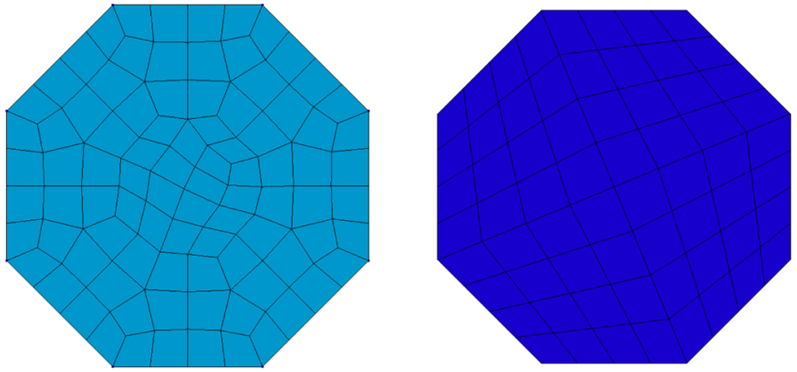

Mapped Meshing

DIANA FEA

Outline

1 Introduction

DianaIE can generate structured meshes for faces that are logically equivalent to a quadrilateral. This means that grid meshes are automatically created for faces with exactly four *end vertices*. Each *end vertex* corresponds to one of the four vertices in the equivalent quadrilateral. A mappable face may have any number of *side vertices*. A side vertex splits a side of the logical map. For more information about mapped meshing see the Diana *Documentation*.

Diana automatically detects if a mapped mesh can be created for a face [Fig. 1]. There are faces that, due to their geometry or because of multiple solutions for the map, may not be found mappable by DianaIE. When a face cannot be meshed using the mapping scheme (used by default), DianaIE will automatically revert to the unstructured mesh engine. In those cases, the user may overrule the automatic corner specification by explicitly appointing the *end vertices* of the face. When the automatic corner detection fails to create a map mesh and the user steering option for defining the corners of the map is activated it is the users' responsibility to ensure that there are no badly shaped elements generated. For this, the opposite sides of the quadrilateral must have the same number of divisions.

This tutorial shows the case of a face that cannot be automatically mappable because has multiple possible pairs of corners for the map: the octagonal sheet has 8 vertices and 8 sides [Fig. 2]. The map mesh engine fails in this case and falls back to the unstructured mesh option. This tutorial exemplifies how, in this situations, the user can explicitly select the four *end vertices* of the map and generate a mapped mesh for this face. Different mapped meshes are created depending on the pairs of *end vertices* selected for the quadrilateral.

The mapped meshing is a two-dimensional functionality applied to surfaces, however, with extrusion of mappable faces, it is possible to make structured meshes in solids.

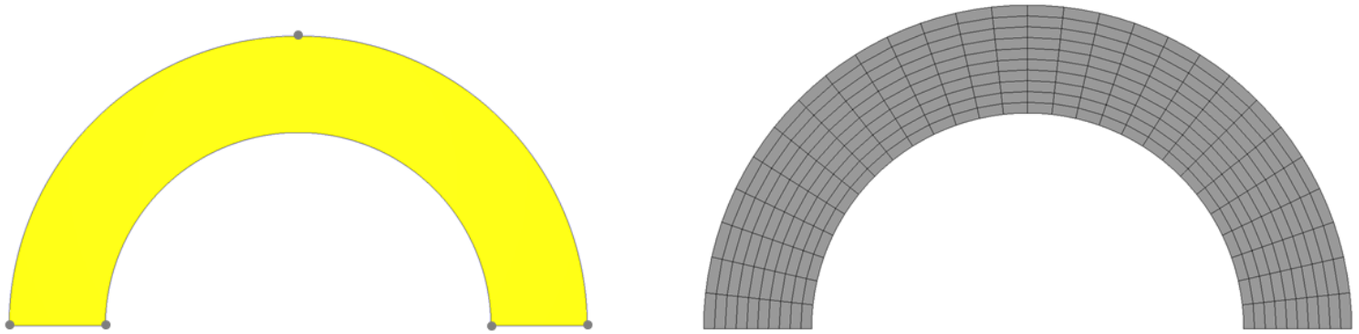

Figure 1: Example of a mapped mesh created automatically in DianaIE

2 Description

This tutorial presents how to specify the corners for a mapped mesh when a face cannot be automatically mapped by DianaIE. This example presents how to set the corner specification for mapped mesh for an octagonal sheet and the different grid meshes that are generated when different pairs of *end vertices* are selected as corners of the map. The geometry of the face considered to exemplify the mapped meshing is an octagon with edges of 1 m [Fig. 2].

This tutorial focus on the demonstration of how to create a mapped mesh. For this reason the common steps of creating a model are not explained in detail.

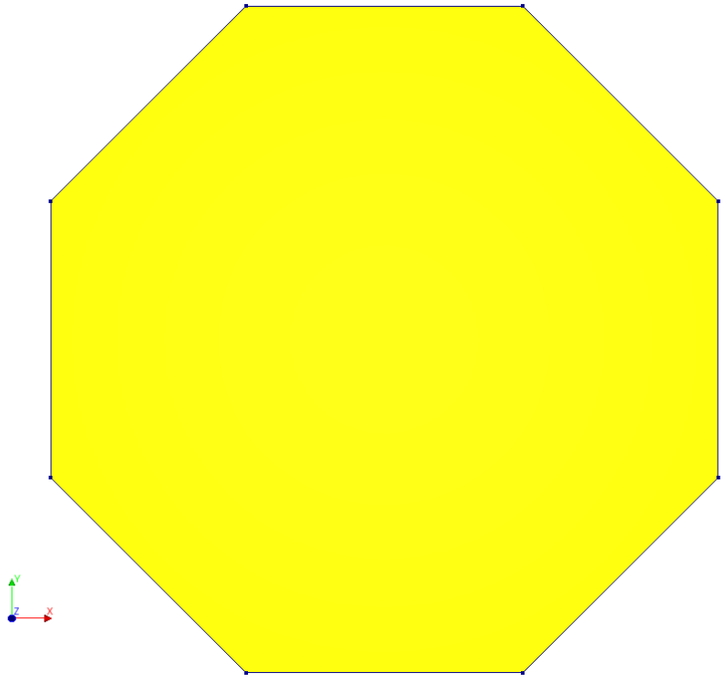

Figure 2: Octagonal sheet

3 Model

In a new project for three-dimensional structural model with default units we create an octagonal sheet. We assign properties to that sheet using regular curved shells and material properties from a model code and consider a thickness of 0.1 m. We do only the essential steps required for the creation of the mesh.

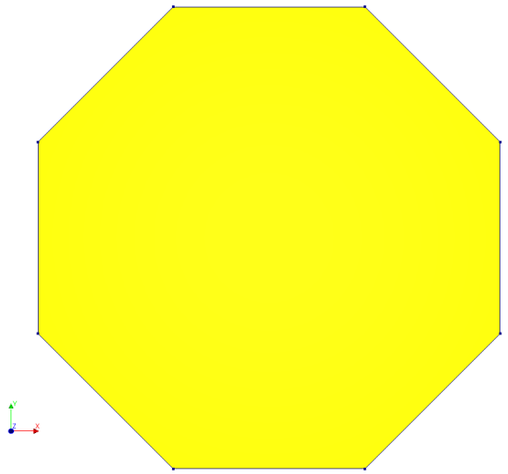

Figure 3: Geometry - octagonal sheet

Table 1: Coordinates for the octagonal sheet

X	Y	Z
0.5	-1.207	0
1.207	-0.5	0
1.207	0.5	0
0.5	1.207	0
-0.5	1.207	0
-1.207	0.5	0
-1.207	-0.5	0
-0.5	-1.207	0

4 Mesh

4.1 Unstructured Mesh

When generating the mesh without any action for mapping the resulting mesh is unstructured [Fig. 4] as the engine cannot appoint the four *end vertices* of the quadrilateral to create a map.

DianaIE

Main menu → Geometry → Mesh → Generate mesh  [Fig. 4]

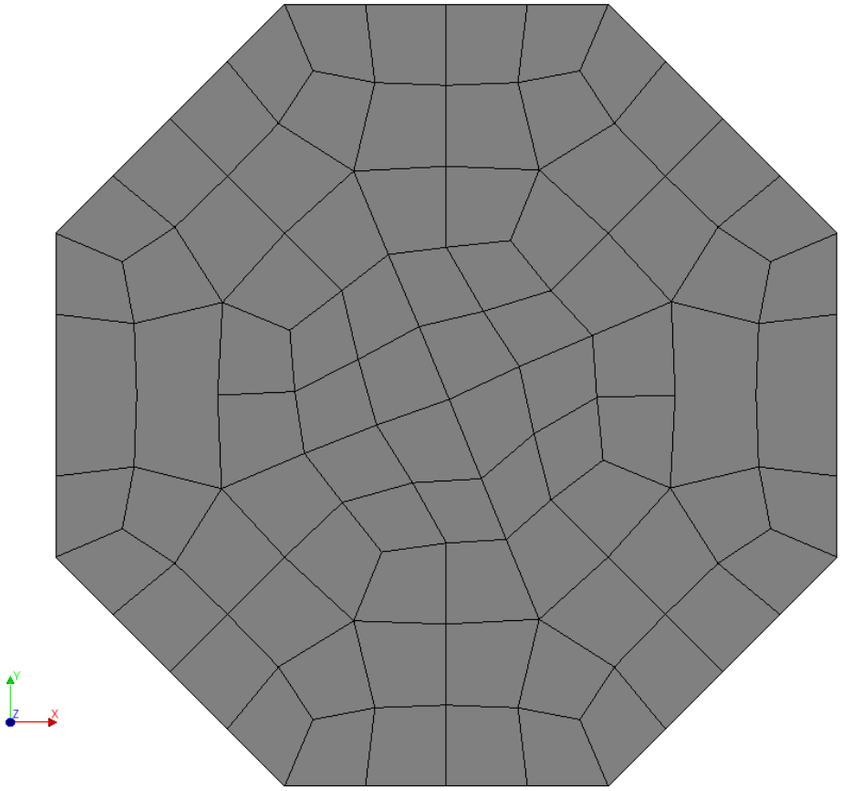

Figure 4: Unstructured mesh

4.2 Mapped Mesh 1

We can explicitly appoint the four *end vertices* for creating the map of the face. The pairs of opposite sides must have the same number of divisions set in the mesh properties, and this is the responsibility of the user. In this case we use the default number of 4 divisions.

DianaIE

Main menu → Geometry → Assign → Set corners for mapping [Fig. 5] [Fig. 6]

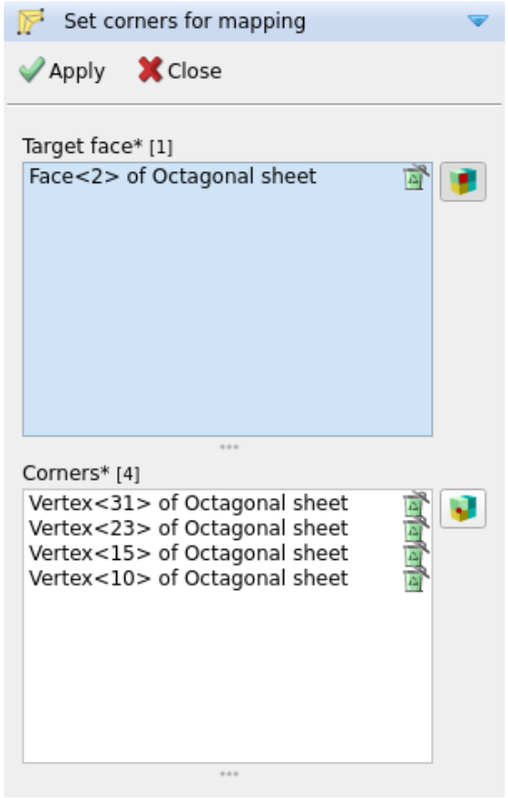

Figure 5: Set corners for mapping

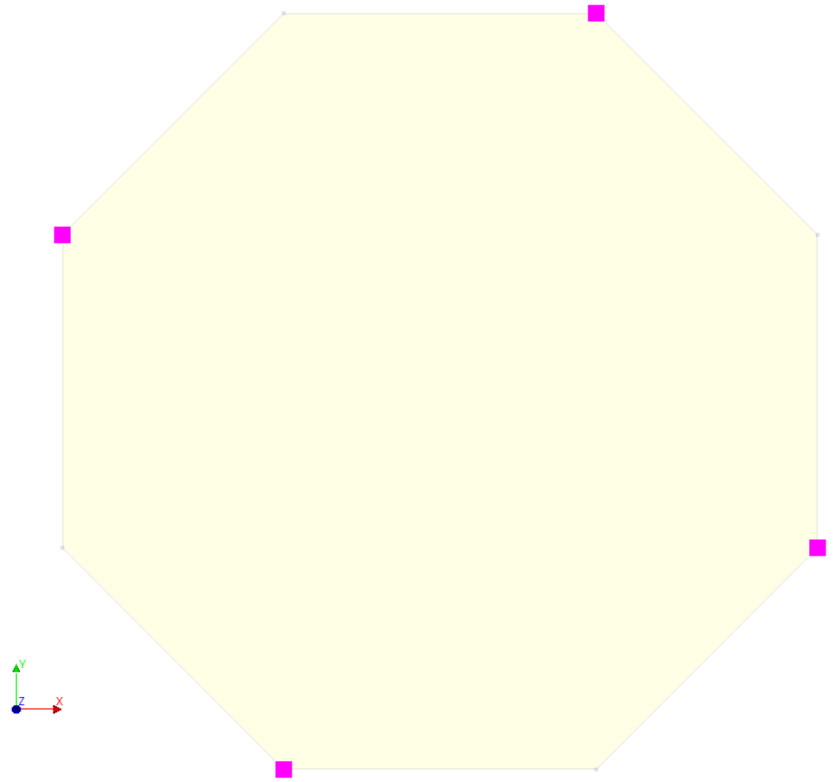

Figure 6: Selected corners for mapping

Note: to clear an explicitly set corner specification, select the face for which the corners have been previously specified and pop up the context menu in the viewer and select *Clear corners for mapping*. This can also be done through the Main menu in *Assign - Clear corners for mapping*.

When we generate the mesh we get a structured mapped mesh [Fig. 7].

DianaIE

Main menu → Geometry → Mesh → Generate mesh  [Fig. 7]

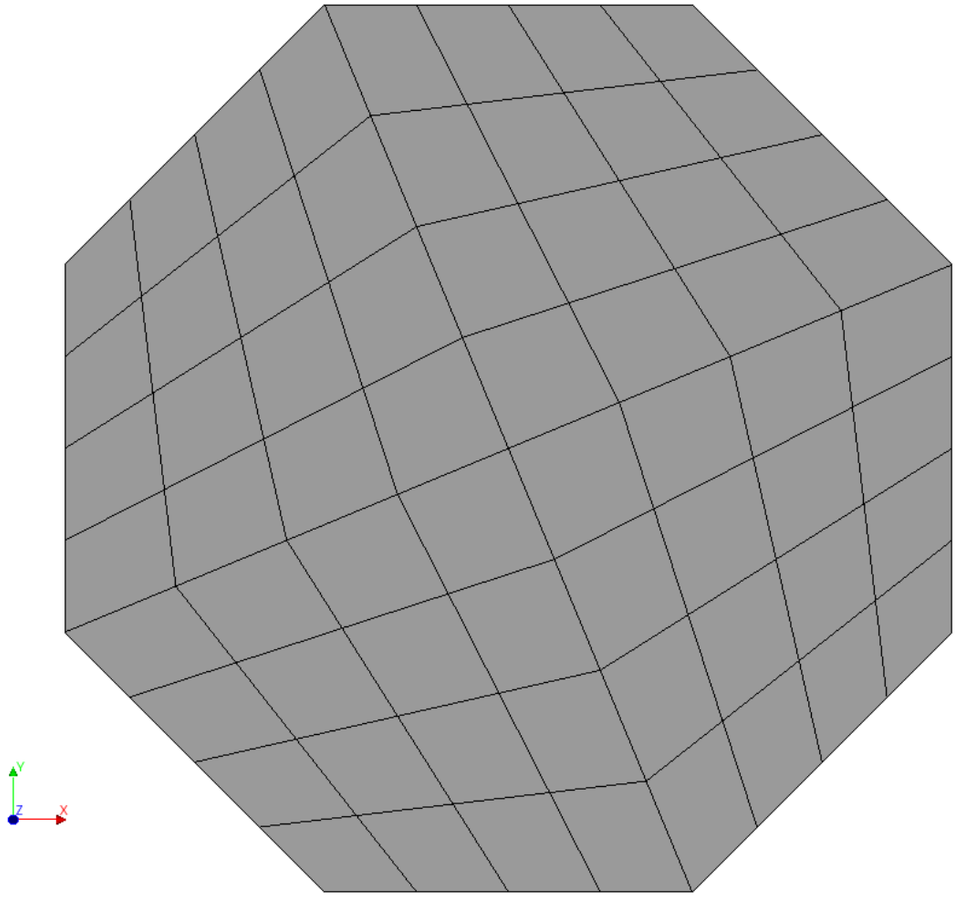

Figure 7: Mapped mesh

4.3 Mapped Mesh 2

We now define other pairs of *end vertices* for creating the map of the face [Fig. 8]. When we generate the mesh we get a structured mapped mesh [Fig. 9].

DianaIE

Main menu → Geometry → Assign → Set corners for mapping [Fig. 8]
Main menu → Geometry → Mesh → Generate mesh [Fig. 9]

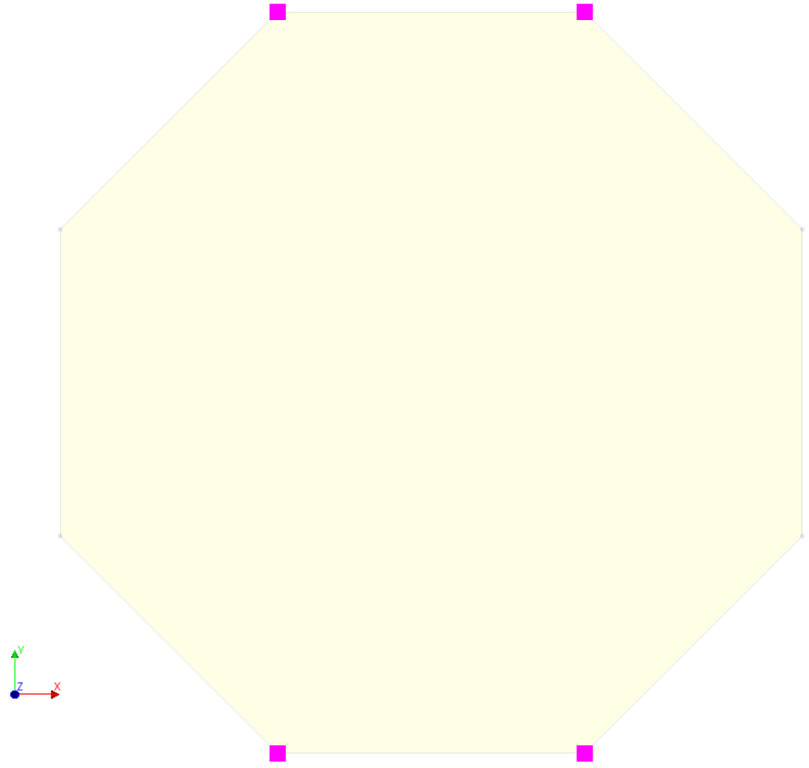

Figure 8: Selected corners for mapping

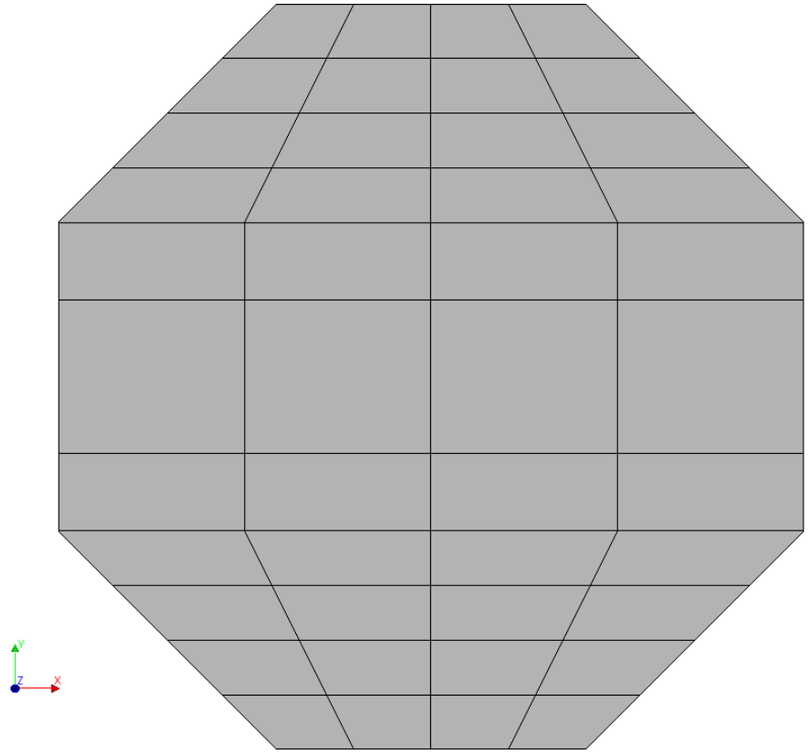

Figure 9: Mapped mesh

4.4 Mapped Mesh 3

We now define other pairs of *end vertices* for creating the map of the face [Fig. 10]. When we generate the mesh we get a structured mapped mesh [Fig. 11].

DianaIE

Main menu → Geometry → Assign → Set corners for mapping [Fig. 10]
Main menu → Geometry → Mesh → Generate mesh [Fig. 11]

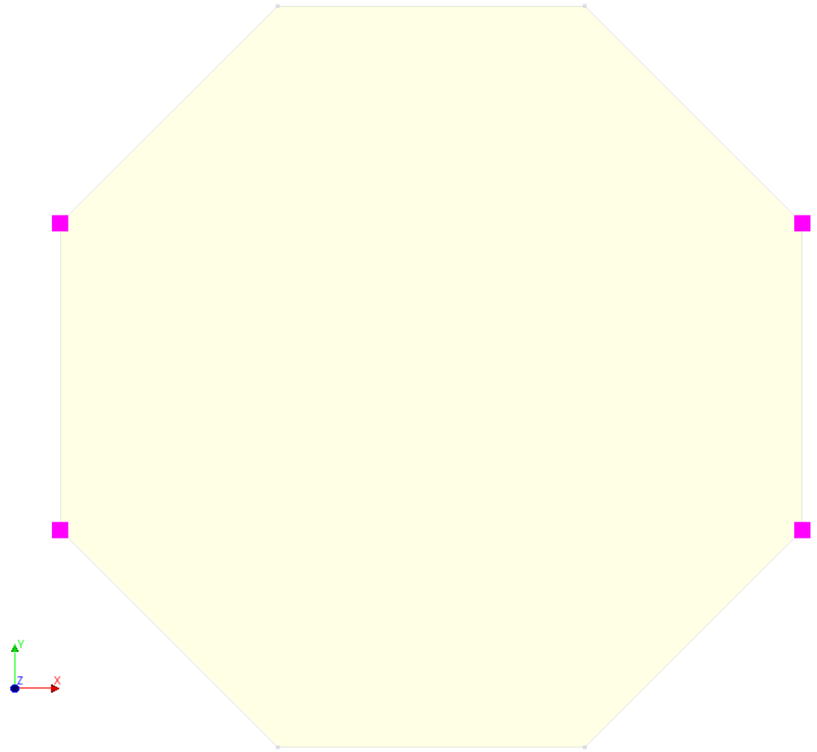

Figure 10: Selected corners for mapping

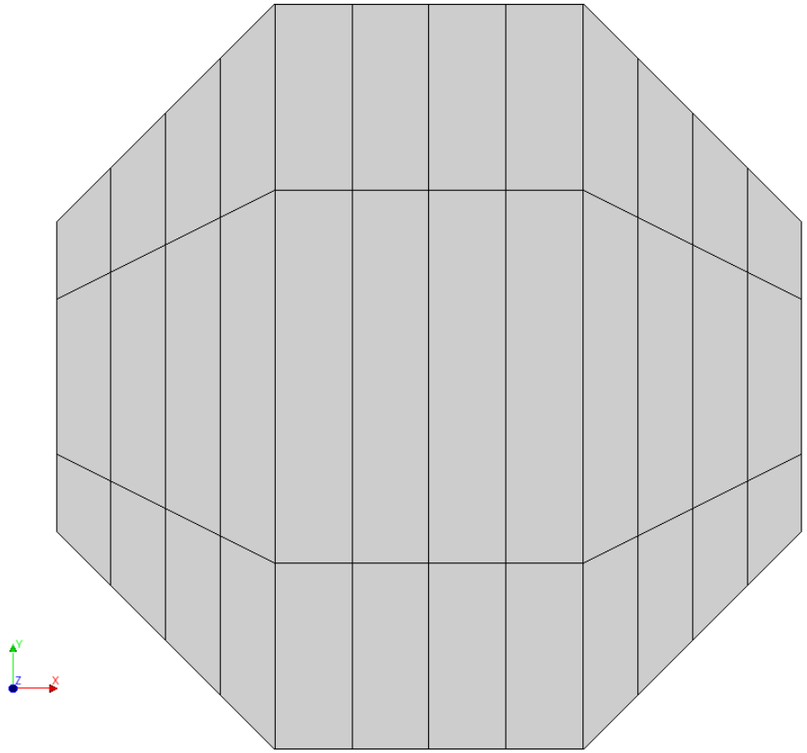

Figure 11: Mapped mesh

Appendix A Additional Information

Folder: Tutorials/MapMesh

Number of elements ≈ 90

Keywords:
ELEMEN: curved q20sh shell.
MATERI: concre crack harden mc2010 rotati soften totstr.

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