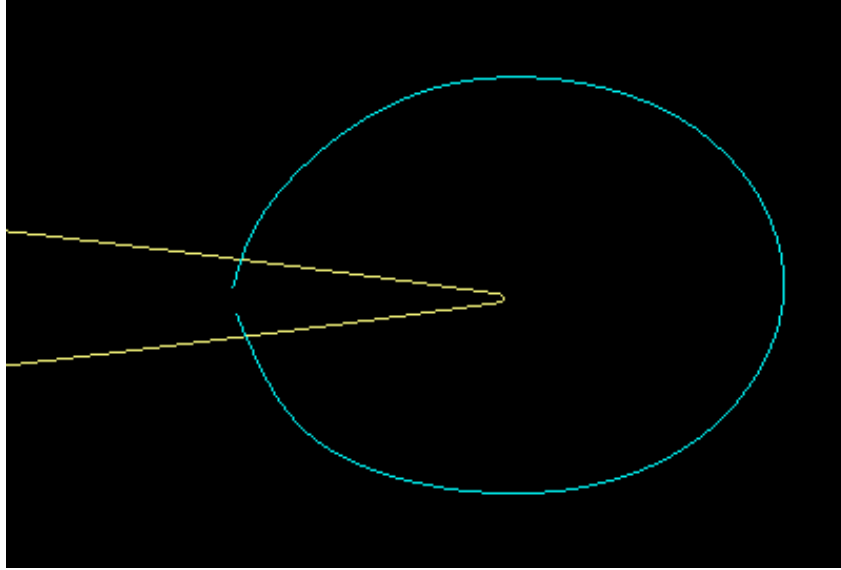


Fig: Curve generated from the corner group

Note:

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

12. *hex2emb*

Usage: “*hex2emb [Options]*”

Options	Expansion	Description	Default value
-P2d	<i>Property 2D</i>	Do not merge blocks with faces having the property name specified with another block with different property.	-
-P3d	<i>Property 3D</i>	Do not merge blocks with faces having the property name specified with another block with different property.	-
-S	<i>Surface Id</i>	Do not merge blocks with faces assigned to the specified surface to another block whose face has been assigned to a different surface.	-
-L	<i>Label Name</i>	Do not merge blocks whose block/Face labels are different.	-
-I	<i>Internal Surface Id</i>	Do not merge blocks which are separated by internal surface.	-
-PA	<i>All Property</i>	Do not merge blocks which have different properties.	-
-LA	<i>All Label</i>	Do not merge blocks which have different labels.	-
-SA	<i>All Surface</i>	Do not merge blocks which have their faces assigned to different surfaces.	-

-IA	<i>All Internal Surface</i>	Do not merge blocks which are separated by any internal surface.	-
-mg	<i>Multi Block Grid</i>	Assume that the input file is a Multi Block Grid.	-
-ug	<i>Unstructured Grid</i>	Assume that the input file is an Unstructured Hex Grid.	-
-o	Output File Name	Output file name with extension '*.grd'.	-

Syntax:

“gp_utilities hex2emb <Input Grid file name> -P2d <Property name> -P3d <Property name> -S <Surface id> -L <Label name> -I <Internal surface id> -PA -LA -SA -IA -mg -ug -o <Output file name>”

Purpose:

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

Example:

COMMAND USED: gp_utilities hex2emb blk.tmp -mg -o output.grd

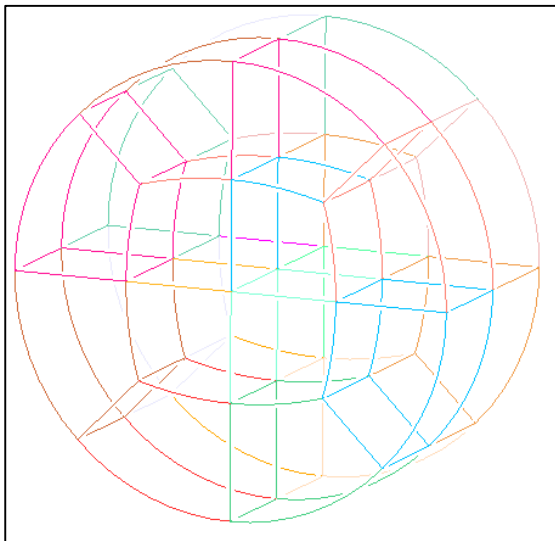


Fig: Multiblock grid contains 24 blocks

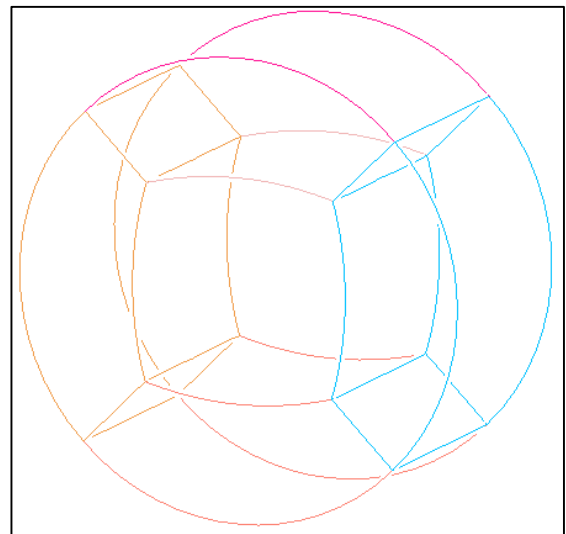


Fig: Multiblock grid reduced to 5 blocks

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".

13. *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.

Example:

Single Intersection:

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

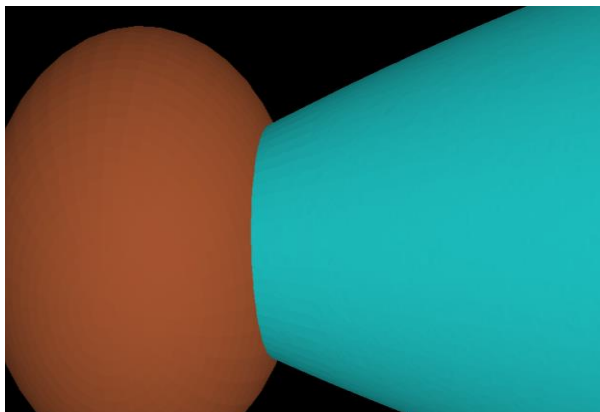


Fig: Two intersecting surfaces

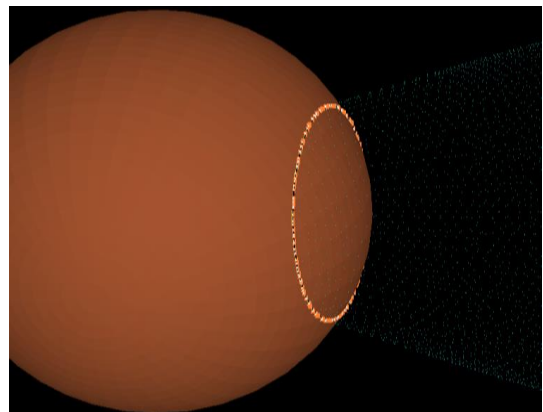


Fig: Corners created on the intersection

Multiple Intersections:

COMMAND USED: *gp_utilities intersection -fn cylinder.fra -is 1 2 -ofn cylinder_out.fra*

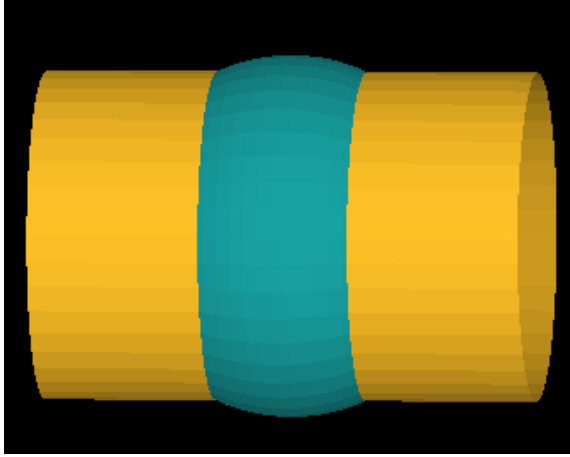


Fig: Two intersecting surfaces

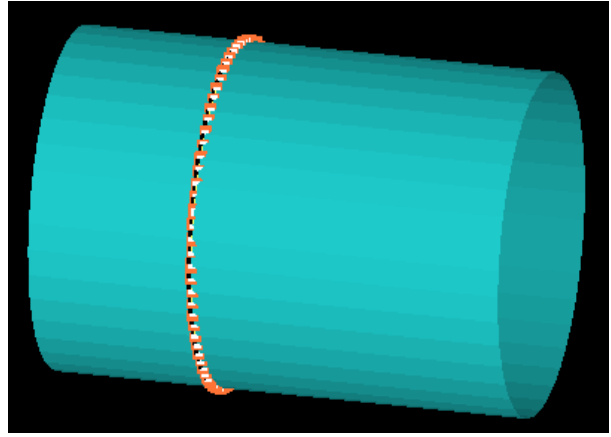


Fig: Corners created on the intersection

Notes:

1. If there are multiple intersections, it will output only one set of intersection corners.

14. *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*

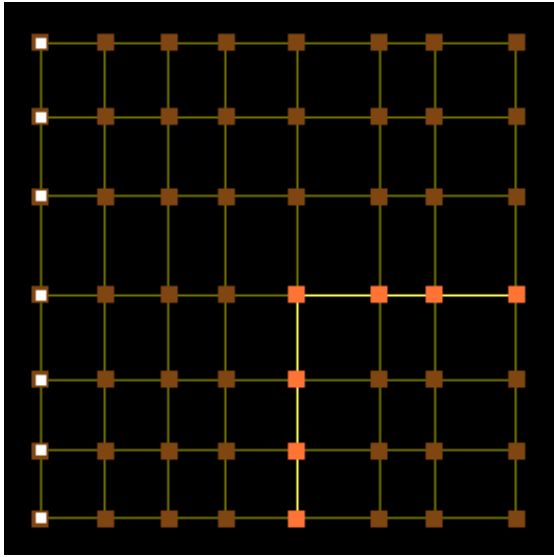


Fig: Corner group for internal wrap

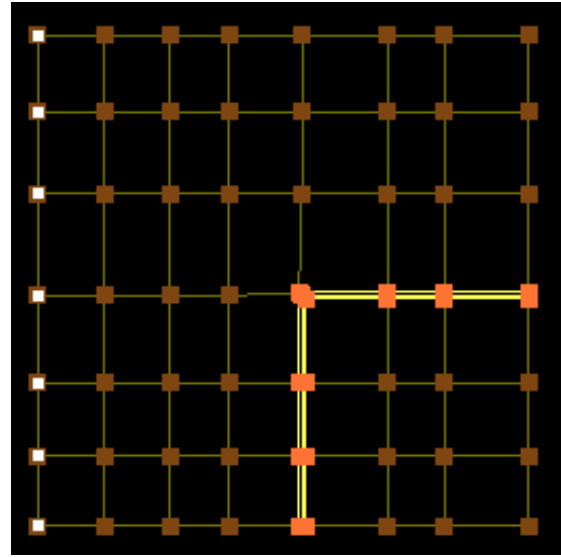


Fig: After internal wrap

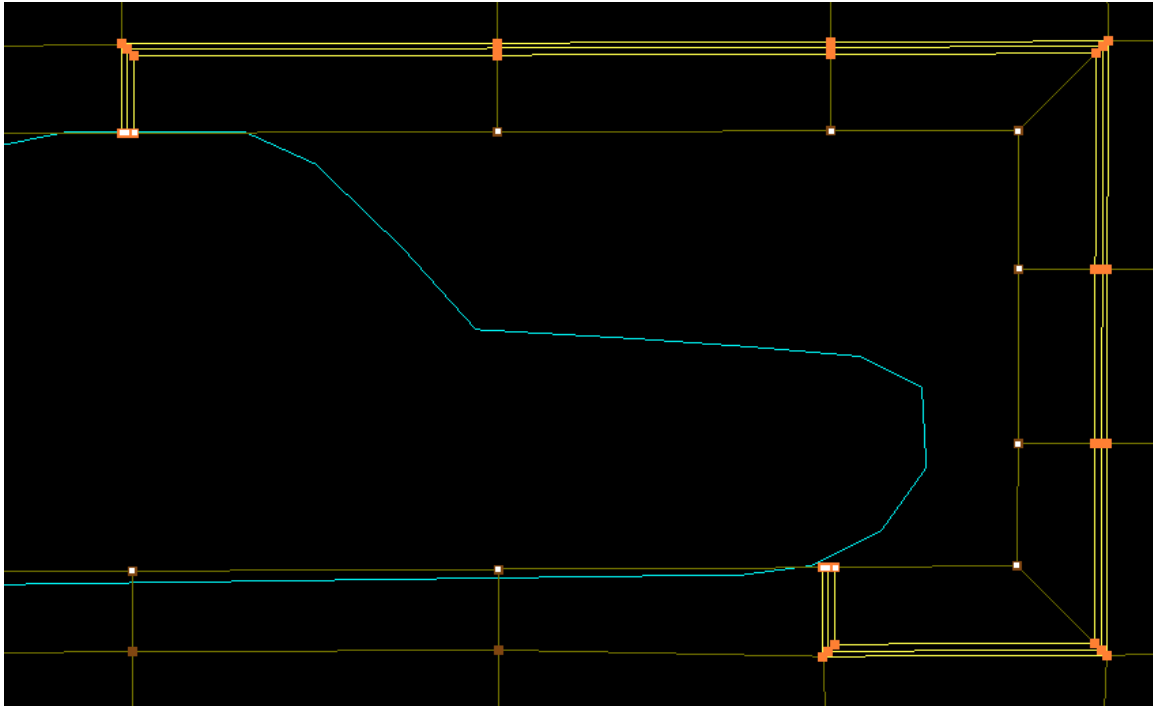


Fig: Internal wrap is used for refining an area of the grid without affecting the far field.

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.

15. *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*

16. *labels_to_properties*

Usage: “*labels_to_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 labels_to_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 labels_to_properties -ifn blk.tmp -ln geometry -p 2 -ln plane1 -p 3 -outfn gridwitpty.grd*

17. *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`

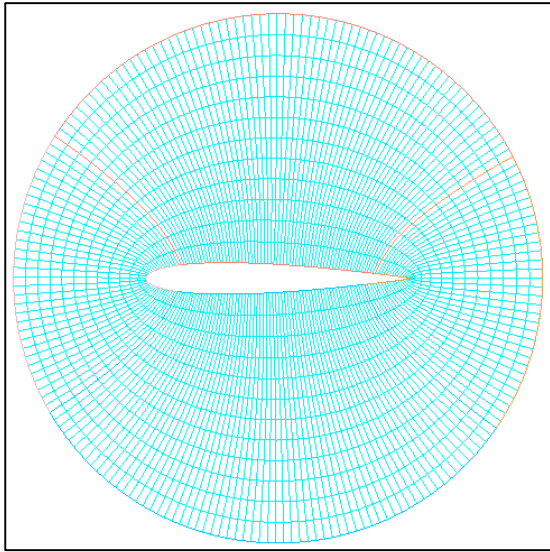


Fig: Before Clustering

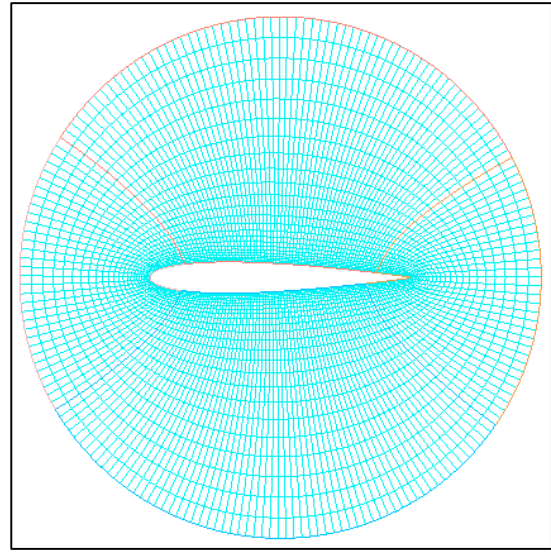


Fig: After Clustering

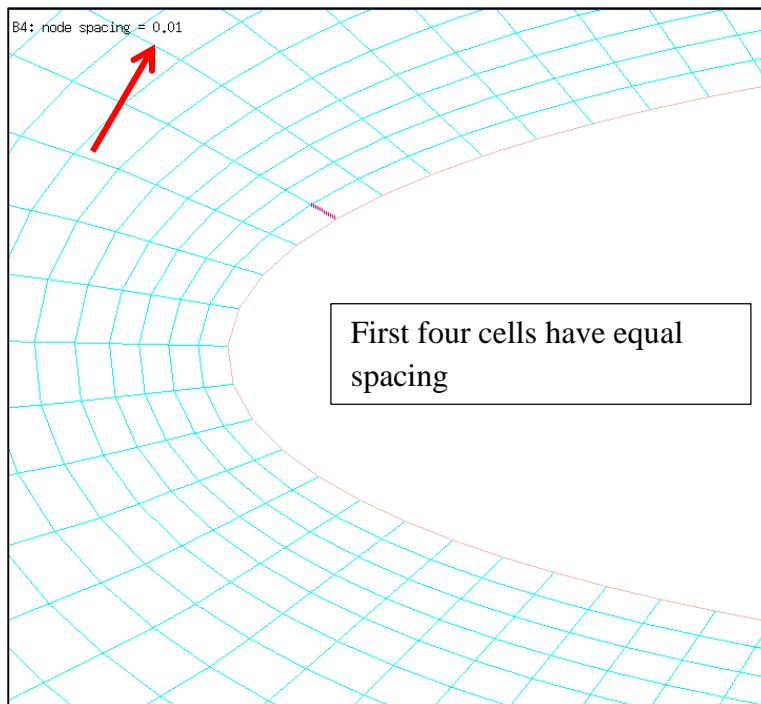


Fig: Clustered grid with the given spacing.

Notes:

1. The sign of “surfnun” indicates the direction of desired clustering for an internal surface.

18. *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 _az.fra -dn surface -ofn az.fra*

19. *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`

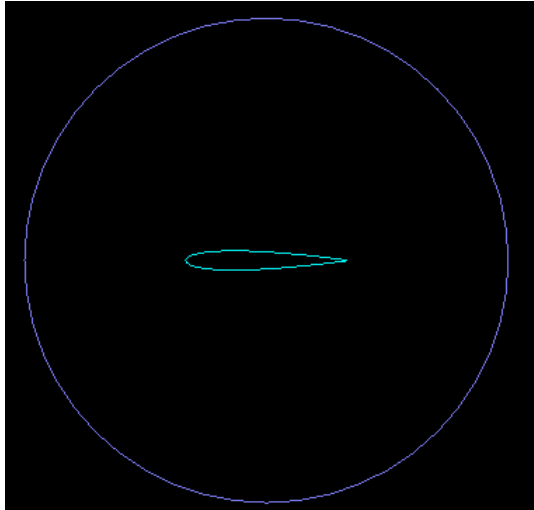


Fig: Surface used for offset.

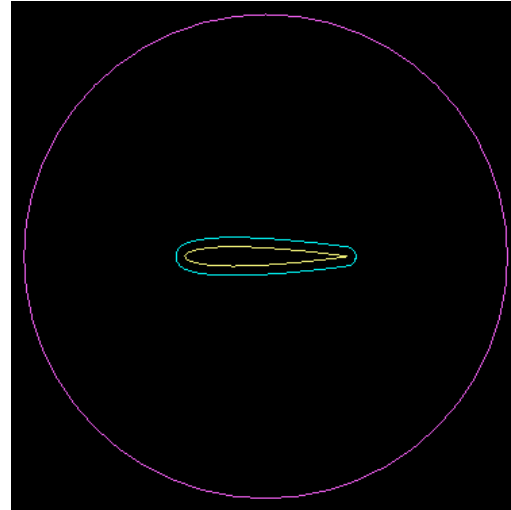


Fig: After offsetting the surface with a ratio 0.1

20. *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.	-
-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*”

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`

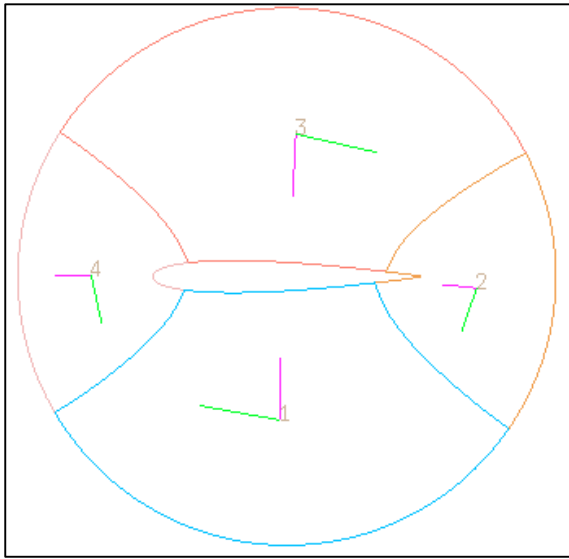


Fig: Before orienting the grid axes option

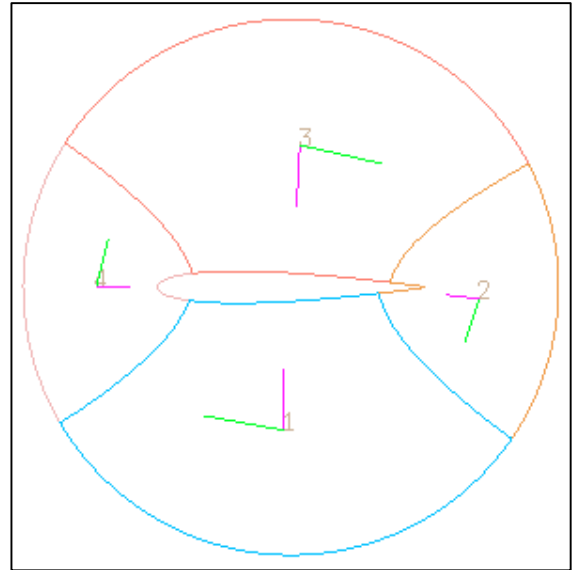


Fig: Oriented the grid axes using the '-mvar'

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`

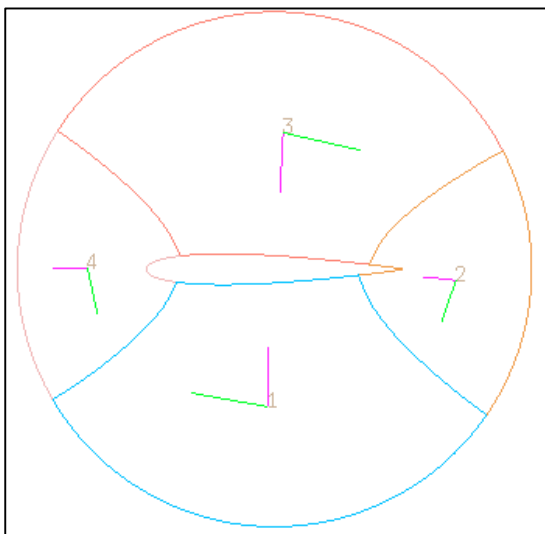


Fig: Before orienting the grid axes

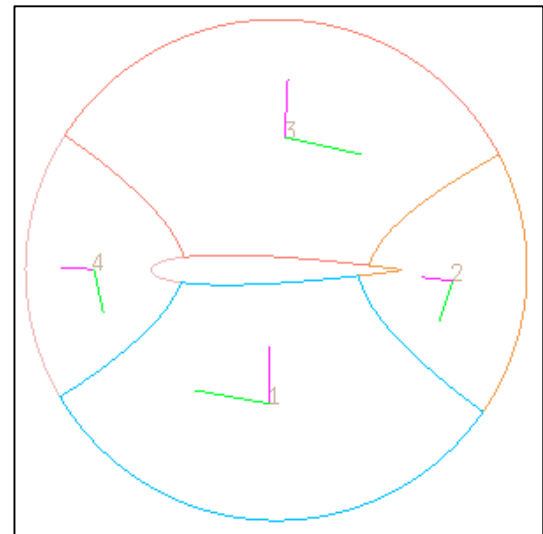


Fig: Oriented the grid axes of block 3

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.

21. *periodic2complete*

Usage: “*periodic2complete* [Options]”

Options	Expansion	Description	Default value
-fn	File name	Input file name with extension ‘*.fra’	-
-ofn	Output file name	Output file name with extension ‘*.fra’.	-

Syntax:

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

Purpose:

Duplicate the periodic topology using the given periodicity and outputs a full valid topology.

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

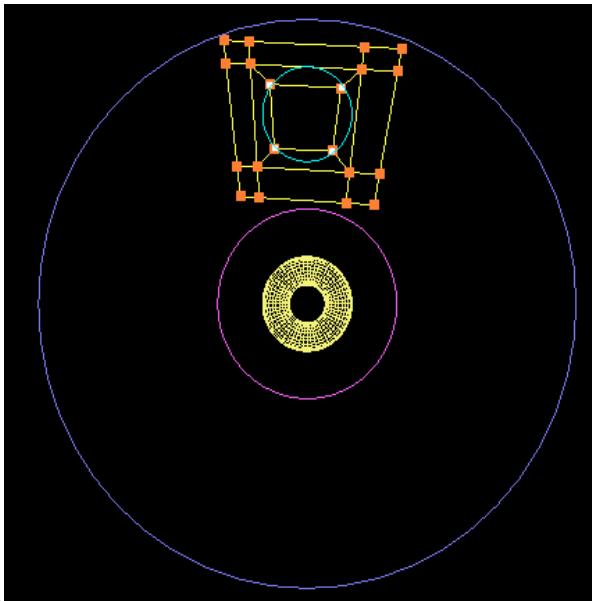


Fig: Periodic topology with periodicity 60

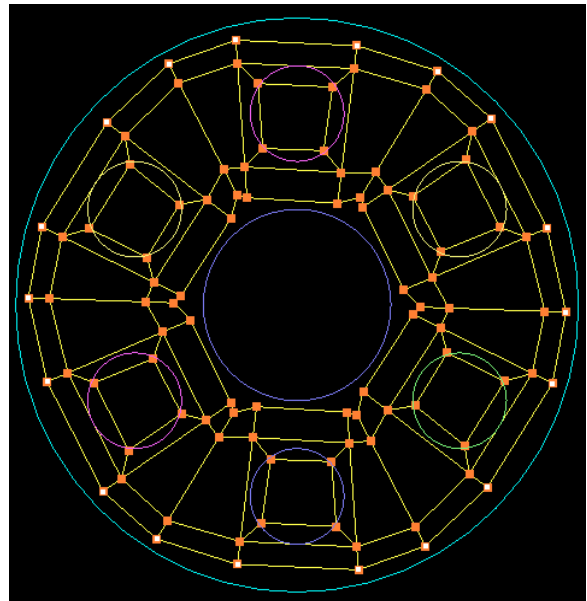


Fig: Regular topology derived from the periodic topology

22. *qchk*

Usage: “*qchk*”

Syntax:

“*gp_utilities qchk* <Minimum no. of bad volumes(0 to 1)> <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:

COMMAND USED: *gp_utilities qchk* wing.grd 1 200 0.15 75

23. *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

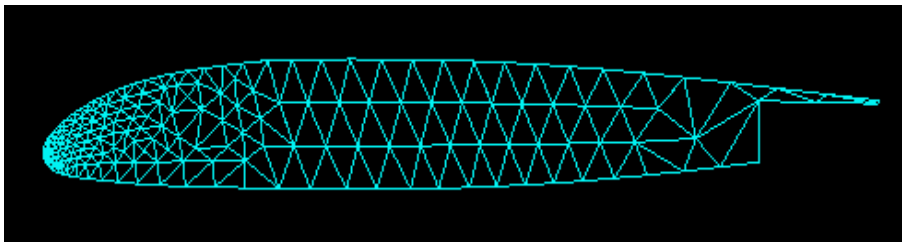


Fig: Before refinement

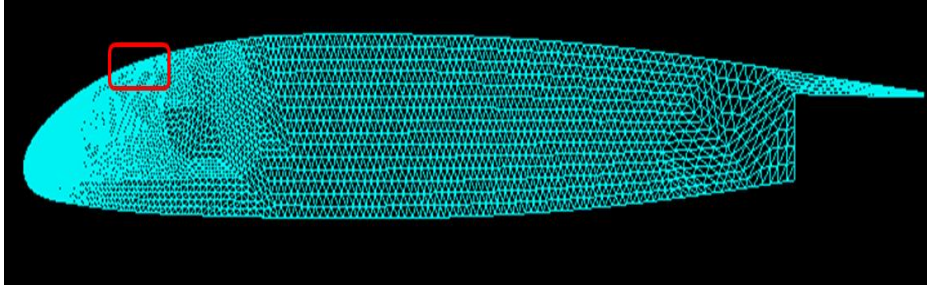


Fig: After refinement

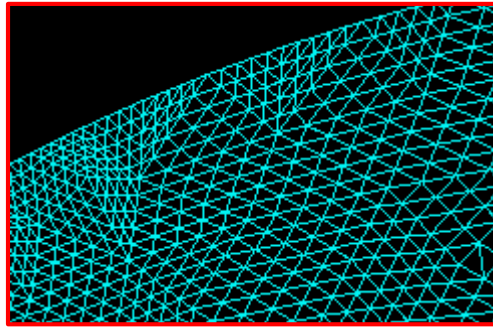


Fig: Zoomed image

24. *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’.	-

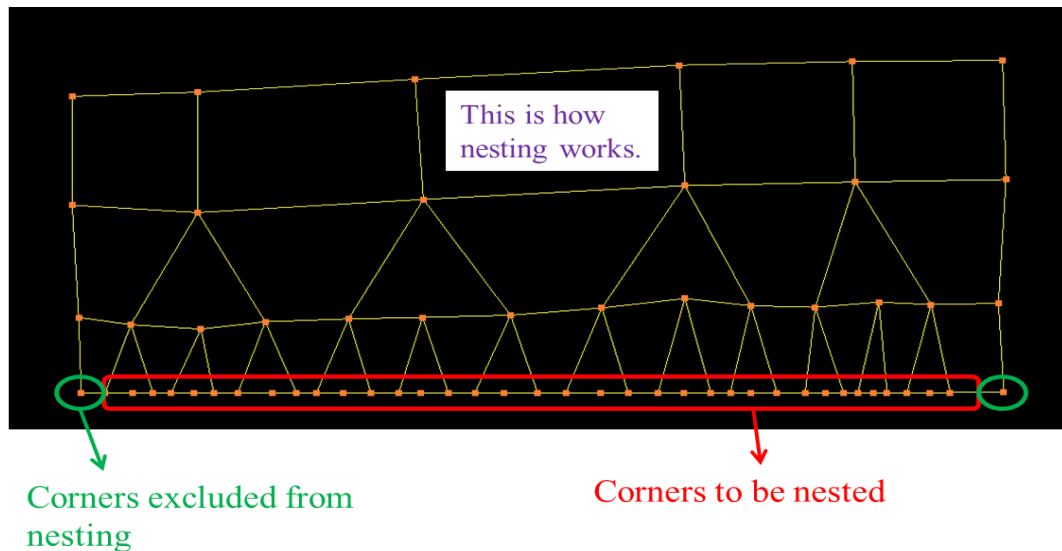
Syntax:

“*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 reverse_nest_out.fra`



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

Note:

1. 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.

25. *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*

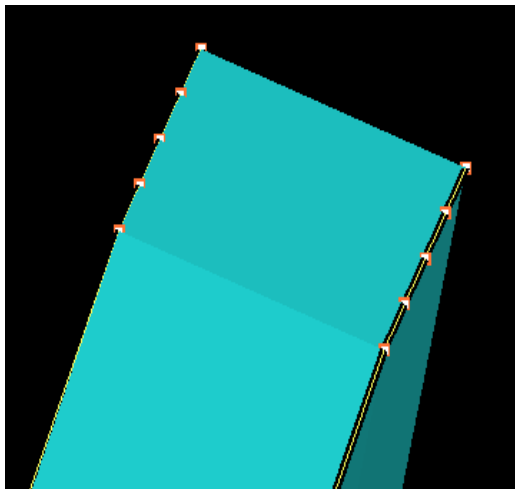


Fig: Surface with feature corners

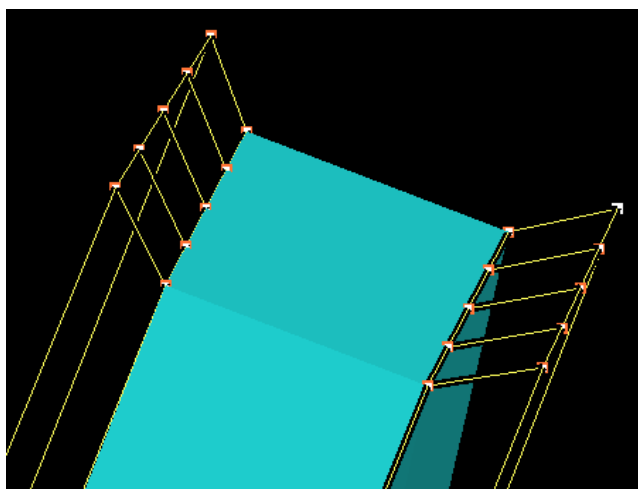


Fig: Surface with ribbon corners

26. *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*

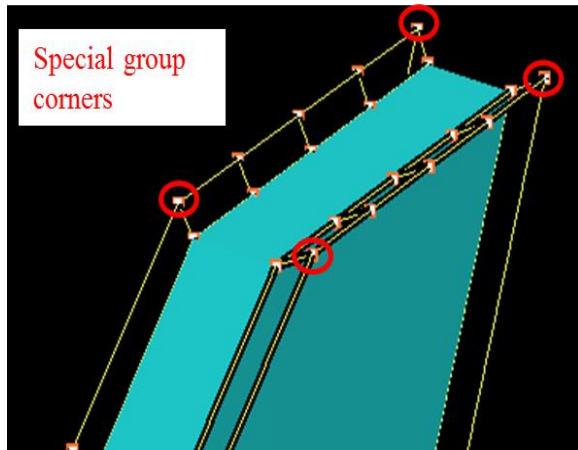


Fig: Surface with ribbon corners

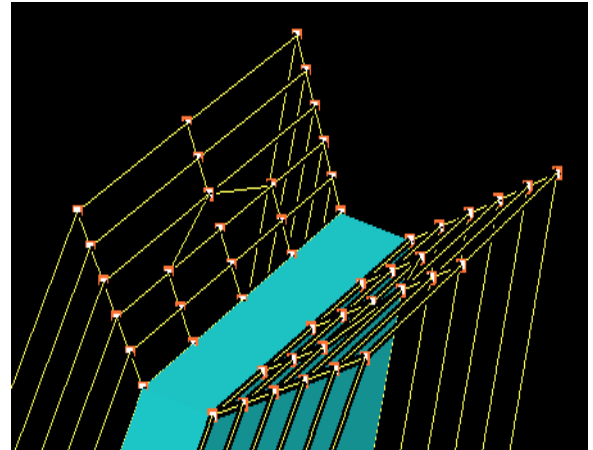


Fig: After reverse nest

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.

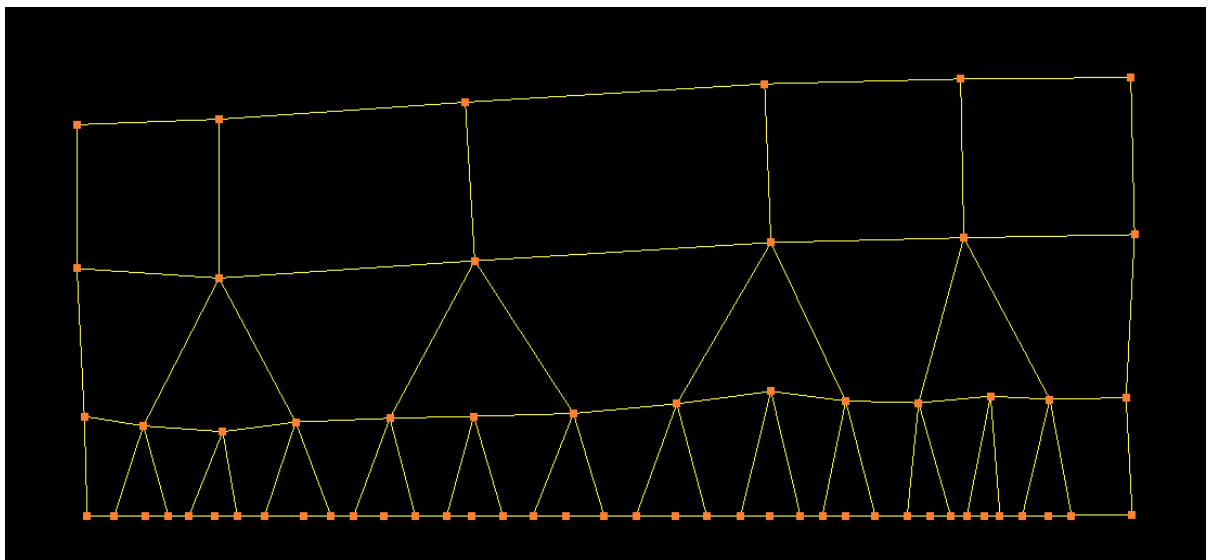


Fig: Showing how the ribbon nest works to reduce the number of corners with each layer.

27. *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 max-min angles. Note that -i option should not be used if it is specified.	None
-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*

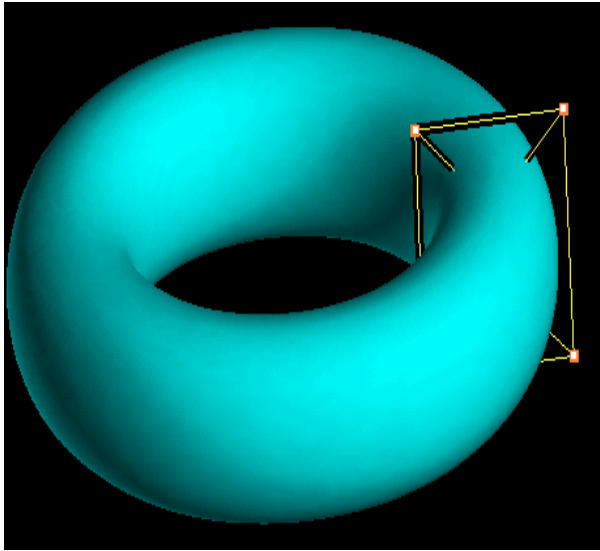


Fig: Topology for rotation

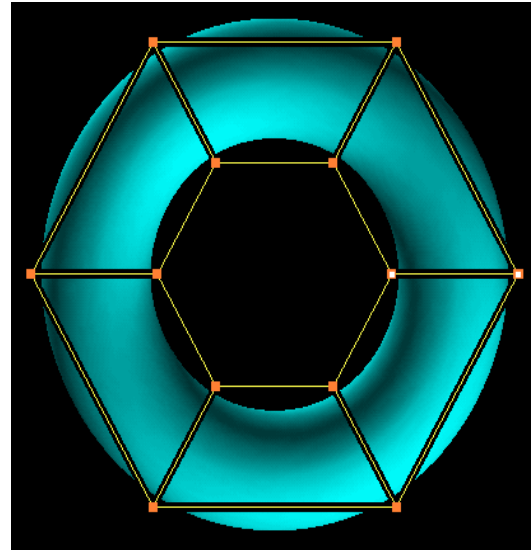


Fig: Topology after rotation

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*

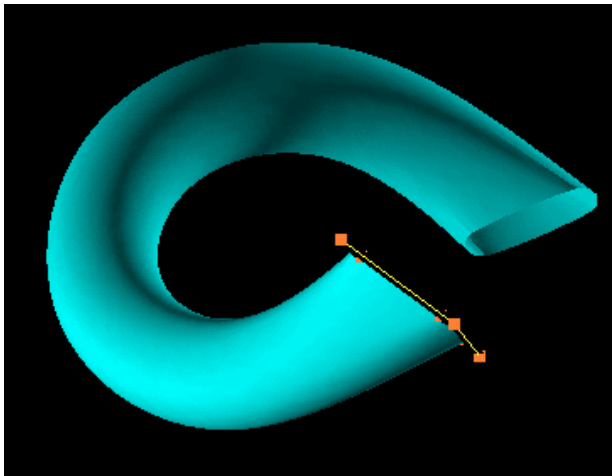


Fig: Topology for rotation

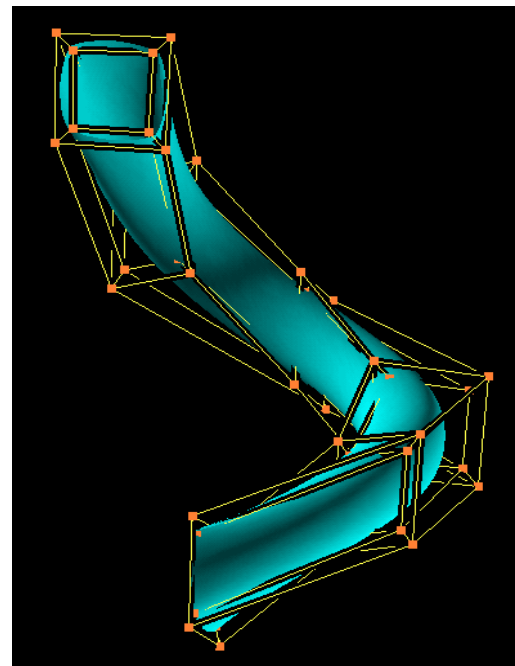


Fig: Topology after rotation

28. *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’.

29. *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*

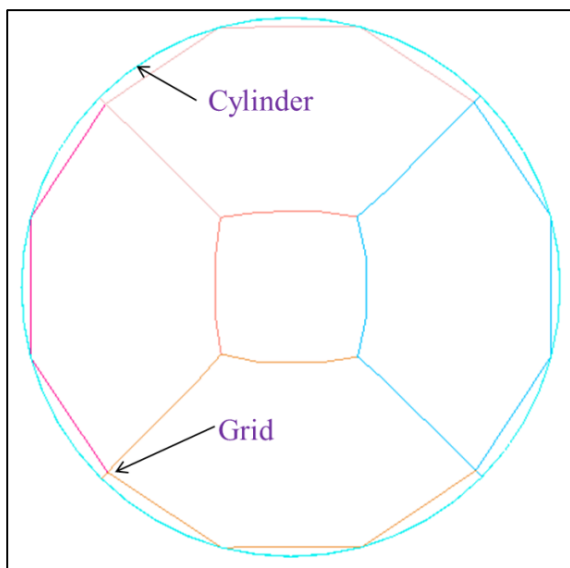


Fig: Before projection

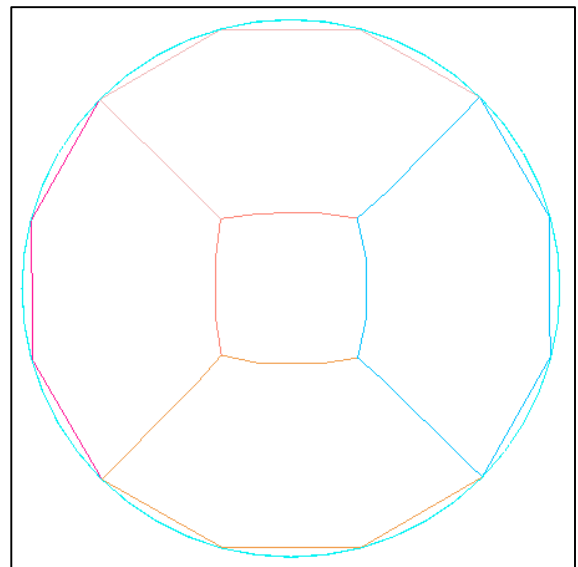
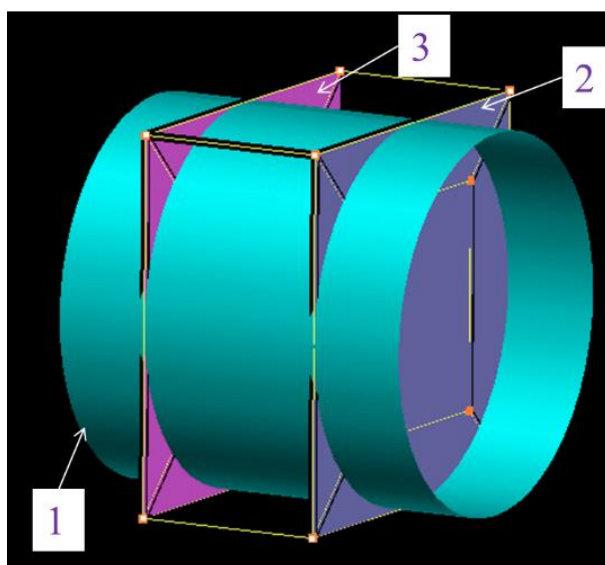


Fig: After projection



-sp 1 2 1 3

Surface 1 is intersecting with 2

Surface 1 is intersecting with 3

Fig: Explaining how to enter surface pairs

30. *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*

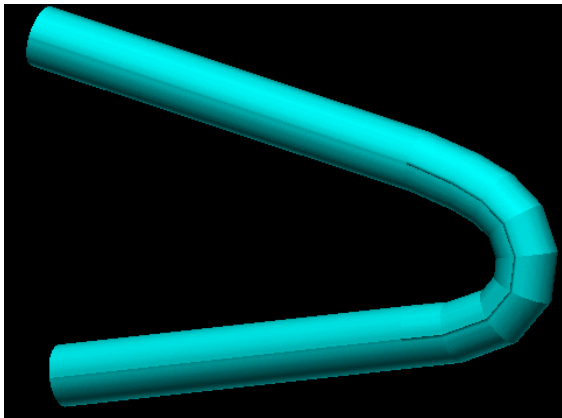


Fig: Before smoothing

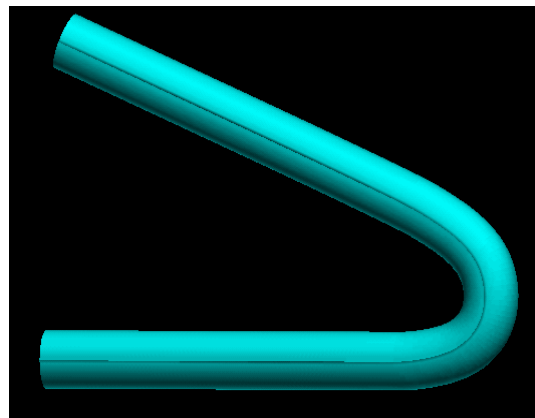


Fig: After smoothing

Note:

1. It is valid only for ‘*.tube’ files.

31. *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*

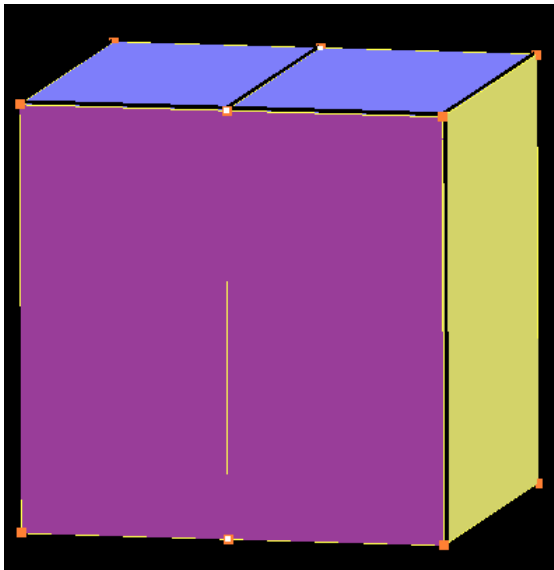


Fig: Topology before splitting

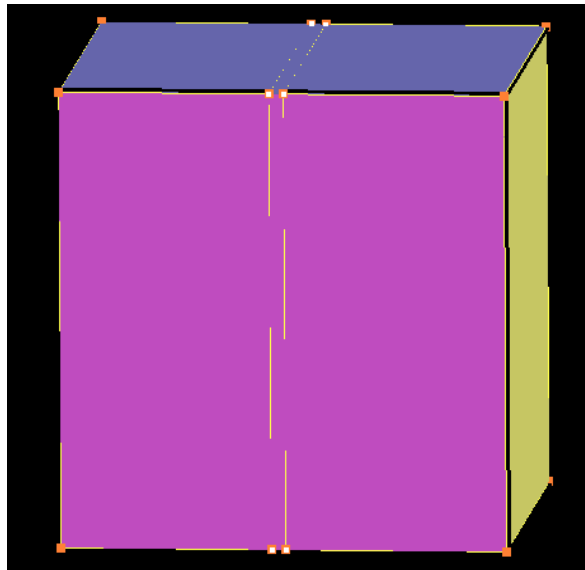


Fig: Topology after splitting

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.

32. *starcdtoctfdpp*

Usage: “*starcdtoctfdpp* <Grid File Name>”

Syntax:

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

Purpose:

Convert a *GridPro* grid file to cfd++ format file. The *GridPro* 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 *starcdtoctfdpp* command as follows:

starcdtoctfdpp blk.tmp

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

33. *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 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:

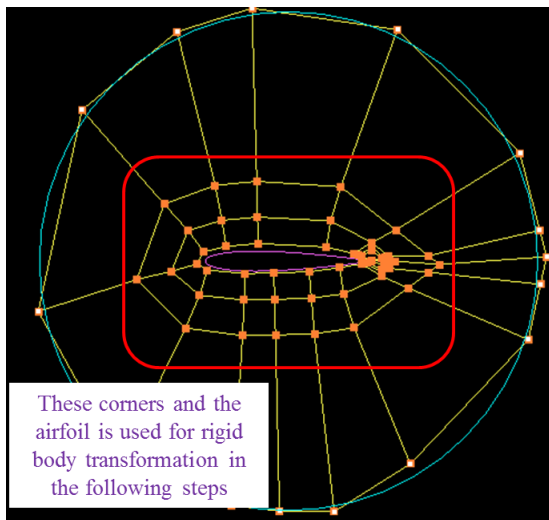


Fig: A valid Topology

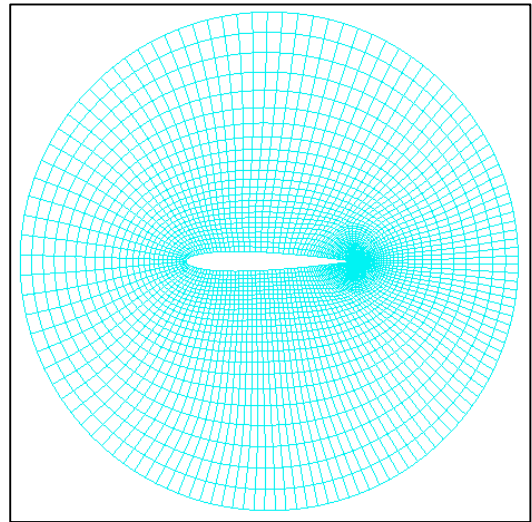


Fig: Grid for the topology

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*

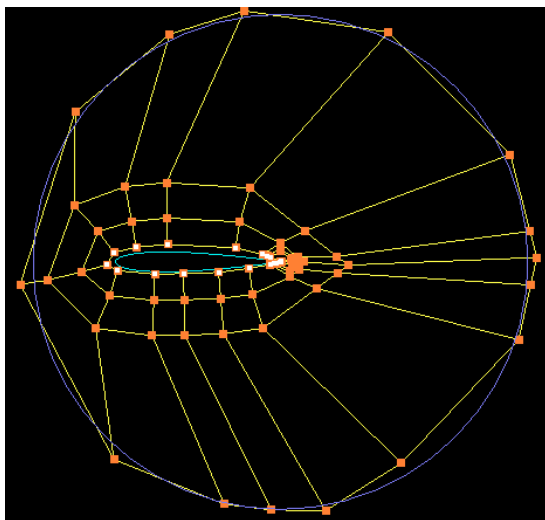


Fig: Applied Transformation (t1)

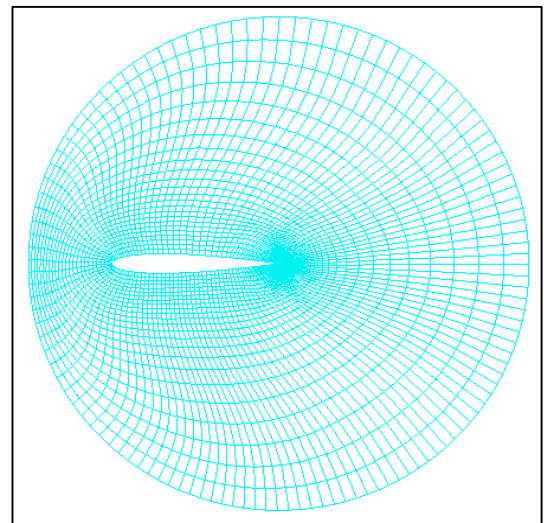


Fig: Grid for the transformed topology

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

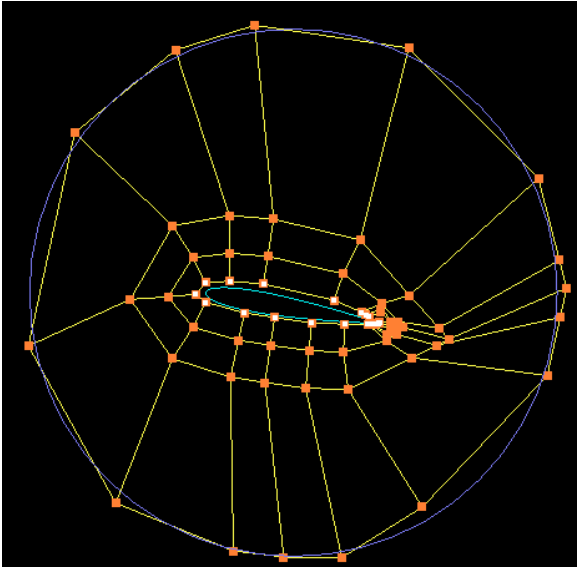


Fig: Applied rotation

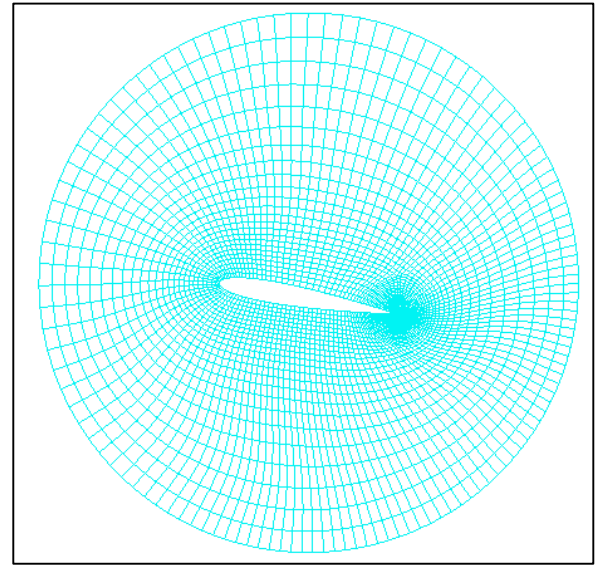


Fig: Grid for the rotated topology

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`

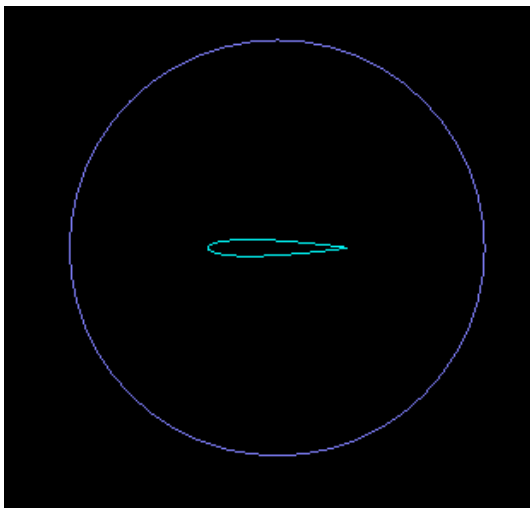


Fig: Before mirroring

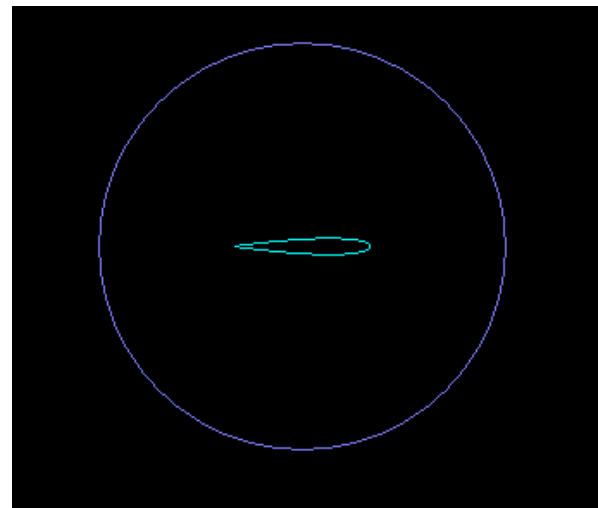


Fig: After mirroring

34. *tube2tria*

Usage: “*tube2tria*”

Syntax:

“*gp_utilities tube2tria* <tube file name> <tria file name>”

Purpose:

Convert a ‘*.tube’ file to ‘*.tria’ file. It works only for the tube which is created using ‘make tube’ command.

Example:

COMMAND USED: *gp_utilities tube2tria* nozzle.tube nozzle_out.tria

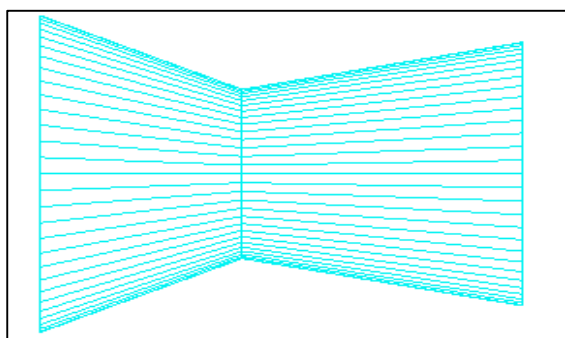


Fig: Tube file

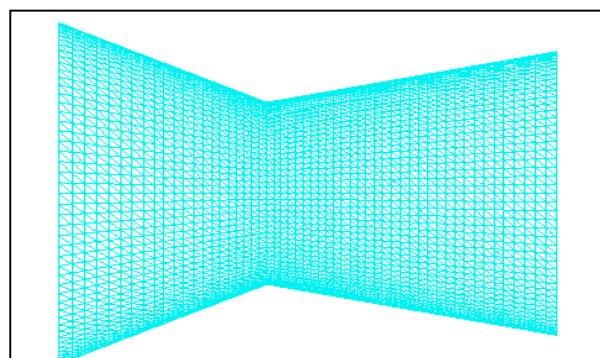


Fig: Tria file

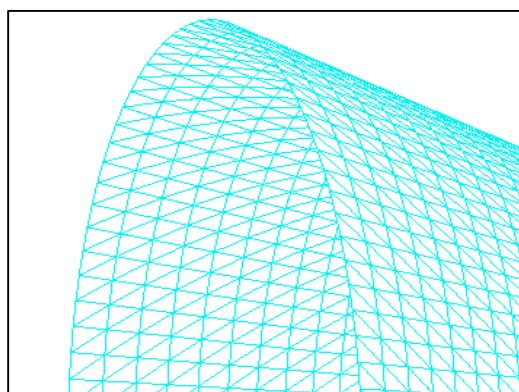


Fig: Zoomed Tria file

35. 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.)

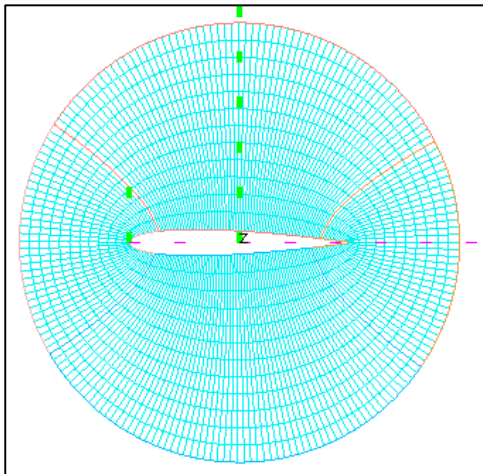


Fig: 2D grid

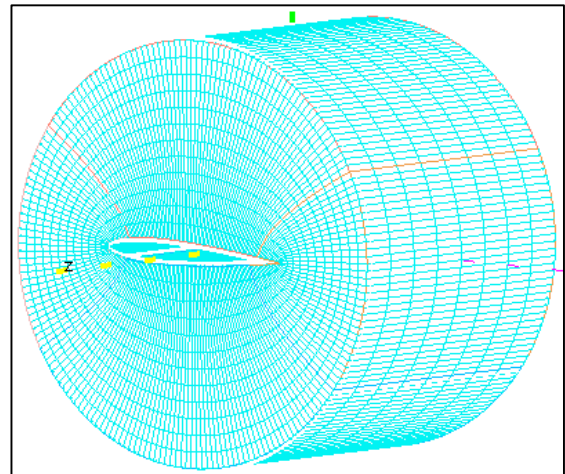


Fig: 3D grid