Intersector Documentation

Release 3.7

/ELSA/MU-10019/V3.7

Oct 19, 2023

CONTENTS

CHAPTER ONE

PREAMBLE

This module provides pre and post processing services relying on mesh-intersection computations on arbitrary polyhedral meshes.

It also gives auxiliary functions that transform topologically and geometrically polyhedral meshes which are useful in the process of mesh generation by intersection.

A mesh can be stored as an array (as defined in the Converter documentation) or in a zone node of a CGNS/python tree (pyTree).

This module is part of Cassiopee, a free open-source pre- and post-processor for CFD simulations.

For use with the array interface, you have to import Intersector module:

```
import Intersector as XOR
```

For use with the pyTree interface:

```
import Intersector.PyTree as XOR
```

CHAPTER

TWO

LIST OF FUNCTIONS

– Main Functions

Intersector.conformUnstr(a1[, a2, tol, ...])	Conformizes a1 (optionally with a2).
Intersector.booleanUnion(a1, a2[, tol, ...])	Computes the union between two closed-surface or two volume meshes.
Intersector.booleanIntersection(a1, a2[, ...])	Computes the intersection between two closed-surface or two volume meshes.
Intersector.booleanMinus(a1, a2[, tol, ...])	Computes the difference between two closed-surface or two volume meshes.
Intersector.diffSurf(a1, a2[, tol, ...])	Computes the difference between a volume mesh and a surface mesh.
Intersector.intersection(a1, a2[, tol, itermax])	Computes the intersection trace (a polyline) between two input closed surfaces.
Intersector.PyTree.XcellN(t, priorities[, ...])	Computes the weight coefficients of visibility for overset grid configurations as a field called xcelln, for both surface and volume mesh of any kind.
Intersector.adaptCells(a[, sensdata, ...])	Adapts an unstructured mesh a with respect to a sensor.

– Collision predicates

Intersector.getOverlappingFaces(a1, a2[, ...])	Returns the list of polygons in a1 and a2 that are overlapping.
Intersector.getCollidingCells(a1, a2[, ...])	Returns the list of cells in a1 and a2 that are colliding.
Intersector.selfX(a)	Checks self-intersections in a mesh.

– Transformation Functions

Intersector.triangulateBC(a, pgs[, improve_qual])	Triangulates specified polygons of a volume mesh.
Intersector.triangulateExteriorFaces(a[, ...])	Triangulates exterior polygons of a volume mesh.
Intersector.reorient(a[, dir])	Reorients outward the external polygons of a mesh.
Intersector.convexifyFaces(a[, convexity_TOL])	Convexifies any non-convex polygon in a mesh.
Intersector.syncMacthPeriodicFaces(a[, ...])	Force periodicity for faces that are supposed to be periodic.
Intersector.prepareCellsSplit(a[, PH_set, ...])	Splits some prescribed polygons following a prescribed splitting policy.
Intersector.splitNonStarCells(a[, ...])	Splits some non-centroid-star_shaped cells.
Intersector.agglomerateSmallCells(a[, vmin, ...])	Agglomerates prescribed cells.
Intersector.agglomerateNonStarCells(a[, ...])	Agglomerates non-centroid-star-shaped cells.
Intersector.agglomerateCellsWithSpecifiedFaces(a, pgs)	Agglomerates cells to make disappear specified polygons.
Intersector.simplifyCells(a, treat_externals)	Simplifies over-defined polyhedral cells (agglomerate some elligible polygons).
Intersector.closeCells(a)	Closes any polyhedral cell in a mesh (processes hanging nodes on edges).

– Adaptation Specific Functions

Intersector.adaptBox(a[, box_ratio, ...])	Adapts a bounding box to a cloud of interior points
Intersector.createHMesh(a[, subdiv_type])	Returns a hierarchical zone hook.
Intersector.deleteHMesh(hmesh)	Releases a hierachical zone hook.
Intersector.conformizeHMesh(hmesh)	Converts the basic element leaves of a hierarchical mesh to a conformal polyhedral mesh.
Intersector.createSensor(hmesh[, ...])	
Intersector.assignData2Sensor(hmesh, sensdata)	
Intersector.deleteSensor(hmesh)	

– Metric Functions

Intersector.edgeLengthExtrema(a)	
Intersector.volumes(a[, algo, all_pgs_convex])	Computes cells volumes in a.
Intersector.centroids(a)	Computes cells centroids in a.
Intersector.computeGrowthRatio(a[, vmin])	Returns a field of growth ratio.

– Extraction Functions

Intersector.extractPathologicalCells(a[, ...])	Extracts all cells that will probably cause trouble to a CFD solver.
Intersector.extractOuterLayers(a, N[, ...])	Extracts prescribed outer cell layers.
Intersector.getCells(t1, ids[, are_face_ids])	Returns the cells in t1 having specified faces or cell ids.

– Check Functions

Intersector.diffMesh(a1, a2)	Returns the difference between 2 meshes as 2 zones.
Intersector.checkCellsClosure(a)	Returns the first cell id that is open.
Intersector.checkCellsFlux(a, PE)	Returns the cell id for which the Gauss flux is the greatest.
Intersector.checkCellsVolume(a, PE)	Computes the minimum volume using the input orientation (ParentElement).
Intersector.checkForDegenCells(a)	Checks if there are any cell with less than 4 faces.

– Conversion Functions

Intersector.convertNGON2DToNGON3D(a)	Converts a Cassiopee NGON Format for polygons (Face/Edge) to a Face/Node Format.

CHAPTER

THREE

CONTENTS

3.1 Main Functions

`Intersector.`**`conformUnstr`**(*a1, a2=None, tol=0., left_or_right=0, itermax=10*)

Makes conformal a TRI or a BAR soup (i.e. a set of elements not necessarily connected as a mesh) by detecting and solving all the collisions between elements.

Colliding elements are cut to get a conformal set. Mixing types BAR and TRI is not currently handled.

Parameters

- **a1** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – First input mesh (BAR or TRI).
- **a2** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Second input mesh (BAR or TRI). If s2 is 'None' self-intersections are solved over s1.
- **tol** (`float`) – Merging tolerance when points (existing or computed by intersections) are too close.
- **left_or_right** (`0, 1 or 2`) – Tells the function what to ouput : the transformed s1 (0), s2(1) or both (2).
- **itermax** (`int`) – Number of intersection/merging iterations. 10 is the default value.

Tips and Notes:

- Set itermax to 1. to improve speed and the Delaunay kernel robustness. The result might have poorer quality triangles though.
- Tolerance :
  - if tol > 0. : the value is used as an absolute overall tolerance
  - if tol = 0. : a value is computed as being 5% of the smallest edge length.

   - if tol < 0. : MIN(5%, -tol) is used as a ratio to apply to the smallest edge length to get the tolerance.

Example of use:

- Makes conform a TRI or BAR soup (array):

```
# - conformUnstr (array) -
# Conforming 1 or 2 TRI/BAR together (same type for both operands
import Generator as G
import Intersector as XOR
import Converter as C
import Geom as D
from Geom.Parametrics import base
import Transform as T

s1 = D.sphere((0,0,0), 1, N=20)

s2 = D.surface(base['plane'], N=30)
s2 = T.translate(s2, (0.2,0.2,0.2))

s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)

x = XOR.conformUnstr(s1, s2, 0., 2)
C.convertArrays2File([x], 'out.plt')

c1 = D.circle((0,0,0), 1, N=100)
c2 = D.circle((0.2,0,0), 1, N=50)

c1 = C.convertArray2Tetra(c1); c1 = G.close(c1)
c2 = C.convertArray2Tetra(c2); c2 = G.close(c2)

x = XOR.conformUnstr(c1, c2, tol=0.)
C.convertArrays2File([x], 'out1.plt')
```

- Makes conform a TRI or BAR soup (pyTree):

```
# - conformUnstr (pyTree) -
# Conforming 1 or 2 TRI/BAR together (same type for both operands)
import Generator.PyTree as G
import Intersector.PyTree as XOR
import Converter.PyTree as C
import Geom.PyTree as D
```

(continues on next page)

(continued from previous page)

```
from Geom.Parametrics import base
import Transform.PyTree as T

s1 = D.sphere((0,0,0), 1, N=20)

s2 = D.surface(base['plane'], N=30)
s2 = T.translate(s2, (0.2,0.2,0.2))

s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)

x = XOR.conformUnstr(s1, s2, tol=0.)
C.convertPyTree2File(x, 'out.plt')

c1 = D.circle((0,0,0), 1, N=100)
c2 = D.circle((0.2,0,0), 1, N=50)

c1 = C.convertArray2Tetra(c1); c1 = G.close(c1)
c2 = C.convertArray2Tetra(c2); c2 = G.close(c2)

x = XOR.conformUnstr(c1, c2, tol=0.)
C.convertPyTree2File(x, 'out1.plt')
```

`Intersector.`**`booleanUnion`**(*a1*, *a2*, *tol=0.*, *preserve_right=1*, *solid_right=1*, *agg_mode=1*, *extrude_pgs=[]*, *multi_zone=False*)

Creates a conformal union between two components, either TRI surfaces or Polyhedral volumes.

Parameters

- **a1** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – First mesh operand.
- **a2** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Second mesh operand.
- **tol** (`float`) – Merging tolerance when points (existing or computed by intersections) are too close.
- **preserve_right** (`0 or 1`) – Indicates the merging direction, either a1->a2 or a2->a1. If set to 1(0), it means a1->a2 (a2->a1), i.e. a2(a1)'s points are preserved.
- **solid_right** (`0 or 1`) – Indicates that the second operand is not penetrable, i.e. it is prioritized over the first operand a1.

- **agg_mode** (0,1 or 2.) – Option for agglomerating cut polygons: 0 to keep them as split triangles, 1 to get convex agglomerations and 2 to get a full agglomeration.
- **extrude_pgs** (list of int) – Optional list of polygons to extrude.
- **multi_zone** (True or False) – If set to True, preserve input zoning of a1 and a2 upon exit.

Prerequisites :

- External polygons must be oriented consistently and outwardly (use Transform.reorderAll before)

Tips and Notes:

- For assembling meshes, set solid_right to 1 and pass the prioritized mesh as second operand.
- extrude_pgs: required whenever a1 and a2 are in contact and a2 is prioritized: avoids to compute useless intersections by telling what are the indices of contact polygons in a2.

Example of use:

- Union of two spherical surface meshes (array):

```
# - booleanUnion (array) -
import Intersector as XOR
import Generator as G
import Converter as C
import Geom as D

s1 = D.sphere((0,0,0), 1, N=20)
s2 = D.sphere((0.,1.,0.), 1, N=30)

s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)

x = XOR.booleanUnion(s1, s2, tol=0.)
C.convertArrays2File([x], 'out.plt')
```

- Union of two volume meshes (pyTree):

```
# - boolean union (PyTree) -
import Intersector.PyTree as XOR
import Converter.PyTree as C
```

(continues on next page)

(continued from previous page)

```
M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

x = XOR.booleanUnion(M1, M2, tol, preserve_right=1, solid_right=1)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGunion11.cgns')

x = XOR.booleanUnion(M1, M2, tol, preserve_right=0, solid_right=1)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGunion01.cgns')

x = XOR.booleanUnion(M1, M2, tol, preserve_right=1, solid_right=0)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGunion10.cgns')

x = XOR.booleanUnion(M1, M2, tol, preserve_right=0, solid_right=0)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGunion00.cgns')
```

`Intersector.`**`booleanIntersection`**(*a1*, *a2*, *tol=0.*, *preserve_right=1*, *solid_right=1*, *agg_mode=1*)

Computes a conformal intersection between two components, either TRI surfaces or Polyhedral volumes.

Parameters

- **a1** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – First mesh operand.
- **a2** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Second mesh operand.
- **tol** (`float`) – Merging tolerance when points (existing or computed by intersections) are too close.
- **preserve_right** (`0 or 1`) – Indicates the merging direction, either a1->a2 or a2->a1. If set to 1(0), it means a1->a2 (a2->a1), i.e. a2(a1)'s points are preserved.

- **solid_right** (0 or 1) – Indicates that the second operand is not penetrable, i.e. it is prioritized over the first operand a1.
- **agg_mode** (0,1 or 2.) – Option for agglomerating cut polygons : 0 to keep them as split triangles, 1 to get convex agglomerations and 2 to get a full agglomeration.

Prerequisites :

- External polygons must be oriented consistently and outwardly (use Transform.reorderAll before)

Example of use:

- Intersection of two spherical surface meshes (array):

```
# - boolean intersection (array) -
import Intersector as XOR
import Generator as G
import Converter as C
import Geom as D

s1 = D.sphere((0,0,0), 1, N=20)
s2 = D.sphere((0.,1.,0.), 1, N=30)

s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)

x = XOR.booleanIntersection(s1, s2, tol=0.)
C.convertArrays2File([x], 'out.plt')
```

- Intersection of two volume meshes (pyTree):

```
# - boolean intersection (PyTree) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = 1.e-12
x = XOR.booleanIntersection(M1, M2, tol, preserve_right=1, solid_right=1)
t = C.newPyTree(['Base',2,x])
```

(continues on next page)

(continued from previous page)

```
C.convertPyTree2File(t, 'boolNGinter11.cgns')

x = XOR.booleanIntersection(M1, M2, tol, preserve_right=0, solid_right=1)
C.convertPyTree2File(x, 'boolNGinter01.cgns')

x = XOR.booleanIntersection(M1, M2, tol, preserve_right=1, solid_right=0)
C.convertPyTree2File(x, 'boolNGinter10.cgns')

x = XOR.booleanIntersection(M1, M2, tol, preserve_right=0, solid_right=0)
C.convertPyTree2File(x, 'boolNGinter00.cgns')
```

`Intersector.`**`booleanMinus`**(*a1, a2, tol=0., preserve_right=1, solid_right=1, agg_mode=1*)

Computes a conformal difference between two components, either TRI surfaces or Polyhedral volumes.

Parameters

- **a1** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – First mesh operand.
- **a2** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Second mesh operand.
- **tol** (`float`) – Merging tolerance when points (existing or computed by intersections) are too close.
- **preserve_right** (`0 or 1`) – Indicates the merging direction, either a1->a2 or a2->a1. If set to 1(0), it means a1->a2 (a2->a1), i.e. a2(a1)'s points are preserved.
- **solid_right** (`0 or 1`) – Indicates that the second operand is not penetrable, i.e. it is prioritized over the first operand a1.
- **agg_mode** (`0,1 or 2.`) – Option for agglomerating cut polygons : 0 to keep them as split triangles, 1 to get convex agglomerations and 2 to get a full agglomeration.

Prerequisites :

- External polygons must be oriented consistently and outwardly (use Transform.reorderAll before)

Example of use:

- Difference of two spherical surface meshes (array):

```
# - booleanMinus (array) -
import Intersector as XOR
import Generator as G
import Converter as C
import Geom as D

s1 = D.sphere((0,0,0), 1, N=20)
s2 = D.sphere((0.,1.,0.), 1, N=30)

s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)

x = XOR.booleanMinus(s1, s2, tol=0.)
C.convertArrays2File([x], 'out.plt')
```

- Difference of two volume meshes (pyTree):

```
# - boolean minus (PyTree) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = 1.e-12

x = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGminus11.cgns')

x = XOR.booleanMinus(M1, M2, tol, preserve_right=0, solid_right=1)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGminus01.cgns')

x = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=0)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGminus10.cgns')
```

(continues on next page)

(continued from previous page)

```
x = XOR.booleanMinus(M1, M2, tol, preserve_right=0, solid_right=0)
t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'boolNGminus00.cgns')
```

Intersector.**intersection**(*a1*, *a2*, *tol=0.*)

Returns the 'BAR' contour defining the intersection between two TRI-surfaces.

Parameters

- **a1** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – First mesh operand.
- **a2** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Second mesh operand.
- **tol** (float) – Merging tolerance when points (existing or computed by intersections) are too close.

Example of use:

- Circular trace of the intersection between two spheres (array):

```
# - intersection (array) -
import Intersector as XOR
import Generator as G
import Converter as C
import Geom as D

s1 = D.sphere((0,0,0), 1, N=20)
s2 = D.sphere((0.,1.,0.), 1, N=30)
s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)
x = XOR.intersection(s1, s2, tol=0.)
C.convertArrays2File([x], 'out.plt')
```

- Circular trace of the intersection between two spheres (pyTree):

```
# - intersection (pyTree) -
import Intersector.PyTree as XOR
import Generator.PyTree as G
import Converter.PyTree as C
import Geom.PyTree as D

s1 = D.sphere((0,0,0), 1, N=20)
```

(continues on next page)

(continued from previous page)

```
s2 = D.sphere((0.,1.,0.), 1, N=30)
s1 = C.convertArray2Tetra(s1); s1 = G.close(s1)
s2 = C.convertArray2Tetra(s2); s2 = G.close(s2)
x = XOR.intersection(s1, s2, tol=0.)
C.convertPyTree2File(x, 'out.cgns')
```

Intersector.**diffSurf**(*a1*, *a2*, *tol=0.*, *preserve_right=1*, *agg_mode=1*)

Cut-cell function : Computes a conformal difference between a volume mesh and a surface mesh

Parameters

- **a1** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – First mesh operand.
- **a2** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Second mesh operand.
- **tol** (float) – Merging tolerance when points (existing or computed by intersections) are too close.
- **preserve_right** (0 or 1) – Indicates the merging direction, either a1->a2 or a2->a1. If set to 1(0), it means a1->a2 (a2->a1), i.e. a2(a1)'s points are preserved.
- **solid_right** (0 or 1) – Indicates that the second operand is not penetrable, i.e. it is prioritized over the first operand a1.
- **agg_mode** (0,1 or 2.) – Option for agglomerating cut polygons : 0 to keep them as split triangles, 1 to get convex agglomerations and 2 to get a full agglomeration.

Prerequisites :

- External polygons must be oriented consistently and outwardly (use Transform.reorderAll before)
- The surface format must be an NGON Face/Node (apply before Intersector.convertNGON2DToNGON3D on the surface)

Example of use:

- Cut-cell mesh with an octree and a sphere (array):

```
# - boolean diffSurf (array) -
import Generator as G
import Geom as D
```

(continues on next page)

(continued from previous page)

```
import Converter as C
import Intersector as XOR

# octree
s = D.sphere((0,0,0), 1., 100); snear = 0.1
t = G.octree([s],[snear], dfar=5., balancing=1,ratio=2)

# ngon conversion
t = C.convertArray2NGon(t)
# ngon conformization
t = C.conformizeNGon(t); t = G.close(t)
# ngon close cells
t = XOR.closeCells(t)
#t = XOR.reorientExternalFaces(t)

# ngon conversion of the sphere
s = C.convertArray2NGon(s)
# ngon conversion to the nuga format
s = XOR.convertNGON2DToNGON3D(s)
#s = XOR.reorientExternalFaces(s)

# Boolean operation
x = XOR.diffSurf(t, s, tol = 0., preserve_right=1, agg_mode=2) # agg_
↪mode=2 : full mode aggregation

C.convertArrays2File([x], 'out.plt')
```

- Cut-cell mesh with an octree and a sphere (pyTree):

```
# - boolean diffSurf (PyTree) -
import Generator.PyTree as G
import Geom.PyTree as D
import Converter.PyTree as C
import Intersector.PyTree as XOR

# octree
s = D.sphere((0,0,0), 1., 100); snear = 0.1
t = G.octree([s],[snear], dfar=5., balancing=1,ratio=2)

# ngon conversion
t = C.convertArray2NGon(t)
```

(continues on next page)

(continued from previous page)

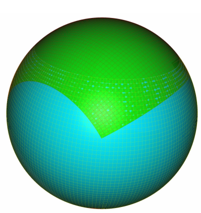
```
# ngon conformization
t = C.conformizeNGon(t); t = G.close(t)
# ngon close cells
t = XOR.closeCells(t)
#t = XOR.reorientExternalFaces(t)

# ngon conversion of the sphere
s = C.convertArray2NGon(s)
# ngon conversion to the nuga format
s = XOR.convertNGON2DToNGON3D(s)
#s = XOR.reorientExternalFaces(s)

# Boolean operation
x = XOR.diffSurf(t, s, tol = 0., preserve_right=1, agg_mode=2) # agg_
↪mode=2 : full mode aggregation

t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'diffs.cgns')
```

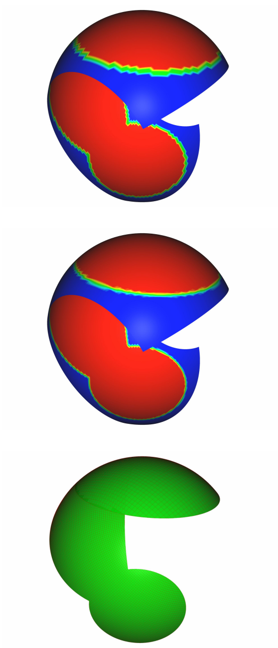
Intersector.PyTree.**XcellN**(*t, priorities, output_type=0, rtol=0.05*)

Computes the visibility coefficient for each cell in an overset surface grid configuration t with one-to-one priorities. t can be structured or unstructured.

Depending on the output_type argument, this function computes:

- a ternary blanking information (0 (hidden), 1(visible) and 0.5(colliding), when output_type=0
- a continuous blanking information (any val in [0,1] based on the ratio of the visible part of the cell), when output_type=1
- a clipped polygonal surface (NGON format) where all the hidden surface parts have been removed, when output_type=2





From left to right: Sphere made of 2 overset patches, results with output_type=0,1 and 2 displayed for the non-prioritized patch.

When output_type is 0 or 1, a 'xcelln' field is added to each zone of the PyTree. When output_type is 2, the fields defined at center are transferred in the output mesh.

Parameters

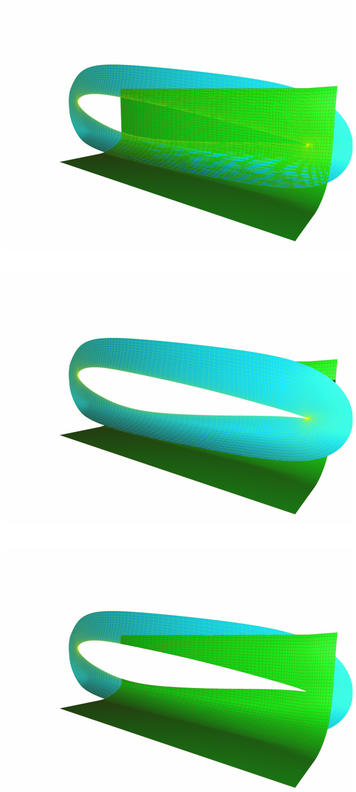
- **t** (`[pyTree, base, zone, list of zones].`) – an overset surface mesh where components are separated in different bases.
- **priorities** (`list of pairs of integers.`) – list of one-to-one pairs of priorities between components.
- **output_type** (`0, 1 or 2.`) – ternary blanking field.
- **rtol** (`float.`) – relative tolerance for detecting and computing intersections.

Prerequisites :

- All the surface patches must be oriented consistently and outwardly (use Transform.reorderAll before)

Tips and Notes:

- each component must set in a separate base.
- priorisation and computation is done between components only : not between zones of the same base.
- wall boundaries are considered whatever the priorisation:



Example of wall treatment on the fuselage/collar zone of a CRM configuration when output_type is 2: if the collar is prioritized (middle) or not (right), the part of the fuselage falling inside the wing is clipped.

Example of use:

- xcelln field on structured configuration:

```
# - XcellN (PyTree) -
import Geom.PyTree as D
import Converter.PyTree as C
import Intersector.PyTree as XOR
import Converter.Internal as I

s = D.sphereYinYang((0,0,0), 1., 50)
zs = I.getZones(s)
t = C.newPyTree(['Base', zs[0], 'Base2', zs[1]])

priorities = []
priorities.append((0,1))

XOR._XcellN(t, priorities, output_type=2)

C.convertPyTree2File(t, "out.cgns")
```

(continues on next page)

(continued from previous page)

```

```

`Intersector.`**`adaptCells`**(*a*, *sensdata=None*, *sensor_type=0*, *smoothing_type=0*, *itermax=-1*, *subdiv_type=0*, *hmesh=None*, *sensor=None*, *conformize=1*)

Adapts a cells (any basic cells - TETRA, PENTA, PYRA, HEXA - currently) with respect to the sensor and its data (sensdata).

Adaptation is a per-cell octal 2:1 decomposition.

With a sensor_type equal to :

- 0 (geometrical sensor), sensdata must contain vertices : a will be refined until any a cell contains at most 1 data vertex.
- 1 (xsensor), sensdata must be a mesh *m*, ant its connectivity is also taken into account by adding refinement wherever a cells are crossed by m edges.
- 2 (nodal sensor), sensdata are nodal values giving the number of required subdivision around that node.
- 3 (cell sensor), sensdata are cell values giving the number of required subdivision per cell.

Parameters

- **a** (`[array] or [ single zone pyTree (currently)]`) – Input mesh (NGON format)
- **sensdata** (`[array, list of arrays] or [pyTree, base, zone, list of zones] for sensor type 0 and 1. Numpy of integers for other sensors.`) – Data for the sensor
- **sensor_type** (`int`) – type of sensor. geometrical (0), xensor (1), nodal sensor (2), cell sensor (3)
- **smoothing_type** (`int`) – first-neighborhood (0), shell-neighborhood(1)
- **itermax** (`int`) – maximum nb of generations
- **subdiv_type** (`int`) – type of adaptation, currently only isotropic (0).
- **hmesh** (`hook`) – structure that holds the hierarchical genealogy structure in case of successive adaptations on a mesh. Instantiated with Intersector.createHMesh

- **sensor** (hook) – structure that holds the sensor and its data in case of successive adaptations on a mesh
- **conformize** (int) – conformal output mesh enabled (1), disabled (0). Enabled by default.

Example of use:

- adaptCells (array):

```
# - adapts a cells with respect to b points (array) -
import Intersector as XOR
import Converter as C
import Generator as G

a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.1), (5,5,5))
a = C.convertArray2NGon(a); a = G.close(a)
#C.convertArrays2File([a], 'a.plt')
b = G.cartHexa((0.,0.,0.), (0.005,0.005,0.005), (5,5,5))
#C.convertArrays2File([b], 'b.plt')

m = XOR.adaptCells(a,b, sensor_type=0)

m = XOR.closeCells(m[0])
C.convertArrays2File([m], 'out.plt')

m = XOR.adaptCells(a,b, sensor_type=1)

m = XOR.closeCells(m[0])
C.convertArrays2File([m], 'xout.plt')
```

- adaptCells (pyTree):

```
# - adapts a cells with respect to b points (PyTree) -
import Intersector.PyTree as XOR
import Converter.PyTree as C
import Generator.PyTree as G

a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.1), (5,5,5))
a = C.convertArray2NGon(a); a = G.close(a)
#C.convertPyTree2File(a, 'a.cgns')
b = G.cartHexa((0.,0.,0.), (0.005,0.005,0.005), (5,5,5))
#C.convertPyTree2File(b, 'b.cgns')
```

(continues on next page)

(continued from previous page)

```
a = C.fillEmptyBCWith(a, 'wall', 'BCWall')
a = C.initVars(a, '{centers:Density} = {centers:CoordinateX} +
↪{centers:CoordinateY}')

XOR._setZonesAndJoinsUId(a)

## static adaptation
m = XOR.adaptCells(a,b, sensor_type=0)
m = XOR.closeCells(m)
C.convertPyTree2File(m, 'out.cgns')

m = XOR.adaptCells(a,b, sensor_type=1)
m = XOR.closeCells(m)
C.convertPyTree2File(m, 'xout.cgns')

m = XOR.adaptCells(a,b, sensor_type=0, smoothing_type=1)
m = XOR.closeCells(m)
C.convertPyTree2File(m, 'out2.cgns')

## dynamic adaptation
hmsh = XOR.createHMesh(a)
m = XOR.adaptCells(a, b, hmesh = hmsh, sensor_type=0)
cm = XOR.conformizeHMesh(m, hmsh)
cm = XOR.closeCells(m)
XOR.deleteHMesh(hmsh);
C.convertPyTree2File(cm, 'out3.cgns')

hmsh = XOR.createHMesh(a)
m = XOR.adaptCells(a, b, hmesh = hmsh, sensor_type=0, smoothing_type=1)

cm = XOR.conformizeHMesh(m, hmsh)
cm = XOR.closeCells(cm)
C.convertPyTree2File(cm, 'out4.cgns')

m = XOR.adaptCells(m, b, hmesh = hmsh, sensor_type=0) # applied to␣
↪existing hmesh with the geometrical sensor

cm = XOR.conformizeHMesh(cm, hmsh)
cm = XOR.closeCells(cm)

XOR.deleteHMesh(hmsh);
```

(continues on next page)

(continued from previous page)

```
C.convertPyTree2File(cm, 'out5.cgns')
```

Tips and Notes:

- Do this transformation before calling any Volume-Volume boolean operations in order to improve the mesh quality of the result.
- When the input mesh has any kind of polyhedral elements, only basic elements will be considered currently for adaptation. but the result wil be conformal, the non-handled elements will modified to respect the conformity.

3.2 Transformation Functions

`Intersector.`**`triangulateBC`**(*a*, *bctype*)

Triangulates the prescribed BC type polygons of a volume mesh.

Parameters

- **a** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **bctype** (`string`) – boundary type ('BCWall', . . .).

Example of use:

- BC polygons triangulation (pyTree):

```
# - triangulateExteriorFaces (PyTree) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

t = C.convertFile2PyTree('boolNG_M1.tp')

t = C.convertArray2NGon(t)

t = C.fillEmptyBCWith(t, 'wall', 'BCWall', dim=3)

t=XOR.triangulateBC(t, 'BCWall')

C.convertPyTree2File(t, 'out.cgns')
```

`Intersector.`**`triangulateExteriorFaces`**`(`*a*, *in_or_out=2*`)`

Triangulates the prescribed external polygons of a volume mesh.

Parameters

- **a** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **in_or_out** (`0,1 or 2`) – In case of a non-connex mesh (i.e. whith holes like an external airflow mesh around bodies), set to 0 for processing only body walls, set to 1 for processing only the outer boundary, or 2 for processing all of them.

Example of use:

- External polygons triangulation (array):

```
# - triangulateExteriorFaces (array) -
import Intersector as XOR
import Converter as C

m = C.convertFile2Arrays('boolNG_M1.tp')
m = C.convertArray2NGon(m[0])

m = XOR.triangulateExteriorFaces(m)
C.convertArrays2File([m], 'out.plt')
```

- External polygons triangulation (pyTree):

```
# - triangulateExteriorFaces (PyTree) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

t = C.convertFile2PyTree('boolNG_M1.tp')
t = C.convertArray2NGon(t)

t = XOR.triangulateExteriorFaces(t)
C.convertPyTree2File(t, 'out.cgns')
```

`Intersector.`**`reorient`**`(`*a*`)`

Reorients outward the external polygons of a mesh.

Example of use:

- Reorientation (array):

```
# - boolean reorientExternalFaces (array) -
import Generator as G
import Converter as C
import Intersector as XOR


a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.2), (10,10,10))
a = C.convertArray2NGon(a)
a = XOR.reorient(a)

C.convertArrays2File([a], 'out.plt')
```

- Reorientation (pyTree):

```
# - boolean reorientExternalFaces (array) -
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.2), (10,10,10))
a = C.convertArray2NGon(a)
a = XOR.reorient(a)

C.convertPyTree2File(a, 'out.cgns')
```

`Intersector.`**`convexifyFaces`**(*a*, *convexity_TOL=1.e-8*)

Makes a convex decomposition of any concave polygon in a mesh.

Parameters

- **a** (`[array, list of arrays]` or `[pyTree, base, zone, list of zones]`) – Input mesh
- **convexity_TOL** (`float`) – convexity angle threshold

Example of use:

- Convexify polygons (array):

```
# - convexifyFaces (array) -
# convexify any concave polygon in the mesh
import Intersector as XOR
import Converter as C
```

(continues on next page)

(continued from previous page)

```
M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])

M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=2) #full agg to convexify afterward
#C.convertArrays2File([m], 'i.plt')
m = XOR.convexifyFaces(m)

C.convertArrays2File([m], 'out.plt')
```

- Convexify polygons (pyTree):

```
# - convexifyFaces (pyTree) -
# convexify any concave polygon in the mesh
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=2) #full agg to convexify afterward
m = XOR.convexifyFaces(m)

C.convertPyTree2File(m, 'out.cgns')
```

`Intersector.`**`syncMacthPeriodicFaces`**(*t, rotationCenter=[0., 0., 0.], rotationAngle=[0., 0., 0.], translation=[0., 0., 0.], tol=-0.01, unitAngle=None, reorient=True*)

Force periodicity when some faces should be periodic but are not due to connectivity inconsistencies (tipically overdefined or splitted faces). This function ensures that a following call to Connector.connectMatchPeriodic succeeds when the mesh has been procuced with the intersection strategy. Periodicity can be defined either by rotation or translation.

Parameters

- **t** (`[pyTree, base, zone, list of zones]`) – Input mesh
- **tol** – tolerance. Negative value (in [-1; 0]) specifies a relative value base on min edge length in the mesh.

Example of use:

- Synchronize faces(pyTree):

```
# - concatenate (PyTree) -

import Converter.PyTree   as C
import Generator.PyTree   as G
import Connector.PyTree   as X
import Transform.PyTree   as T
import Intersector.PyTree as XOR
import Post.PyTree        as P
import Converter.Internal as I

## build a cartesian mesh
a    = G.cartHexa((0.,0.,0.), (1.,1.,1.), (10,10,10))
a    = C.convertArray2NGon(a)

XOR._reorient(a)

## triangulate top face #################
aF = P.exteriorFaces(a)
aF = T.splitSharpEdges(aF)
top = I.getZones(aF)[5]

BCs = [top]
BCNames = ['wall']
BCTypes = ['BCWallViscous']

C._recoverBCs(a, (BCs, BCNames, BCTypes))
a = XOR.triangulateBC(a, 'BCWallViscous')
C._deleteZoneBC__(a)
```

(continues on next page)

(continued from previous page)

```
###########################################

a = XOR.syncMacthPeriodicFaces(a, translation=[0.,0.,9.])

a = X.connectMatchPeriodic(a, translation=[0.,0.,9.])

C.convertPyTree2File(a, 'out.cgns')
```

Intersector.**prepareCellsSplit**(*a, PH_set=1, split_policy=0, PH_conc_threshold=1. / 3., PH_cvx_threshold=0.05, PG_cvx_threshold=1.e-8*)

Prepares the bad cells split (`splitNonStarCells`) by splitting some of their polygons with a prescribed policy : convexification, starification.

Parameters

- **a** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **PH_set** (`0 or 1`) – PH to process. 0 for concave cells or 1 for non-centroid-star_shaped cells
- **split_policy** (`0,1 or 2`) – 0 : convexify concave pgs. 1 : starify concave pgs from worst vertex. 2 : starify concave pgs from concave-chains ends.
- **PH_conc_threshold** (`float`) – Concavity dihedral angle threshold for cells
- **PH_cvx_threshold** (`float`) – Convexity dihedral angle threshold for cells
- **PG_cvx_threshold** (`float`) – Convexity angle threshold for polygons

Example of use:

- prepareCellsSplit (array):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector as XOR
import Converter as C

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])
```

(continues on next page)

(continued from previous page)

```
M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=2) #full agg to convexify afterward
#C.convertArrays2File([m], 'i.plt')
m = XOR.prepareCellsSplit(m, PH_set = 0, split_policy = 2, PH_conc_
↪threshold = 1./3., PH_cvx_threshold = 0.05, PG_cvx_threshold = 1.e-2)

C.convertArrays2File([m], 'out.plt')
```

- prepareCellsSplit (pyTree):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=2) #full agg to convexify afterward
#C.convertArrays2File([m], 'i.plt')
m = XOR.prepareCellsSplit(m, PH_set = 0, split_policy = 2, PH_conc_
↪threshold = 1./3., PH_cvx_threshold = 0.05, PG_cvx_threshold = 1.e-2)

C.convertPyTree2File(m, 'out.cgns')
```

`Intersector.`**`splitNonStarCells`**(*a, PH_conc_threshold=1. / 3., PH_cvx_threshold=0.05, PG_cvx_threshold=1.e-8*)

First strategy to eradicate bad cells : Splits non-centroid-star-shaped (NCSS) cells into two cells. These cells might be NCSS as well so this function should be called several times to get rid off the pathologies. Some call agglomerateSmallCells should be done afterwards to balance the growth ratio.

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **PH_conc_threshold** (float) – Concavity dihedral angle threshold for cells
- **PH_cvx_threshold** (float) – Convexity dihedral angle threshold for cells
- **PG_cvx_threshold** (float) – Convexity angle threshold for polygons

Tips and Notes:

- Call prepareCellsSplit before this function to ensure to process as much pathologies as possible.

Example of use:

- splitNonStarCells (array):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector as XOR
import Converter as C

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])

M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)

m = XOR.simplifyCells(m, 1)
m = XOR.prepareCellsSplit(m, PH_set = 0, split_policy = 0, PH_conc_
↪threshold = 1./3., PH_cvx_threshold = 0.05, PG_cvx_threshold = 1.e-8)
m= XOR.splitNonStarCells(m, PH_conc_threshold = 1./3., PH_cvx_threshold␣
↪= 0.05, PG_cvx_threshold = 1.e-8)
```

(continues on next page)

(continued from previous page)

```
C.convertArrays2File([m], 'out.plt')
```

- splitNonStarCells (pyTree):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)

m = XOR.simplifyCells(m, 1)
m = XOR.prepareCellsSplit(m, PH_set = 0, split_policy = 0, PH_conc_
↪threshold = 1./3., PH_cvx_threshold = 0.05, PG_cvx_threshold = 1.e-8)
m= XOR.splitNonStarCells(m, PH_conc_threshold = 1./3., PH_cvx_threshold␣
↪= 0.05, PG_cvx_threshold = 1.e-8)

C.convertPyTree2File(m, 'out.cgns')
```

Intersector.**simplifyCells**(*a*, *treat_externals*, *angular_threshold=1.e-12*)

Agglomerates superfluous polygons that over-defines cells. After agglomerating (e.g. after calling `agglomerateSmallCells`) , we end up with cells that are multiply-connected, i.e. they share more than one polygon. If 2 cells share 2 polygons that are connected (sharing an edge) and their dihedral angle is below the angular_threshold, then the polygons are agglomerated upon exit. The angular threshold (expressed in radian) is the maximum aboslute deviation around the planar position.

Parameters

- **a** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **treat_externals** (`0 or 1`) – Process outer polygons (1) or not (0).

- **angular_threshold** (float) – Largest angular deviation admitted between adjacent polygons in order to allow their agglomeration.

Example of use:

- simplifyCells (array):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector as XOR
import Converter as C

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])

M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)
#C.convertArrays2File([m], 'i.plt')

m = XOR.simplifyCells(m, 1)

C.convertArrays2File([m], 'out.plt')
```

- simplifyCells (pyTree):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)
```

(continues on next page)

(continued from previous page)

```
m = XOR.simplifyCells(m, 1)

C.convertPyTree2File(m, 'out.cgns')
```

`Intersector.`**`agglomerateSmallCells`**(*a*, *vmin=0.*, *vratio=0.01*, *angular_threshold=1.e-12*)

Agglomerates cells that are too small (below vmin) or having a poor growth ratio with a neighbor (below vratio) with the best neighbor available. The agglomeration process does not create non-star-shaped agglomerates.

Parameters

- **a** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **vmin** (`float`) – volume threshold.
- **vratio** (`float`) – growth ratio threshold.
- **angular_threshold** (`float`) – Largest angular deviation admitted between adjacent polygons in order to allow their agglomeration.

Tips and Notes:

- See `computeGrowthRatio` to get the definition of the computed growth ratio.

Example of use:

- agglomerateSmallCells (array):

```
# - boolean diffSurf (array) -
import Generator as G
import Geom as D
import Converter as C
import Intersector as XOR

# octree
s = D.sphere((0,0,0), 1., 100); snear = 0.1
t = G.octree([s], [snear], dfar=5., balancing=1, ratio=2)

# ngon conversion
t = C.convertArray2NGon(t)
# ngon conformization
t = C.conformizeNGon(t); t = G.close(t)
```

(continues on next page)

(continued from previous page)

```
# ngon close cells
t = XOR.closeCells(t)
#t = XOR.reorientExternalFaces(t)

# ngon conversion of the sphere
s = C.convertArray2NGon(s)
# ngon conversion to the nuga format
s = XOR.convertNGON2DToNGON3D(s)
#s = XOR.reorientExternalFaces(s)

# Boolean operation
x = XOR.diffSurf(t, s, tol = 0., preserve_right=1, agg_mode=2) # agg_
↪mode=2 : full mode aggregation
C.convertArrays2File(x, 'diffsurf.plt')
x = XOR.agglomerateSmallCells(x, vmin=0., vratio=0.1)
C.convertArrays2File(x, 'agg.plt')
```

- agglomerateSmallCells (pyTree):

```
# - boolean diffSurf (PyTree) -
import Generator.PyTree as G
import Geom.PyTree as D
import Converter.PyTree as C
import Intersector.PyTree as XOR

# octree
s = D.sphere((0,0,0), 1., 100); snear = 0.1
t = G.octree([s],[snear], dfar=5., balancing=1,ratio=2)

# ngon conversion
t = C.convertArray2NGon(t)
# ngon conformization
t = C.conformizeNGon(t); t = G.close(t)
# ngon close cells
t = XOR.closeCells(t)
#t = XOR.reorientExternalFaces(t)

# ngon conversion of the sphere
s = C.convertArray2NGon(s)
# ngon conversion to the nuga format
s = XOR.convertNGON2DToNGON3D(s)
```

(continues on next page)

(continued from previous page)

```
#s = XOR.reorientExternalFaces(s)

# Boolean operation
x = XOR.diffSurf(t, s, tol = 0., preserve_right=1, agg_mode=2) # agg_
↪mode=2 : full mode aggregation

x = XOR.agglomerateSmallCells(x, vmin=0., vratio=0.1)

t = C.newPyTree(['Base',2]); t[2][1][2].append(x)
C.convertPyTree2File(t, 'diffs.cgns')
```

`Intersector.`**`agglomerateNonStarCells`**`(a)`

Agglomerate cells that are non-centroid-star-shaped. The agglomeration process does not create non-star-shaped agglomerates.

Parameters

a (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh

Example of use:

- agglomerateNonStarCells (array):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector as XOR
import Converter as C

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])

M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)
#C.convertArrays2File([m], 'i.plt')

m = XOR.agglomerateNonStarCells(m)
```

(continues on next page)

(continued from previous page)

```
C.convertArrays2File(m, 'out.plt')
```

- agglomerateNonStarCells (pyTree):

```
# - convexify any concave polygon in the mesh (array) -
import Intersector.PyTree as XOR
import Converter.PyTree as C

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)

m = XOR.agglomerateNonStarCells(m)

C.convertPyTree2File(m, 'out.cgns')
```

Intersector.**agglomerateCellsWithSpecifiedFaces**(*a*, *pgs*, *simplify*)

Agglomerate cells that are non-centroid-star-shaped. The agglomeration process does not create non-star-shaped agglomerates.

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **pgs** (list of integers) – list of polygons to remove

Example of use:

- agglomerateCellsWithSpecifiedFaces (array):

```
import Generator as G
import Transform as T
```

(continues on next page)

(continued from previous page)

```
import Converter as C
import Converter as I
import Intersector as XOR
import KCore.test as test
import Post as P

t1 = G.cart((0,0,0), (1,1,1), (10,10,10))
t1 = C.convertArray2NGon(t1); t1 = G.close(t1)
t2 = G.cart((1.,0,0), (1,1,1), (10,10,10))
t2 = C.convertArray2NGon(t2); t2 = G.close(t2)

# test 1 : volume/volume
res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

# create a list of polygon list (t1), one list per zone

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, res[0])

C.convertArrays2File([t], "out.plt")

#test 2 : volume/surface

t2 = P.exteriorFaces(t2)
t2 = XOR.convertNGON2DToNGON3D(t2)

res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, res[0])

C.convertArrays2File([t], "out1.plt")
```

- agglomerateCellsWithSpecifiedFaces (pyTree):

```
import Generator.PyTree as G
import Transform.PyTree as T
import Converter.PyTree as C
import Converter.Internal as I
import Intersector.PyTree as XOR
import KCore.test as test
import Post.PyTree as P

t1 = G.cart((0,0,0), (1,1,1), (10,10,10))
```

(continues on next page)

(continued from previous page)

```
t1 = C.convertArray2NGon(t1); t1 = G.close(t1)
t2 = G.cart((1.,0,0), (1,1,1), (10,10,10))
t2 = C.convertArray2NGon(t2); t2 = G.close(t2)

# test 1 : volume/volume
res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

# create a list of polygon list (t1), one list per zone
nb_zones = len(res)
t1zones_pgids = []
for i in range(nb_zones):
  t1zones_pgids.append(res[i][0])

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, t1zones_pgids)

C.convertPyTree2File(t, "out.cgns")

#test 2 : volume/surface

t2 = P.exteriorFaces(t2)
t2 = XOR.convertNGON2DToNGON3D(t2)

res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

t1zones_pgids = []
for i in range(nb_zones):
  t1zones_pgids.append(res[i][0])

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, t1zones_pgids)

C.convertPyTree2File(t, "out1.cgns")
```

Tips and Notes:

- When assembling 2 meshes m1 and m2 where m2 is priorized, to improve the assembly quality, do before calling the boolean union:

1) getOverlappingFaces (m1, skin(m2)) where skin(m2) is the external polygonal skin of m2
2) agglomerateCellsWithSpecifiedFaces on m1 with the above list of polygons

Intersector.**closeCells**(*a*)

Closed any polyhedral cell in a mesh which is open because it has, and only has, hanging nodes on its edges.

Parameters

a (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh

Example of use:

- closeCells (array):

```
# - triangulateExteriorFaces (array) -
import Intersector as XOR
import Converter as C

m = C.convertFile2Arrays('boolNG_M1.tp')
m = C.convertArray2NGon(m[0])

m = XOR.closeCells(m)
C.convertArrays2File([m], 'out.plt')
```

- closeCells (pyTree):

```
# - triangulateExteriorFaces (array) -
import Intersector.PyTree as XOR
import Converter.PyTree as C
import KCore.test as test

m = C.convertFile2PyTree('boolNG_M1.tp')
m = C.convertArray2NGon(m)

m = XOR.closeCells(m)
C.convertPyTree2File(m, 'out.cgns')
```

Tips and Notes:

- Do this transformation whenever you need to use a surface algorithm on the octree (e.g. `reorient`)

3.3 Adaptation Specific Functions

`Intersector.`**adaptBox**(*a*, *box_ratio*)

Adapts the bounding box of a cloud of points. Adaptation is an octal 2:1 decomposition.

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input points cloud
- **box_ratio** – ratio to scale the box

Example of use:

- adaptBox (array):

```
# - adapt the bounding box of a point cloud (array) -

import Converter as C
import Generator as G
import Intersector as XOR

a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.1), (5,5,5))
a = C.convertArray2NGon(a); a = G.close(a)

m = XOR.adaptBox(a, box_ratio=10.)
m = XOR.closeCells(m) # optional : to close the polyhedral cells

C.convertArrays2File([m], 'out.plt')
```

- adaptBox (pyTree):

```
# - adapt the bounding box of a point cloud (array) -

import Converter.PyTree as C
import Generator.PyTree as G
import Intersector.PyTree as XOR

a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.1), (5,5,5))
a = C.convertArray2NGon(a); a = G.close(a)

m = XOR.adaptBox(a, box_ratio=10.)
```

(continues on next page)

(continued from previous page)

```
m = XOR.closeCells(m) # optional : to close the polyhedral cells

C.convertPyTree2File(m, 'out.cgns')
```

Intersector.**createHMesh**(*a*, *subdiv_type=0*)

Builds a hierarchcial mesh structure for a and returns a hook

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input points cloud
- **subdiv_type** (int) – type of adaptation, currently only isotropic (0).

Example of use:

- createHMesh:

```
# - dynamic adaptation
#
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


mesh = G.cart((0,0,0), (1,1,1), (20,20,20))
mesh = C.convertArray2NGon(mesh)

source = G.cartHexa((8,8,8), (0.2,0.2,0.2), (20,20,20))

XOR._setZonesAndJoinsUId(mesh)

hmsh = XOR.createHMesh(mesh)

senso = XOR.createSensor(hmsh)
XOR.assignData2Sensor(senso, source)

m = XOR.adaptCells(mesh, hmesh = hmsh, sensor=senso)

m = XOR.conformizeHMesh(m, hmsh)
m = XOR.closeCells(m)
```

(continues on next page)

(continued from previous page)

```
XOR.deleteHMesh(hmsh);
XOR.deleteSensor(senso);

C.convertPyTree2File(m, 'out.cgns')
```

`Intersector.`**`deleteHMesh`**(*hmesh*)

Deletes a hierarchcial mesh

Parameters
hmesh (hook) – hmesh hook

Example of use:

- deleteHMesh:

```
# - dynamic adaptation
#
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


mesh = G.cart((0,0,0), (1,1,1), (20,20,20))
mesh = C.convertArray2NGon(mesh)

source = G.cartHexa((8,8,8), (0.2,0.2,0.2), (20,20,20))

XOR._setZonesAndJoinsUId(mesh)

hmsh = XOR.createHMesh(mesh)

senso = XOR.createSensor(hmsh)
XOR.assignData2Sensor(senso, source)

m = XOR.adaptCells(mesh, hmesh = hmsh, sensor=senso)

m = XOR.conformizeHMesh(m, hmsh)
m = XOR.closeCells(m)


XOR.deleteHMesh(hmsh);
XOR.deleteSensor(senso);
```

(continues on next page)

(continued from previous page)

```
C.convertPyTree2File(m, 'out.cgns')
```

Intersector.**conformizeHMesh**(*a*, *hooks*)

Converts the basic element leaves of a hierarchical mesh (*hooks* is a list of pointers to hiearchical zones) to a conformal polyhedral mesh. Each hierarchical zone is referring to a zone in the original Pytree *t*. So the mesh is replaced in the returned tree and the BCs/Joins/Fields are transferred.

Parameters

- **a** (hooks) – Input mesh
- **hooks** – list of pointers to hiearchical zones

Example of use:

- conformizeHMesh:

```
# - dynamic adaptation
#
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


mesh = G.cart((0,0,0), (1,1,1), (20,20,20))
mesh = C.convertArray2NGon(mesh)

source = G.cartHexa((8,8,8), (0.2,0.2,0.2), (20,20,20))

XOR._setZonesAndJoinsUId(mesh)

hmsh = XOR.createHMesh(mesh)

senso = XOR.createSensor(hmsh)
XOR.assignData2Sensor(senso, source)

m = XOR.adaptCells(mesh, hmesh = hmsh, sensor=senso)

m = XOR.conformizeHMesh(m, hmsh)
m = XOR.closeCells(m)
```

(continues on next page)

(continued from previous page)

```
XOR.deleteHMesh(hmsh);
XOR.deleteSensor(senso);

C.convertPyTree2File(m, 'out.cgns')
```

`Intersector.`**`createSensor`**(*hmesh*, *sensor_type=0*, *smoothing_type=0*, *itermax=-1*)

Creates a sensor and returns a hook on it.

Parameters

- **hmesh** (hook) – hmesh hook
- **sensor_type** (int) – type of sensor. geometrical (0), xensor (1), nodal sensor (2), cell sensor (3)
- **smoothing_type** (int) – first-neighborhood (0), shell-neighborhood(1)
- **itermax** (int) – maximum nb of generations

Example of use:

- createSensor:

```
# - dynamic adaptation
#
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


mesh = G.cart((0,0,0), (1,1,1), (20,20,20))
mesh = C.convertArray2NGon(mesh)

source = G.cartHexa((8,8,8), (0.2,0.2,0.2), (20,20,20))

XOR._setZonesAndJoinsUId(mesh)

hmsh = XOR.createHMesh(mesh)

senso = XOR.createSensor(hmsh)
XOR.assignData2Sensor(senso, source)

m = XOR.adaptCells(mesh, hmesh = hmsh, sensor=senso)
```

(continues on next page)

(continued from previous page)

```
m = XOR.conformizeHMesh(m, hmsh)
m = XOR.closeCells(m)


XOR.deleteHMesh(hmsh);
XOR.deleteSensor(senso);

C.convertPyTree2File(m, 'out.cgns')
```

Intersector.**assignData2Sensor**(*sensor*, *sensdata*)

Assigns data to a sensor.

Parameters

- **sensor** (hook) – sensor hook
- **sensdata** ([array, list of arrays] or [pyTree, base, zone, list of zones] for sensor type 0 and 1. Numpy of integers for other sensors.) – Data for the sensor

Example of use:

- assignData2Sensor:

```
# - dynamic adaptation
#
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


mesh = G.cart((0,0,0), (1,1,1), (20,20,20))
mesh = C.convertArray2NGon(mesh)

source = G.cartHexa((8,8,8), (0.2,0.2,0.2), (20,20,20))

XOR._setZonesAndJoinsUId(mesh)

hmsh = XOR.createHMesh(mesh)

senso = XOR.createSensor(hmsh)
XOR.assignData2Sensor(senso, source)

m = XOR.adaptCells(mesh, hmesh = hmsh, sensor=senso)
```

(continues on next page)

(continued from previous page)

```
m = XOR.conformizeHMesh(m, hmsh)
m = XOR.closeCells(m)


XOR.deleteHMesh(hmsh);
XOR.deleteSensor(senso);

C.convertPyTree2File(m, 'out.cgns')
```

`Intersector.`**`deleteSensor`**(*sensor*)

Deletes a sensor

Parameters
sensor (hook) – sensor hook

Example of use:

- deleteSensor:

```
# - dynamic adaptation
#
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR


mesh = G.cart((0,0,0), (1,1,1), (20,20,20))
mesh = C.convertArray2NGon(mesh)

source = G.cartHexa((8,8,8), (0.2,0.2,0.2), (20,20,20))

XOR._setZonesAndJoinsUId(mesh)

hmsh = XOR.createHMesh(mesh)

senso = XOR.createSensor(hmsh)
XOR.assignData2Sensor(senso, source)

m = XOR.adaptCells(mesh, hmesh = hmsh, sensor=senso)

m = XOR.conformizeHMesh(m, hmsh)
m = XOR.closeCells(m)
```

(continues on next page)

(continued from previous page)

```
XOR.deleteHMesh(hmsh);
XOR.deleteSensor(senso);

C.convertPyTree2File(m, 'out.cgns')
```

3.4 Metric Functions

Intersector.**edgeLengthExtrema**(*a*)

Returns the minimum edge length in a.

Parameters

a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

Intersector.**volumes**(*a*)

Returns the cell volumes as a field (PyTree) or a numpy of floats.

Parameters

a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

Intersector.**centroids**(*a*)

Returns the cell centroids as a points cloud.

Parameters

a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

Intersector.**computeGrowthRatio**(*a*, *vmin=0.*)

For each cell, the growth ratio with each of its neighbors is computed as the ratio of the biggest volume to the smallest one.

The maximum over all the neighbors is chosen:

Growth Ratio for Cell i = MAX_k (MAX(vi, vk) / MIN(vi, vk)) where k is a neighbor.

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **vmin** (float) – volume threshold.

Example of use:

- computeGrowthRatio (array):

```
# - Extract pathological cells (uncomputable or non-star) (array) -
import Converter as C
import Intersector as XOR

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])

M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])

tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)

aspect_ratio = XOR.computeGrowthRatio(m)
aspect_ratio = C.center2Node(aspect_ratio)

C._addVars([m, aspect_ratio])

C.convertArrays2File(m, 'out.plt')
```

- computeGrowthRatio (pyTree):

```
# - Extract pathological cells (uncomputable or non-star) - (array)

import Converter.PyTree as C
import Intersector.PyTree as XOR

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3
```

(continues on next page)

(continued from previous page)

```
t = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)

t=XOR.computeGrowthRatio(t)
C.convertPyTree2File(t, 'out.cgns')
```

3.5 Extraction Functions

Intersector.**extractPathologicalCells**(*a*, *neigh_level=0*)

Extracts cells that will potentially cause a failure when running a CFD solver. There are 4 zones upon exit, one for each pathology:

- Non-centroid-star-shaped Cells
- Cells having degenrated polygons for which the normal cannot be computed
- Cells having degenrated polygons for a delaunay triangulation fails
- Open Cells

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **neigh_level** (int) – Number of neighbor layers (surounding pathologies) to extract as well

Example of use:

- extractPathologicalCells (array):

```
# - Extract pathological cells (uncomputable or non-star) - (array)

import Converter as C
import Intersector as XOR

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])

M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])
```

(continues on next page)

(continued from previous page)

```
tol = -0.5e-3

m = XOR.booleanMinus(M1, M2, tol, preserve_right=1, solid_right=1, agg_
↪mode=1)
#C.convertArrays2File([m], 'i.plt')

m=XOR.extractPathologicalCells(m, 2) # ask for 2 level of neighgbors

C.convertArrays2File(m, 'out.plt')
```

- extractPathologicalCells (pyTree):

```
# - Extract pathological cells (PyTree) -
# uncomputable or non-star
import Converter.PyTree as C
import Intersector.PyTree as XOR

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)

tol = -0.5e-3

t = XOR.booleanMinus(M1, M2, tol, preserve_right=0, solid_right=0, agg_
↪mode=1)

t = XOR.extractPathologicalCells(t, 2) # ask for 2 level of neighgbors

C.convertPyTree2File(t, "out.cgns")
```

Intersector.**extractOuterLayers**(*a*, *N*, *discard_external=0*)

Extracts prescribed outer cell layers.

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **N** (int) – Number of layers to extract

- **discard_external** (0 or 1) – For volume mesh with holes (e.g. external flow), set it to 1 to extract only layers around bodies, or 0 to extract over all the outer polygons.

Example of use:

- extractOuterLayers (array):

```
# - extractOuterLayers (array) -
import Converter as C
import Intersector as XOR
import Generator as G

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])
M1 = C.conformizeNGon(M1); M1 = G.close(M1)
m = XOR.extractOuterLayers(M1, 1, discard_external=0)

C.convertArrays2File(m, "out.plt")
```

- extractOuterLayers (pyTree):

```
# - extractOuterLayers (pyTree) -
import Converter.PyTree as C
import Intersector.PyTree as XOR
import Generator.PyTree as G
t = C.convertFile2PyTree('boolNG_M1.tp')
t = C.conformizeNGon(t); t = G.close(t)
t = XOR.extractOuterLayers(t, 1, discard_external=0, output_
↪remaining=True)

C.convertPyTree2File(t, "out.cgns")
```

Intersector.**getCells**(*a*, *ids*, *are_face_ids=True*)

Returns the cells in t1 having specified faces or cell ids.

Parameters

- **a** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **ids** (numpy of ints) – face or cell ids
- **are_face_ids** (boolean) – Tells whether the ids are referring to faces or cells.

Example of use:

See getCollidingCells for an example.

Intersector.**getOverlappingFaces**(*t1*, *t2*, *RTOL*, *ps_min*, *dir2*)

Detects all the overlapping polygons in t1 and t2. Returns the result as a list sized as the number of zones in t1. Each entry gives 2 lists : the first is the pg ids in t1 ith-zone, the second is the pg ids in t2 (joined).

Parameters

- **t1** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **t2** ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh
- **RTOL** (float) – relative tolerance
- **ps_min** (float) – minimal dot product between normals of a pair of polygon to consider them as potentially overlapping.
- **dir2** (tuple) – given direction to compare t1's faces with. If None, t2's normals are used.

Example of use:

- getOverlappingFaces (array):

```
import Generator as G
import Transform as T
import Converter as C
import Converter as I
import Intersector as XOR
import KCore.test as test
import Post as P

t1 = G.cart((0,0,0), (1,1,1), (10,10,10))
t1 = C.convertArray2NGon(t1); t1 = G.close(t1)
t2 = G.cart((1.,0,0), (1,1,1), (10,10,10))
t2 = C.convertArray2NGon(t2); t2 = G.close(t2)

# test 1 : volume/volume
res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

# create a list of polygon list (t1), one list per zone
```

(continues on next page)

(continued from previous page)

```
t = XOR.agglomerateCellsWithSpecifiedFaces(t1, res[0])

C.convertArrays2File([t], "out.plt")

#test 2 : volume/surface

t2 = P.exteriorFaces(t2)
t2 = XOR.convertNGON2DToNGON3D(t2)

res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, res[0])

C.convertArrays2File([t], "out1.plt")
```

- getOverlappingFaces (pyTree):

```
import Generator.PyTree as G
import Transform.PyTree as T
import Converter.PyTree as C
import Converter.Internal as I
import Intersector.PyTree as XOR
import KCore.test as test
import Post.PyTree as P

t1 = G.cart((0,0,0), (1,1,1), (10,10,10))
t1 = C.convertArray2NGon(t1); t1 = G.close(t1)
t2 = G.cart((1.,0,0), (1,1,1), (10,10,10))
t2 = C.convertArray2NGon(t2); t2 = G.close(t2)

# test 1 : volume/volume
res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

# create a list of polygon list (t1), one list per zone
nb_zones = len(res)
t1zones_pgids = []
for i in range(nb_zones):
  t1zones_pgids.append(res[i][0])

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, t1zones_pgids)

C.convertPyTree2File(t, "out.cgns")
```

(continues on next page)

(continued from previous page)

```
#test 2 : volume/surface

t2 = P.exteriorFaces(t2)
t2 = XOR.convertNGON2DToNGON3D(t2)

res = XOR.getOverlappingFaces(t1, t2, RTOL = 0.05, amax = 0.1)

t1zones_pgids = []
for i in range(nb_zones):
  t1zones_pgids.append(res[i][0])

t = XOR.agglomerateCellsWithSpecifiedFaces(t1, t1zones_pgids)

C.convertPyTree2File(t, "out1.cgns")
```

Tips and Notes:

- When assembling 2 meshes m1 and m2 where m2 is priorized, to improve the assembly quality, do before calling the boolean union:

1) getOverlappingFaces (m1, skin(m2)) where skin(m2) is the external polygonal skin of m2
2) agglomerateCellsWithSpecifiedFaces on m1 with the above list of polygons

---

`Intersector.`**`getCollidingCells`**(*t1*, *t2*, *RTOL*)

Returns the list of cells in t1 and t2 that are colliding. Possible combinations of mesh types for (t1,t2) are (volume,volume), (volume,surface), (surface, polyline).

Parameters

- **t1** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **t2** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **RTOL** (`float`) – relative tolerance

Example of use:

- getCollidingCells (array):

```
import Generator as G
import Transform as T
import Converter as C
import Converter as I
import Intersector as XOR
import KCore.test as test
import Post as P

t1 = G.cart((0,0,0), (1,1,1), (10,10,10))
t1 = C.convertArray2NGon(t1); t1 = G.close(t1)
t2 = G.cart((1.,1.5,3.), (1,1,1), (10,10,10))
t2 = C.convertArray2NGon(t2); t2 = G.close(t2)

res = XOR.getCollidingCells(t1, t2, RTOL = 0.05)

m = XOR.getCells(t1, res[0], are_face_ids=False)

C.convertArrays2File([m], "out.plt")
```

- getCollidingCells (pyTree):

```
import Generator.PyTree as G
import Transform.PyTree as T
import Converter.PyTree as C
import Converter.Internal as I
import Intersector.PyTree as XOR
import KCore.test as test
import Post.PyTree as P

t1 = G.cart((0,0,0), (1,1,1), (10,10,10))
t1 = C.convertArray2NGon(t1); t1 = G.close(t1)
t2 = G.cart((1.,1.5,3.), (1,1,1), (10,10,10))
t2 = C.convertArray2NGon(t2); t2 = G.close(t2)

res = XOR.getCollidingCells(t1, t2, RTOL = 0.05)

[ids_in1,ids_in2] = res[0]

m = XOR.getCells(t1, [ids_in1], are_face_ids=False)

C.convertPyTree2File(m, "out.cgns")
```

(continues on next page)

(continued from previous page)

```
C.convertPyTree2File(t1, "t1.cgns")
C.convertPyTree2File(t2, "t2.cgns")
```

3.6 Check Functions

Intersector.**selfX**(*a*)

Checks self-intersections in a mesh. Returns the first two cell indices that collide.

Parameters
a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

Example of use:

- selfX (array):

```
# - boolean difference (array) -
import Intersector as XOR
import Converter as C
import Transform as T

M1 = C.convertFile2Arrays('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1[0])
M1 = C.conformizeNGon(M1)
M1 = XOR.closeCells(M1)


M2 = C.convertFile2Arrays('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2[0])
M2 = C.conformizeNGon(M2)
M2 = XOR.closeCells(M2)

tol = -0.5e-3


M = T.join(M1,M2)
M = XOR.selfX(M)

C.convertArrays2File([M], 'out.plt')
```

- selfX (pyTree):

```
# - boolean difference (array) -
import Intersector.PyTree as XOR
import Converter.PyTree as C
import Transform.PyTree as T

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)
M1 = C.conformizeNGon(M1)
M1 = XOR.closeCells(M1)


M2 = C.convertFile2PyTree('boolNG_M2.tp')
M2 = C.convertArray2NGon(M2)
M2 = C.conformizeNGon(M2)
M2 = XOR.closeCells(M2)

tol = -0.5e-3


M = T.join(M1,M2)
M = XOR.selfX(M)

C.convertPyTree2File(M, 'out.cgns')
```

`Intersector.`**`diffMesh`**(*a1*, *a2*)

Extracts the diff between 2 meshes. Returns 2 zones : one zone with the a1 cells that are not in a2, the second one is the reciprocal.

Parameters

- **a1** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh
- **a2** (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh

Example of use:

- diffMesh (array):

```
# - boolean diffSurf (array) -
import Generator as G
import Geom as D
import Converter as C
import Intersector as XOR
```

(continues on next page)

(continued from previous page)

```
# octree
s = D.sphere((0,0,0), 1., 100); snear = 0.1
t = G.octree([s],[snear], dfar=5., balancing=1,ratio=2)

# ngon conversion
t = C.convertArray2NGon(t)
# ngon conformization
t = C.conformizeNGon(t); t = G.close(t)
# ngon close cells
t = XOR.closeCells(t)
#t = XOR.reorientExternalFaces(t)

# ngon conversion of the sphere
s = C.convertArray2NGon(s)
# ngon conversion to the nuga format
s = XOR.convertNGON2DToNGON3D(s)
#s = XOR.reorientExternalFaces(s)

# Boolean operation
x = XOR.diffSurf(t, s, tol = 0., preserve_right=1, agg_mode=2) # agg_
↪mode=2 : full mode aggregation

xa = XOR.agglomerateSmallCells(x, 0., 10.)

x = XOR.diffMesh(x,xa[0])
C.convertArrays2File(x, 'diffM.plt')
```

- diffMesh (pyTree):

```
# - boolean diffSurf (array) -
import Generator.PyTree as G
import Geom.PyTree as D
import Converter.PyTree as C
import Intersector.PyTree as XOR

# octree
s = D.sphere((0,0,0), 1., 100); snear = 0.1
t = G.octree([s],[snear], dfar=5., balancing=1,ratio=2)

# ngon conversion
```

(continues on next page)

(continued from previous page)

```
t = C.convertArray2NGon(t)
# ngon conformization
t = C.conformizeNGon(t); t = G.close(t)
# ngon close cells
t = XOR.closeCells(t)
#t = XOR.reorientExternalFaces(t)

# ngon converion of the sphere
s = C.convertArray2NGon(s)
# ngon converion to the nuga format
s = XOR.convertNGON2DToNGON3D(s)
#s = XOR.reorientExternalFaces(s)

# Boolean operation
x = XOR.diffSurf(t, s, tol = 0., preserve_right=1, agg_mode=2) # agg_
↪mode=2 : full mode aggregation

xa = XOR.agglomerateSmallCells(x, 0., 10.)

x = XOR.diffMesh(x,xa)
C.convertPyTree2File(x, 'diffM.cgns')
```

`Intersector.`**`checkCellsClosure`**`(`*a*`)`

Checks that input mesh cells are closed, i.e. each cell' edge is shared by exactly two polygons.

Parameters

a (`[array, list of arrays] or [pyTree, base, zone, list of zones]`) – Input mesh

Example of use:

- checkCellsClosure (array):

```
# - boolean reorientExternalFaces (array) -
import Generator as G
import Converter as C
import Intersector as XOR


a = G.cartHexa((0.,0.,0.), (0.1,0.1,0.2), (10,10,10))
a = C.convertArray2NGon(a)
```

(continues on next page)

(continued from previous page)

```
err = XOR.checkCellsClosure(a)
```

- checkCellsClosure (pyTree):

```
# - boolean checkCellsClosure (pyTree) -
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR

M1 = C.convertFile2PyTree('boolNG_M1.tp')
M1 = C.convertArray2NGon(M1)

err = XOR.checkCellsClosure(M1)
```

Intersector.**checkCellsFlux**(*a*)

Computes the cell fluxes using the ParentElement elsA's node for orientation.

Parameters

a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

Example of use:

- checkCellsFlux (pyTree):

```
# - selectCells (pyTree) -
import Converter.PyTree as C
import Intersector.PyTree as XOR
import Converter.Internal as I


t = C.convertFile2PyTree('boolNG_M1.tp')
t = C.convertArray2NGon(t)
t = XOR.closeCells(t)

I._createElsaHybrid(t, method=1, methodPE=1)

XOR.checkCellsFlux(t)
```

`Intersector.`**`checkCellsVolume`**`(a)`

Computes the minimum volume using the ParentElement elsA's node for orientation.

Parameters

a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

Example of use:

- checkCellsVolume (pyTree):

```
# - boolean checkCellsClosure (array) -
import Generator.PyTree as G
import Converter.PyTree as C
import Intersector.PyTree as XOR
import Geom.PyTree as D
import Converter.Internal as I

t = C.convertFile2PyTree('boolNG_M1.tp')
t = C.convertArray2NGon(t)
t = XOR.closeCells(t)

I._createElsaHybrid(t, method=1, methodPE=1)

err = XOR.checkCellsVolume(t)
```

`Intersector.`**`checkForDegenCells`**`(a)`

Checks if there are any cell with less than 4 faces.

Parameters

a ([array, list of arrays] or [pyTree, base, zone, list of zones]) – Input mesh

---

3.7 Conversion Functions

`Intersector.`**`convertNGON2DToNGON3D`**`(a)`

Converts a polygon surface stored in the Cassiopee NGON format (Face/Edge) to a Face/Node format.

CHAPTER

FOUR

INDEX

- genindex
- modindex
- search