MASTER OF SCIENCE IN COMPUTATIONAL MECHANICS
UNIVERSIDAD POLITÉCNICA DE CATALUÑA

Subject: Computational Structural Mechanics and dynamics

Student: ANTONIO SOLITO

Practice 4

Exercise 1: Cylindrical tank

3D CASE

Geometry

Define the geometry of the structure in the preprocessor of Tdyn:

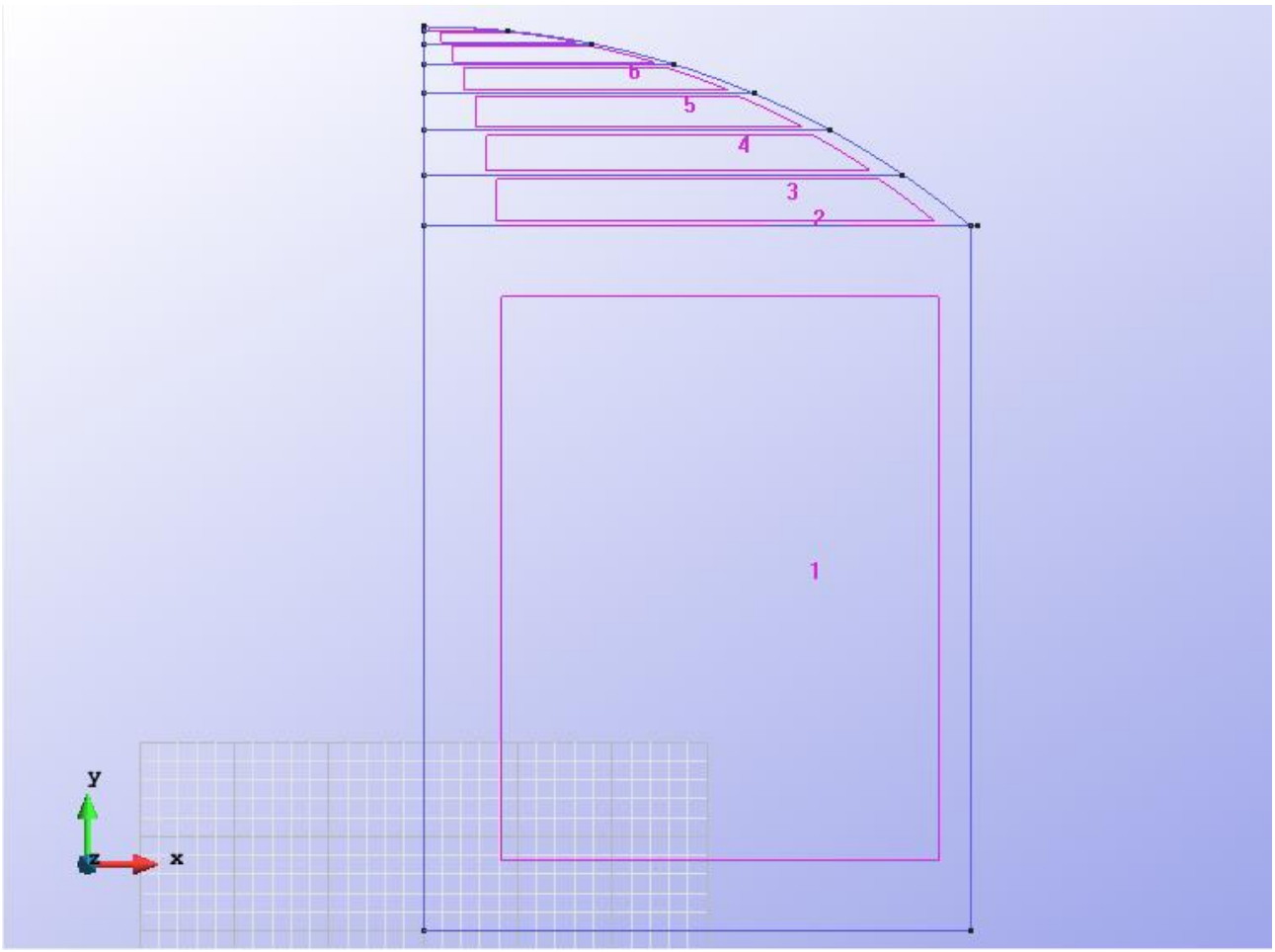

Figure 1 - Geometry of the structure

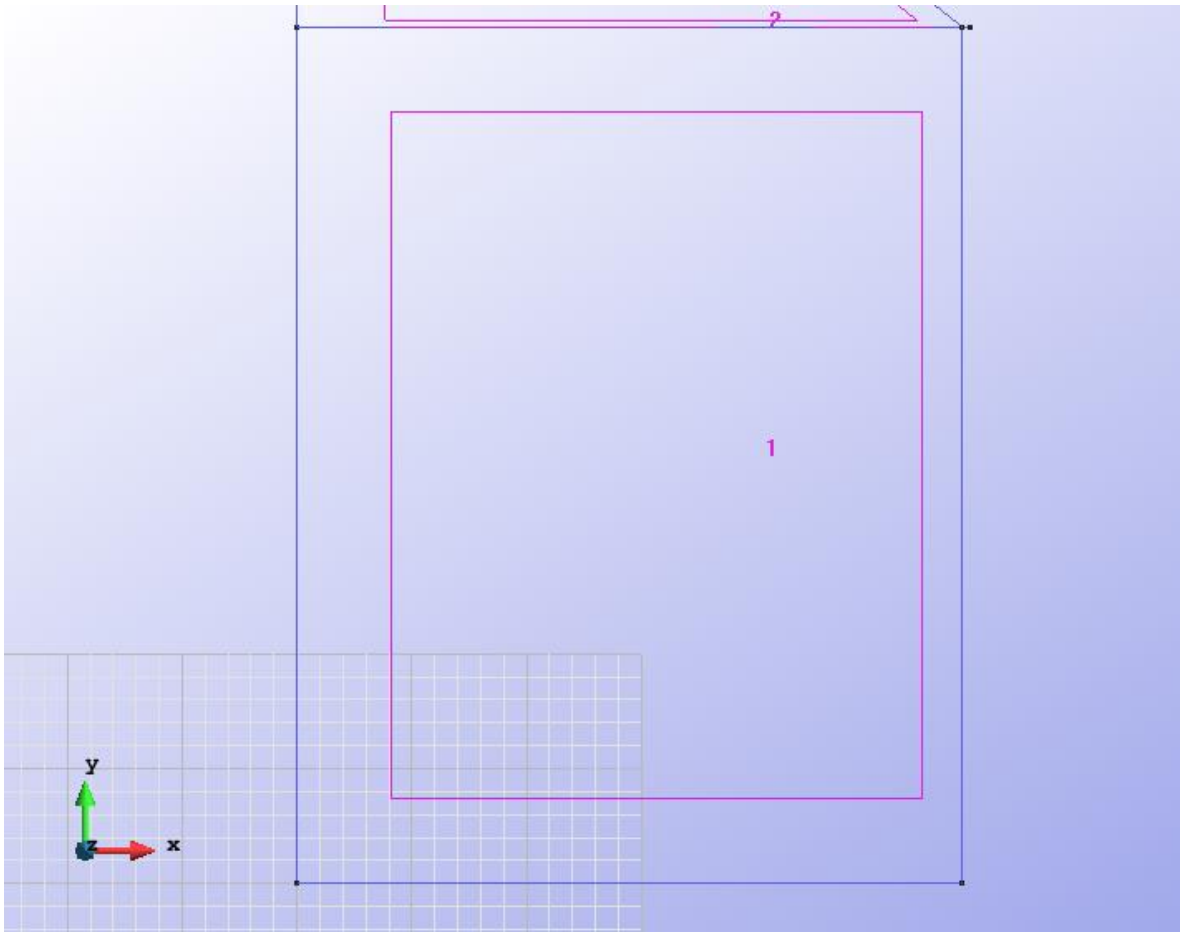

Figure 2 - Geometry of the lower structure

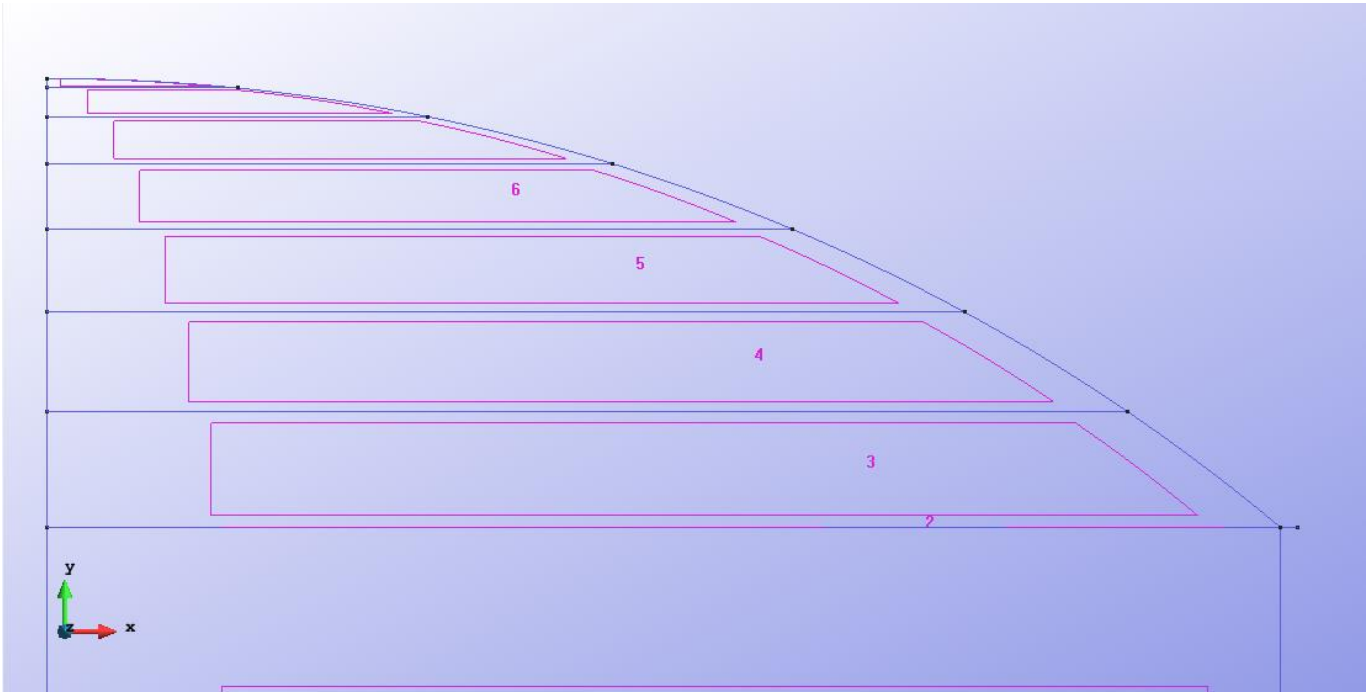

Figure 3 - Geometry of the high structure

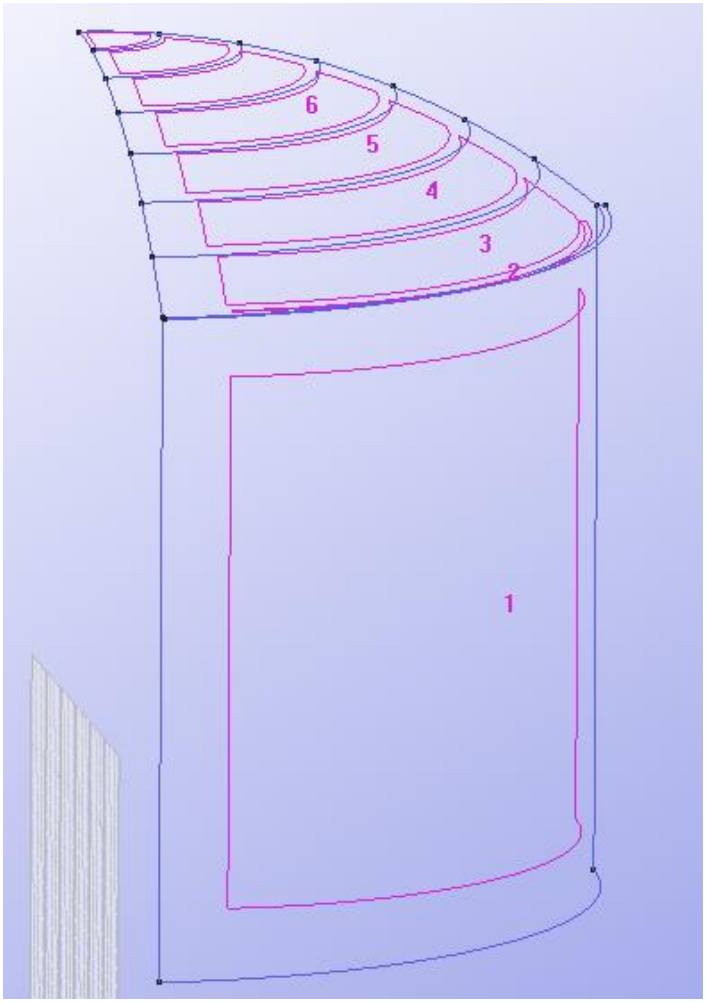

Figure 4 - Geometry of the structure in the 3D view

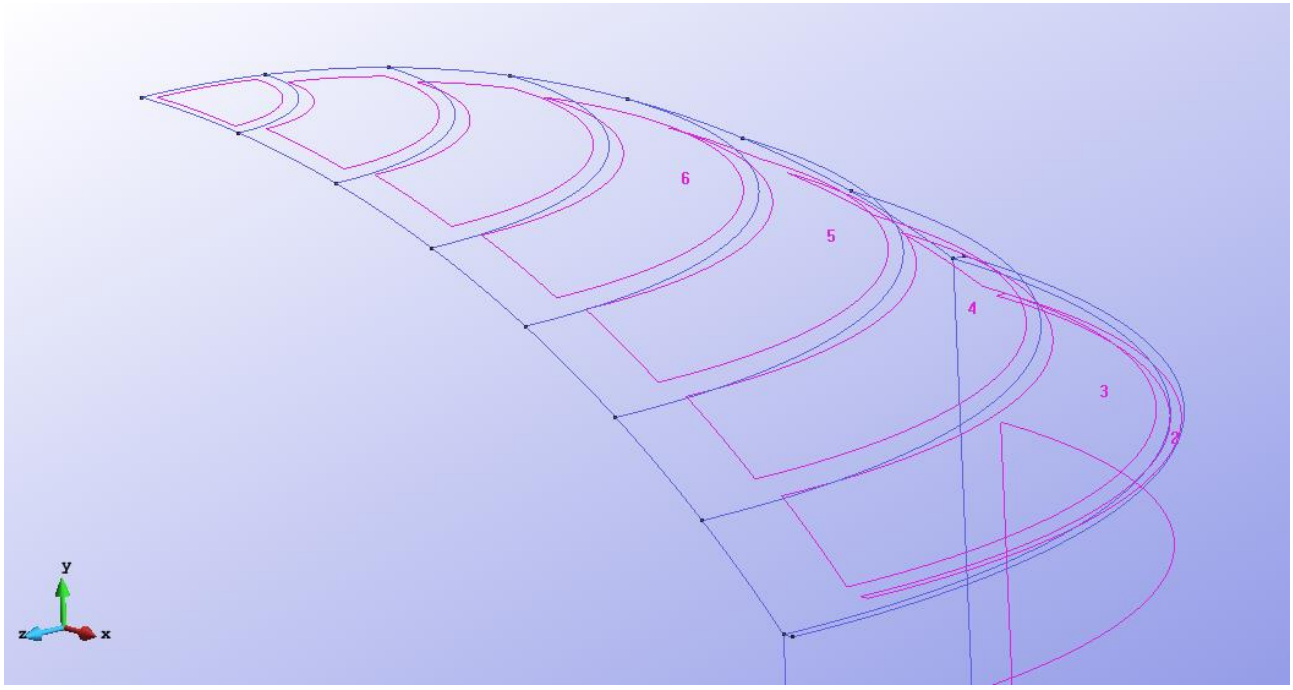

Figure 5 - Geometry of the high structure in the 3D view

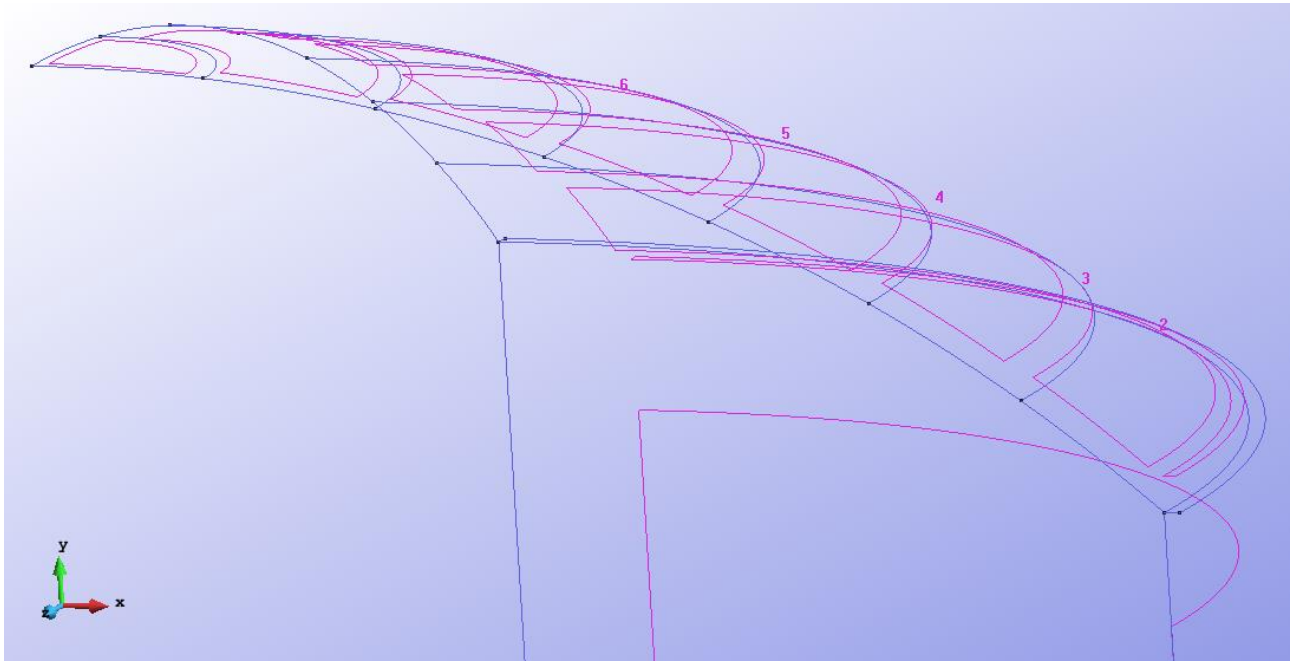

Figure 6 – Other figure of the high structure in 3D view

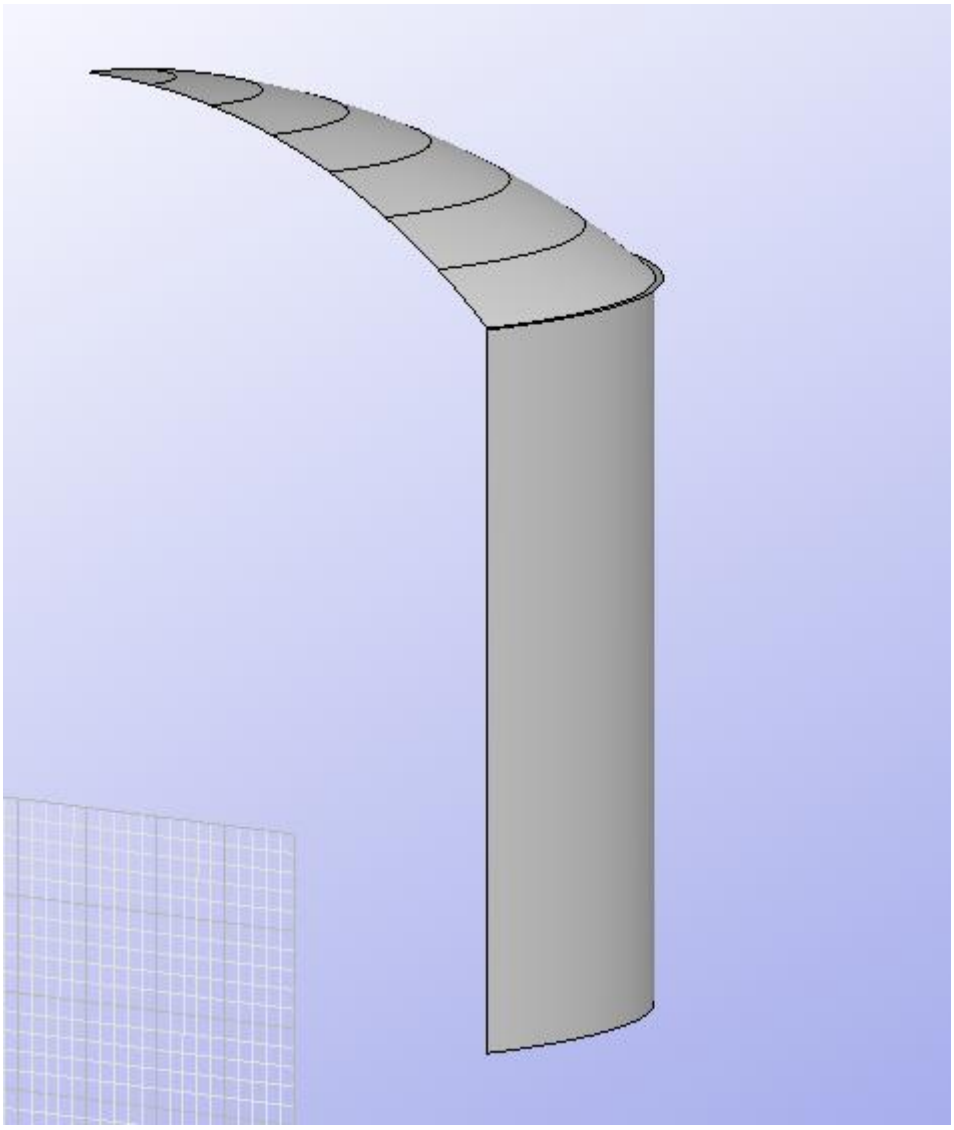
Figure 7 - Geometry of the structure in the flat view

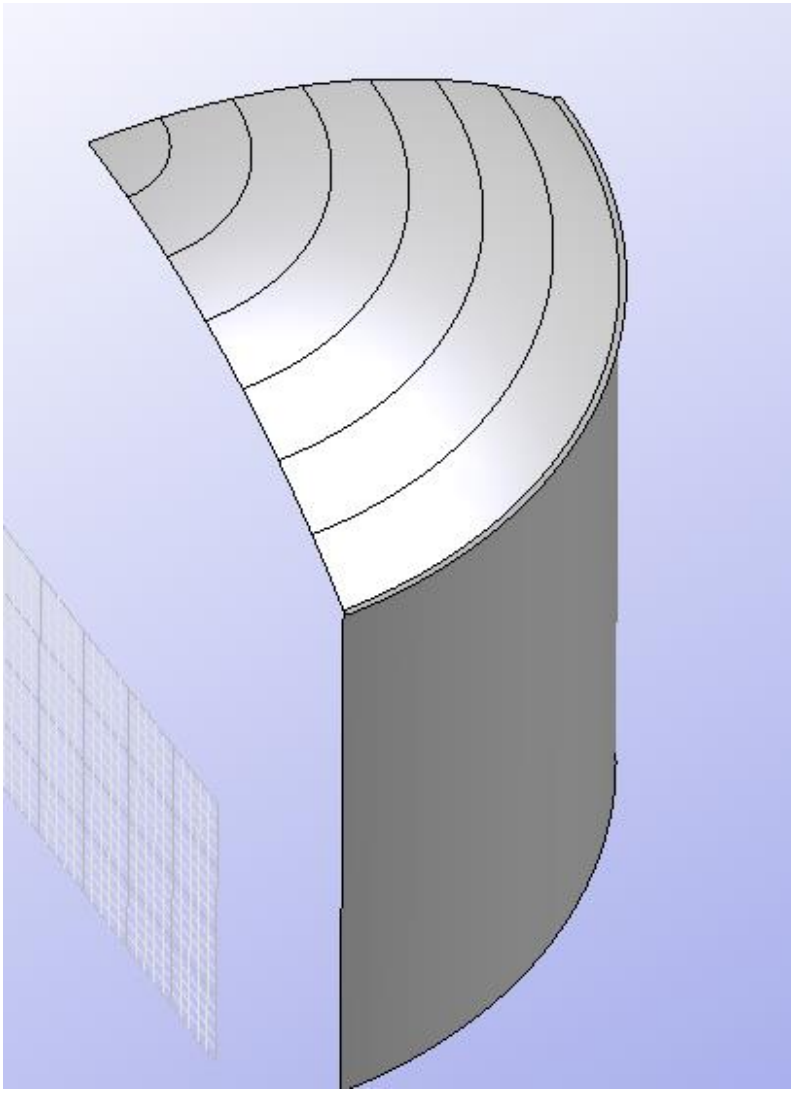

Figure 8 - Other figure of the structure in flat view

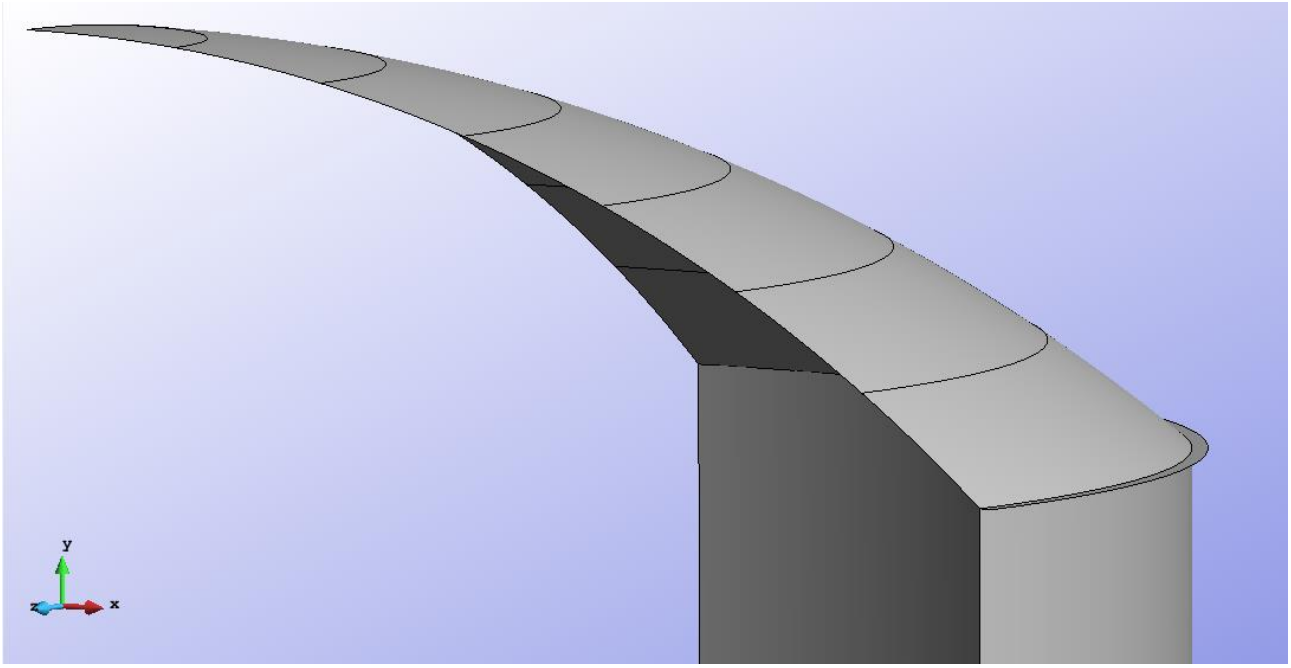

Figure 9 - Geometry of the high structure in the flat view

Data

Problem Type:

Once the geometry is defined, we can see which type of problem must be solved.
In this case we face a swell on 3D so we chose the following work options.

- Simulation type: **Structural analysis;**
- Simulation dimension: **3D;**
- Element types: **Shells;**
- Analysis type: **Static analysis;**
- Material constitutive model: **Linear-elastic model;**
- Geometric constitutive model: **Linear geometry;**
- Gravity: **Negative Y direction;**
- Units system: **Int. system (SI) – N,m,Pa;**
- Geometry units: **m.**

Boundary conditions:

The types of boundary conditions that are enforced in this exercise are the following:

- Constraints – **Fixed constraints.**

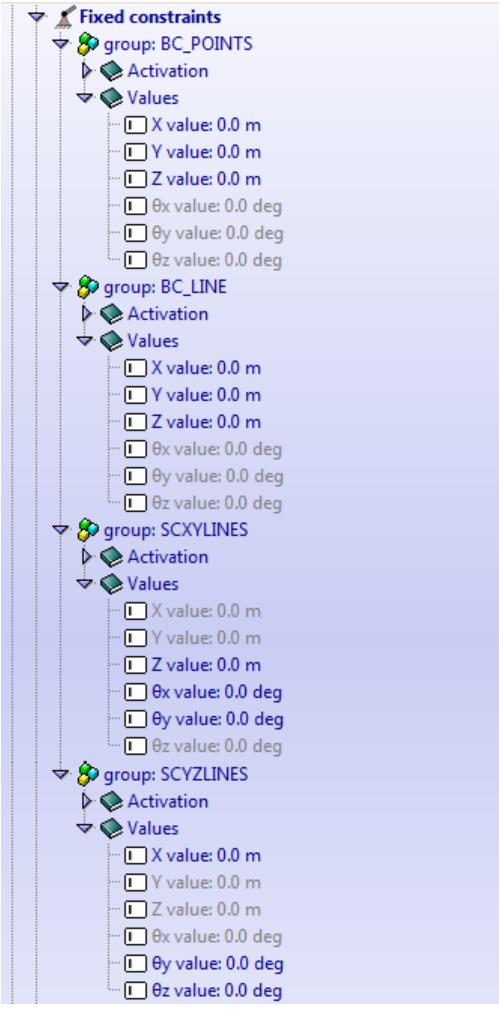

Figure 10 – Fixed constraints

Materials and properties:

We use the material for the parts of the structure with the following mechanical characteristics.

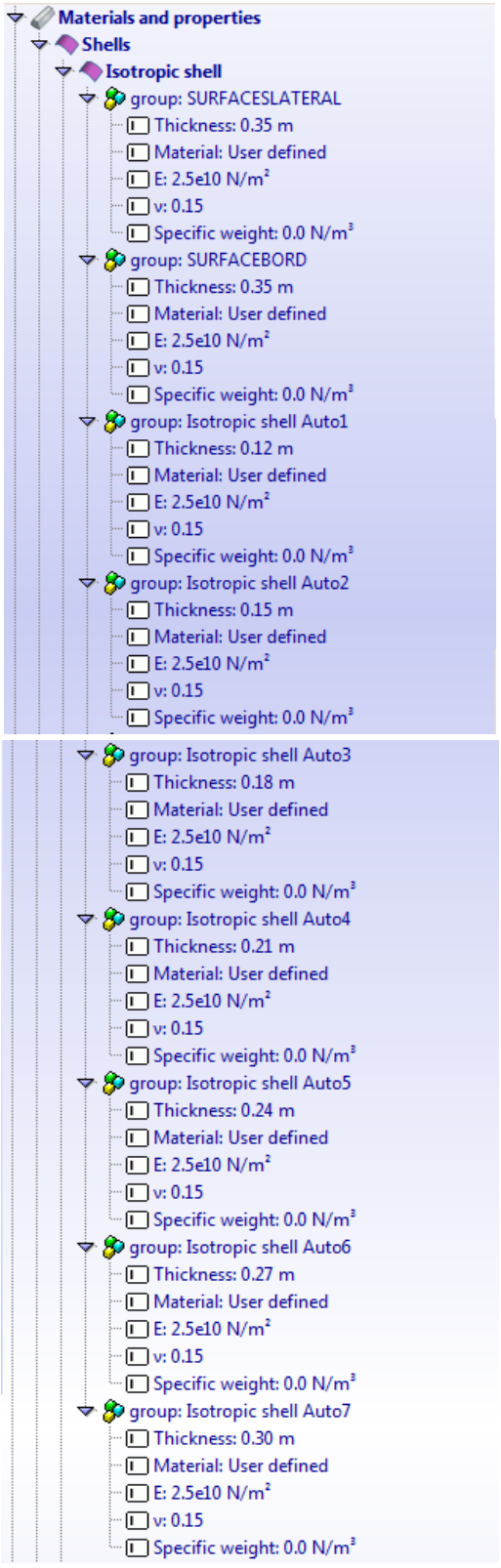

Figure 11 – Material

From Auto 1 to Auto 7 there are the properties for the parts of the “cupola”.

Load-cases

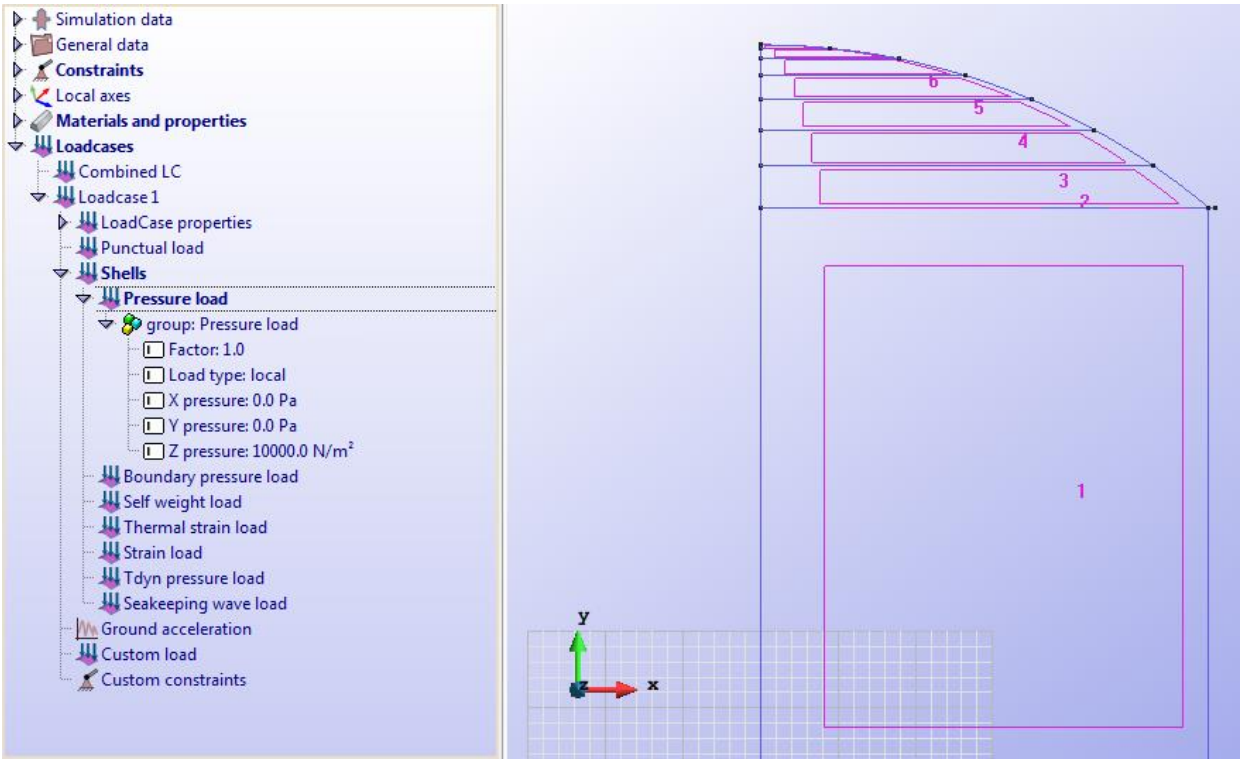

Figure 12 – Options for the load

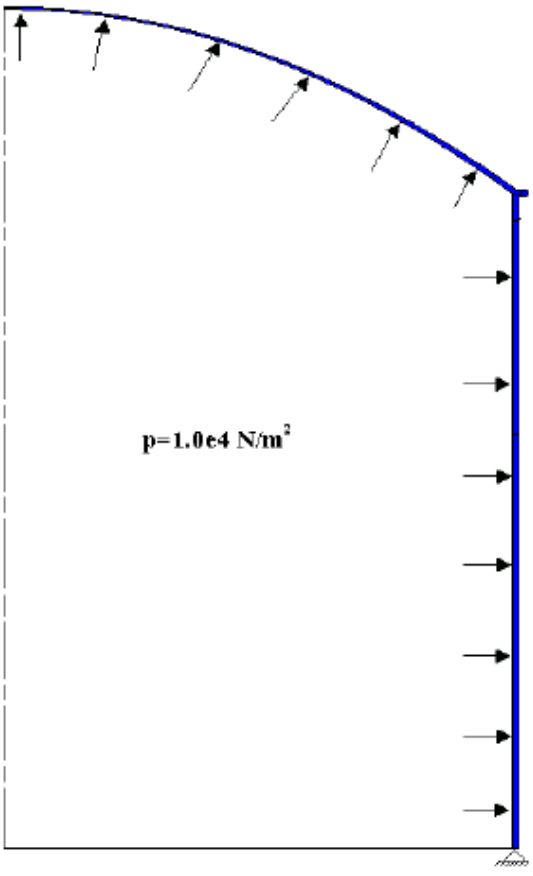

Figure 13 - Representation of the pressure load in the tank

Meshing / Generate: To generate the mesh we have used the following option:

- For elements with three nodes: Quadratic type= Normal; Element type= Triangle.

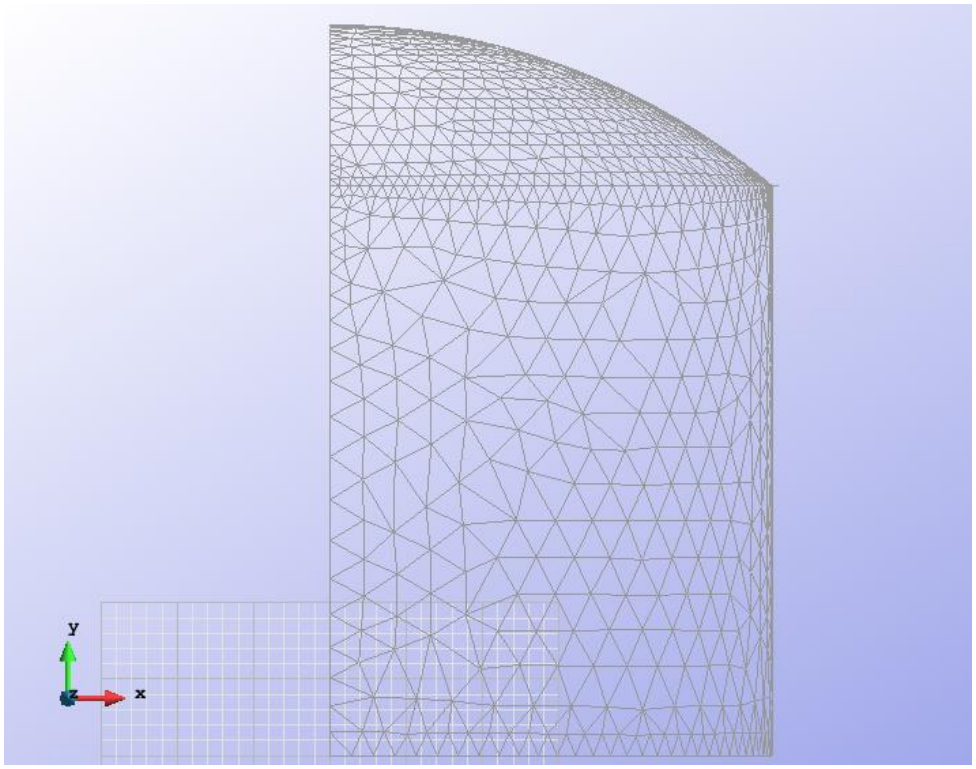

Figure 14 – Meshe of elements with three nodes

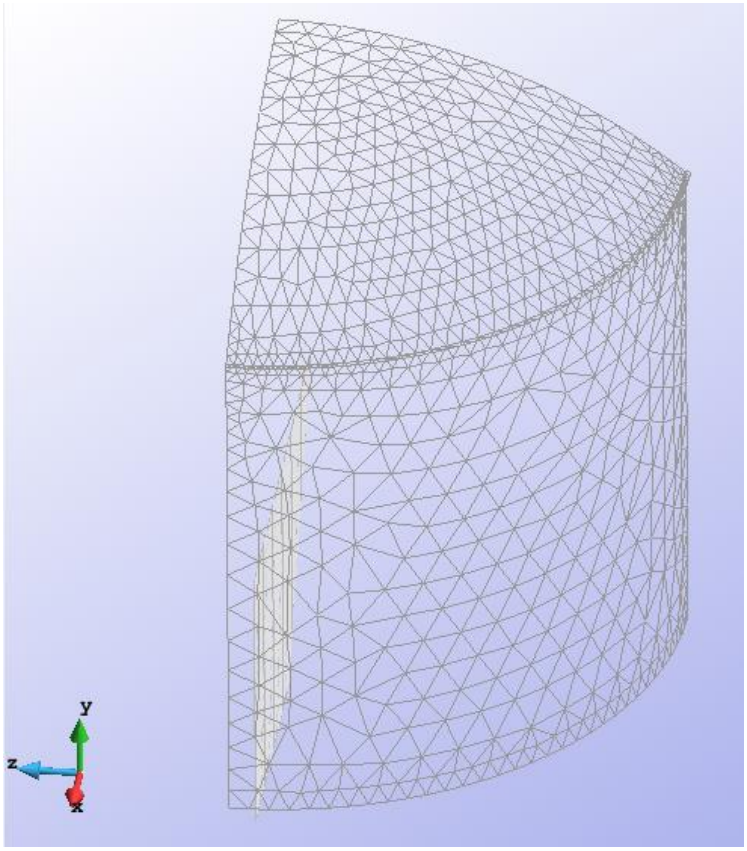

Figure 15 – Other view of the meshe of elements with three nodes

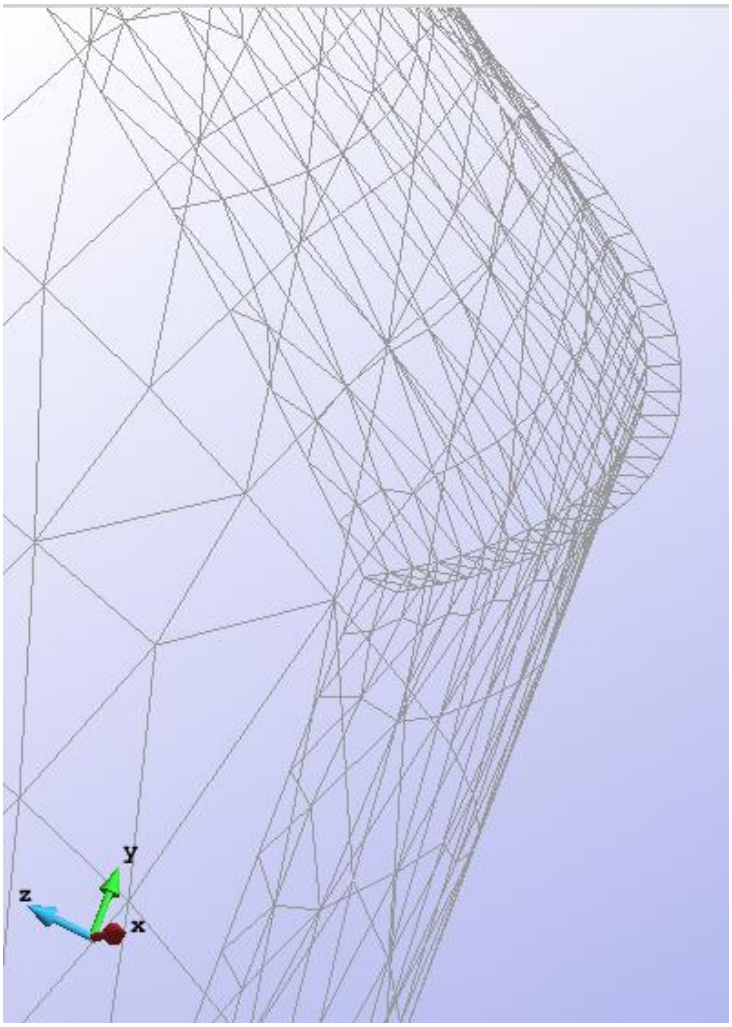

Figure 16 – Other view of the meshe of elements with three nodes

Calculate / Calculate

Once the mesh is generated, we proceed to calculate the problem for the different meshe proposed.

File / Post Process

The following figures show the results of the analysis sought after in this exercise.

RESULTS WITH ELEMENTS OF 3 NODES

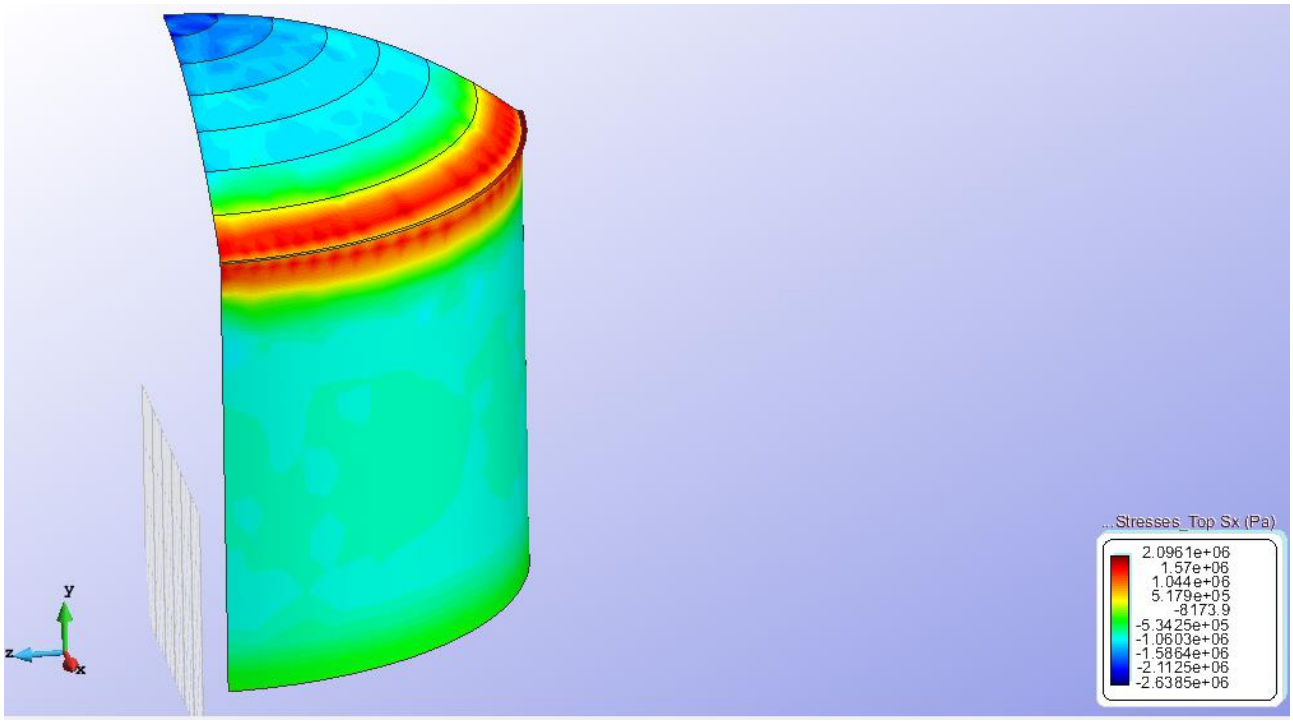

Figure 17 – Stresses Top Sx

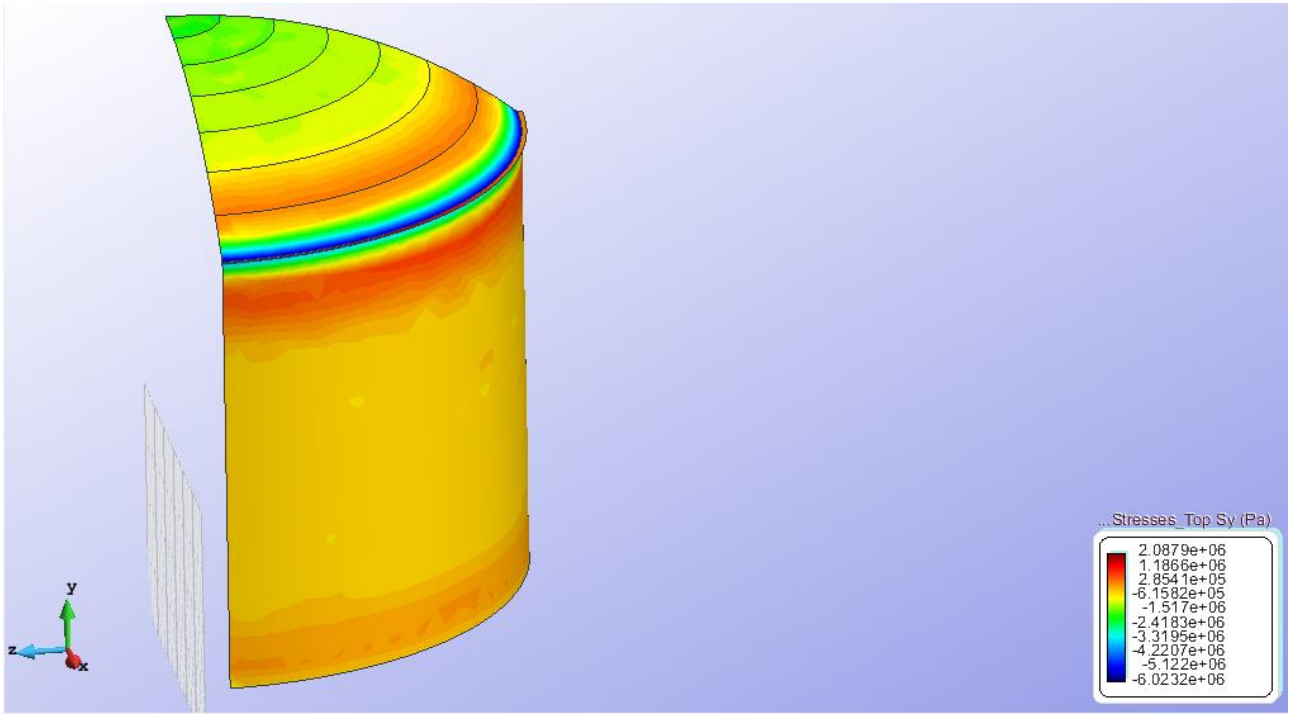

Figure 18 – Stresses Top Sy

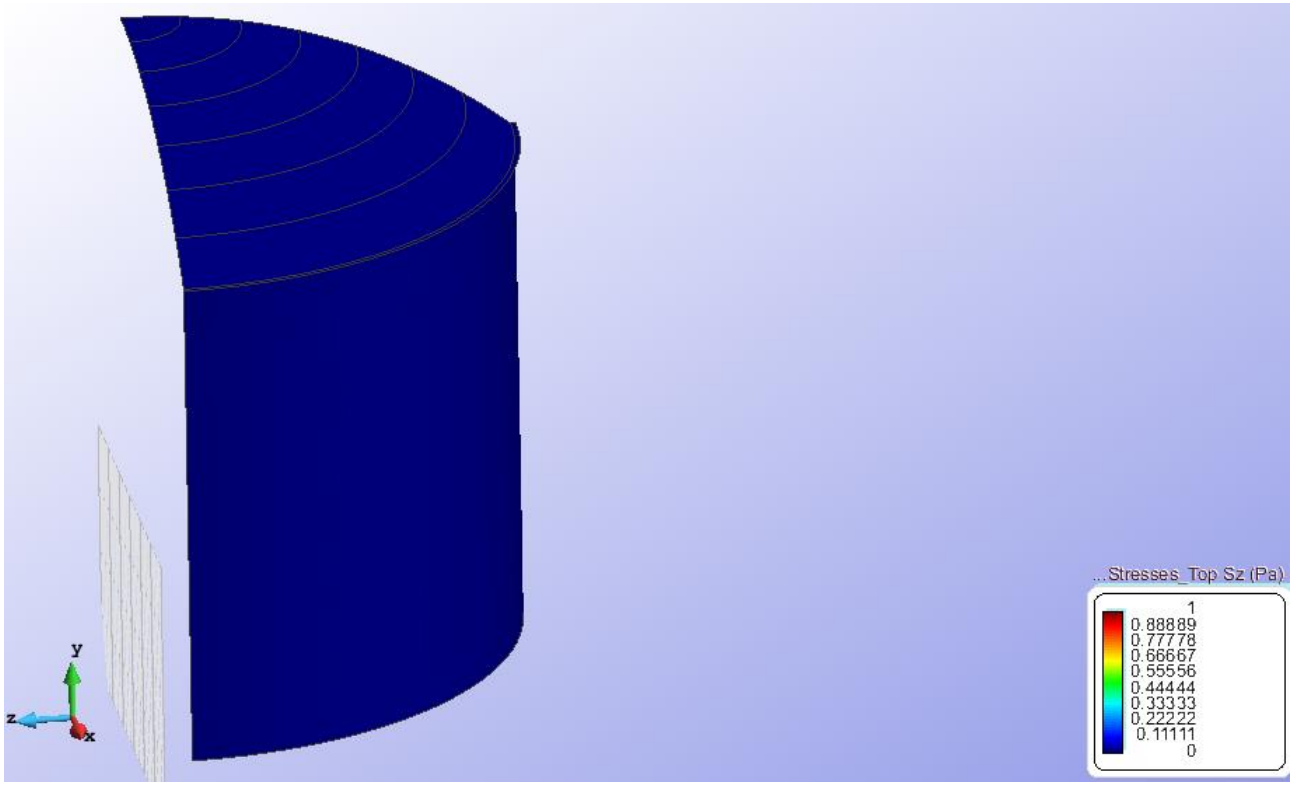

Figure 19 – Stresses Top Sz

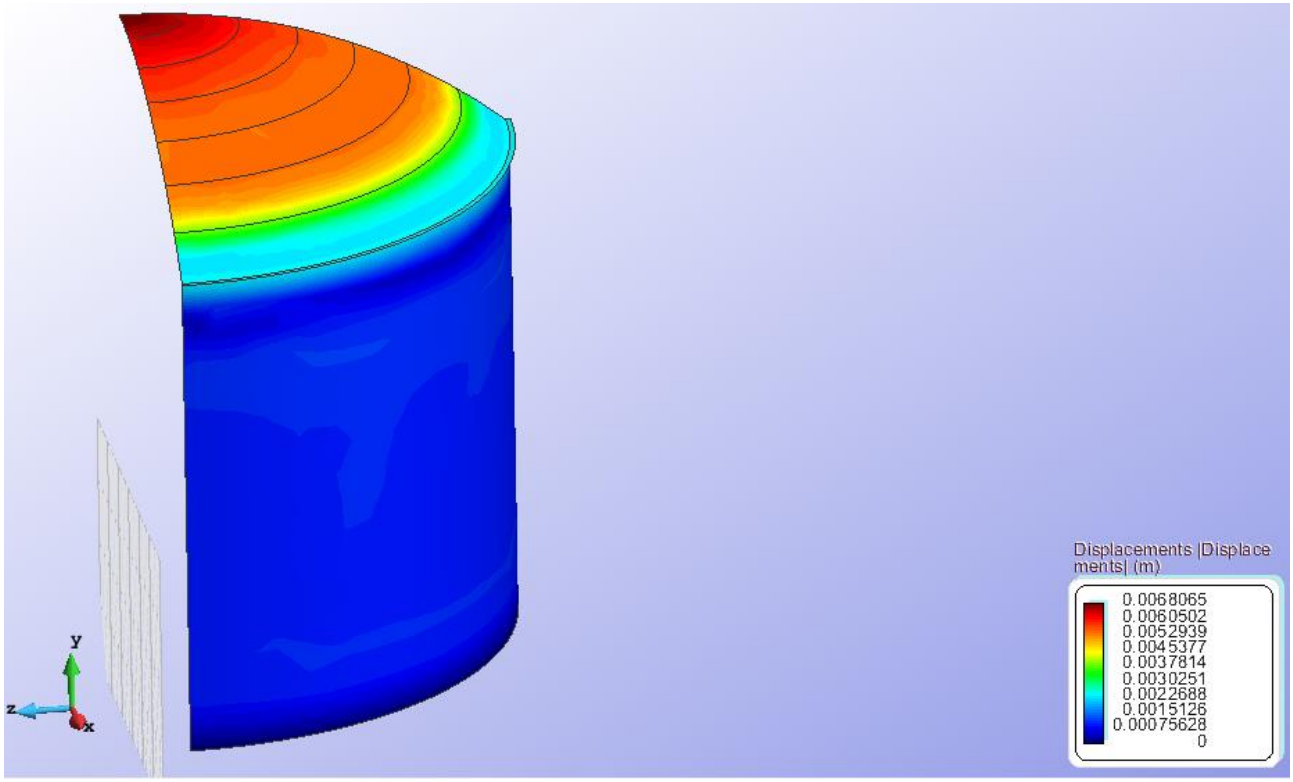

Figure 20 – Displacements

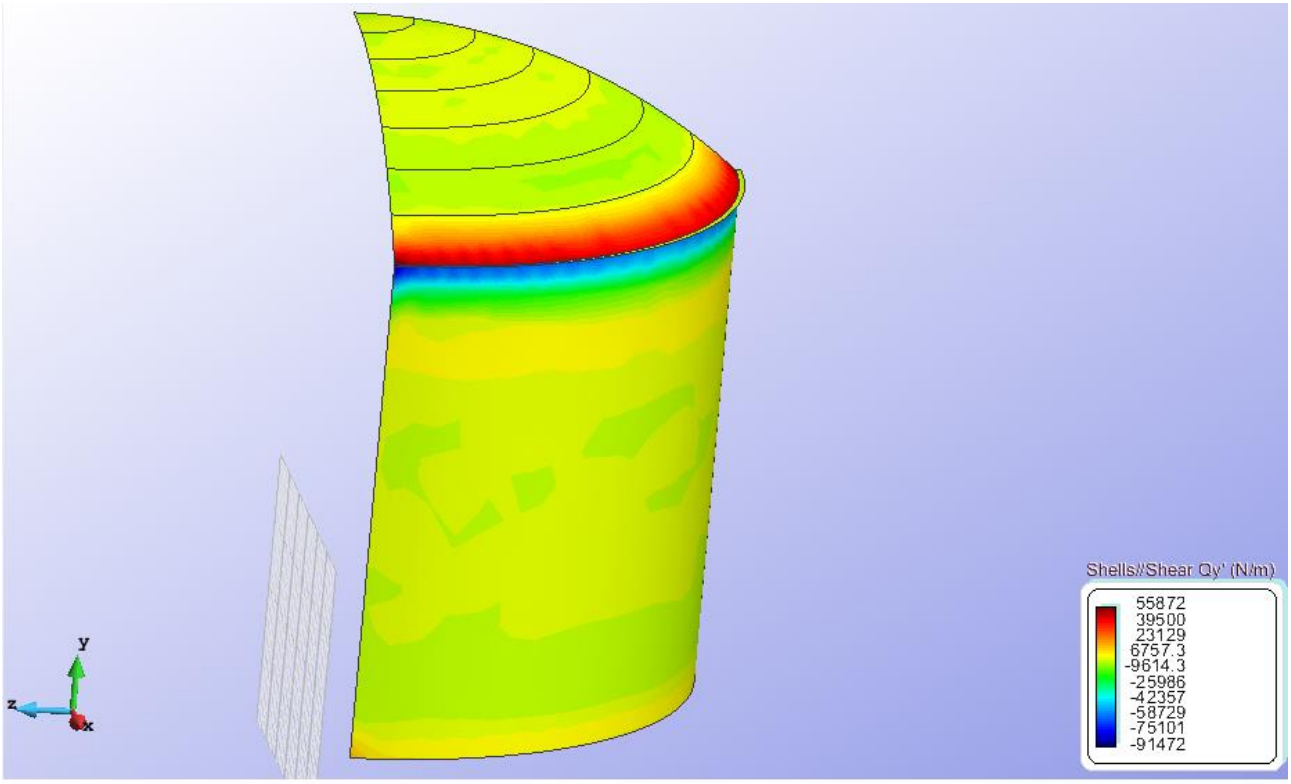

Figure 21 – Qy

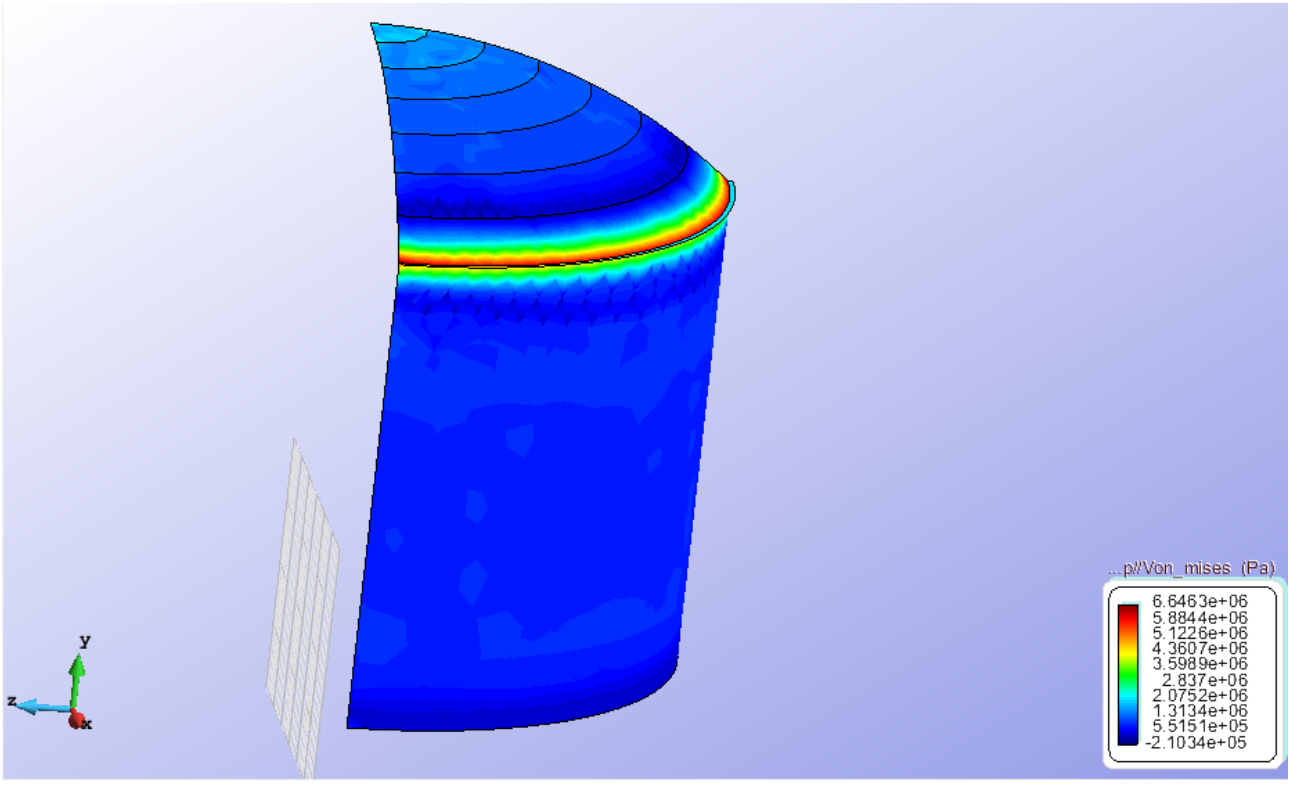

Figure 22 – Von Mises

2D CASE

Geometry

Define the geometry of the structure in the preprocessor of Gid:

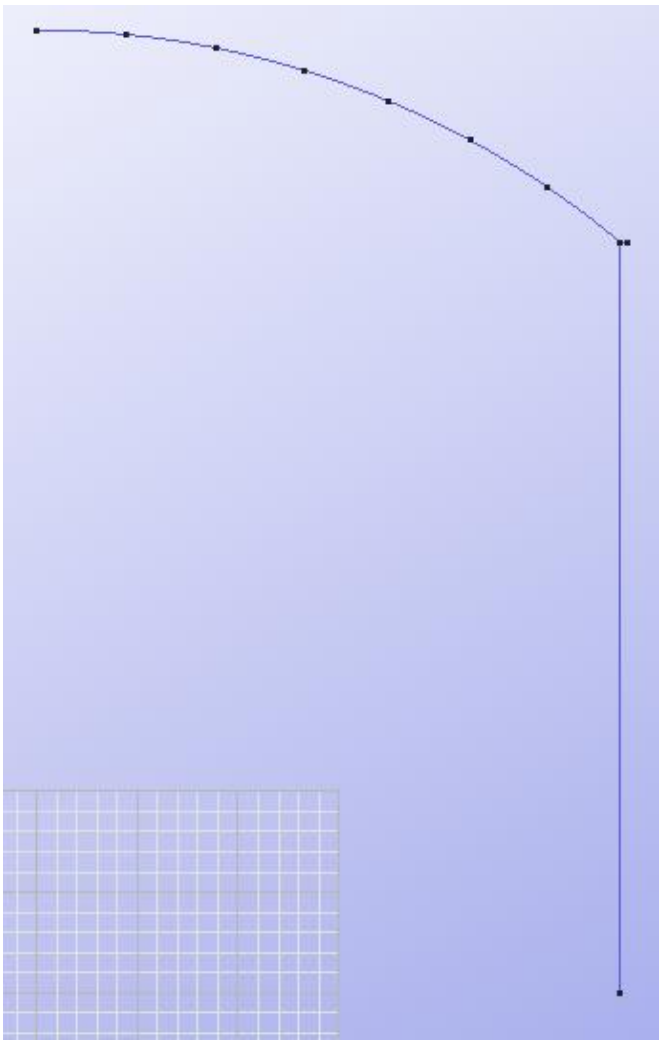

Figure 23 - Geometry of the structure

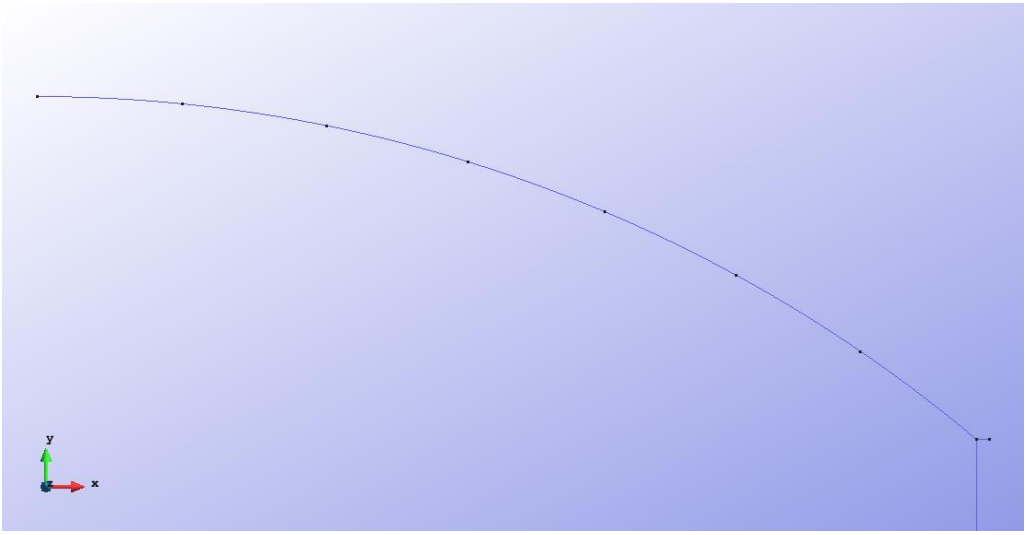

Figure 24 - Geometry of the spherical cupola

Data

Problem Type:

Once the geometry is defined, we can see which type of problem must be solved.
In this case we face a revolutions shells problem; therefore we choose the module RamSeries_Educational_2D/Rev_Shell using the following sequence of commands:

Data / Problem Type / RamSeries_Eductional_2D / Rev_Shell

Boundary conditions:

The types of boundary conditions that are enforced in this exercise are the following:

- Displacements Constraints / Point Constraints.

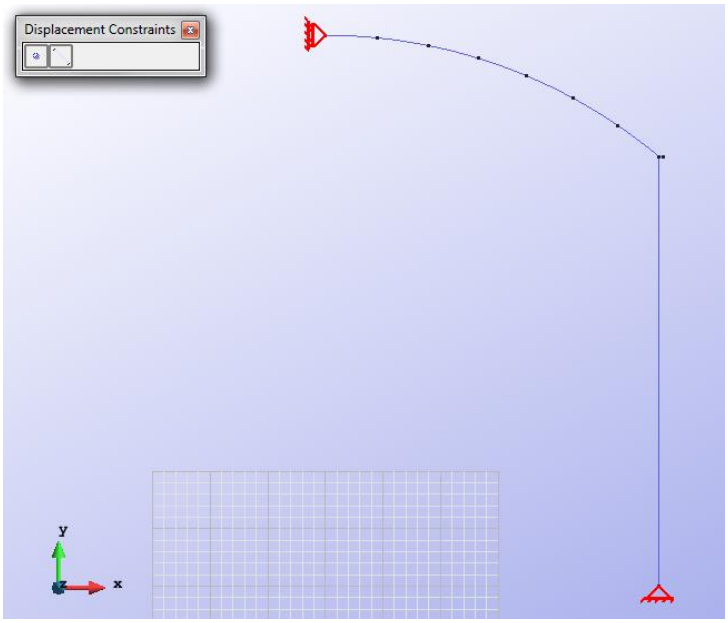

Figure 25 – Point Constraints

- Loads / Uniform loads.

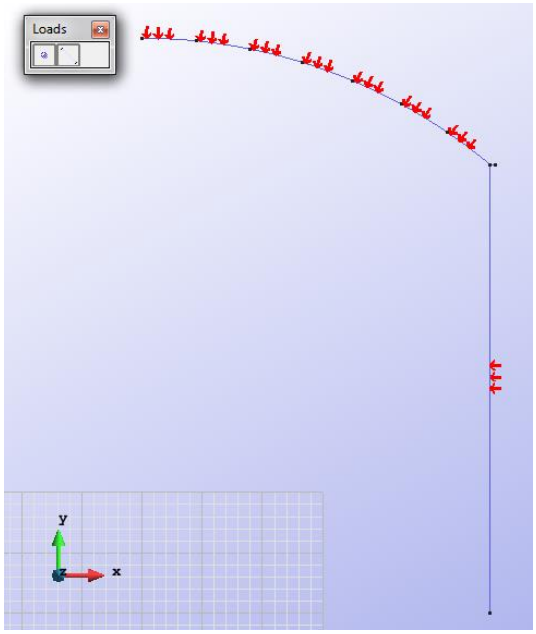

Figure 26 – Uniform loads

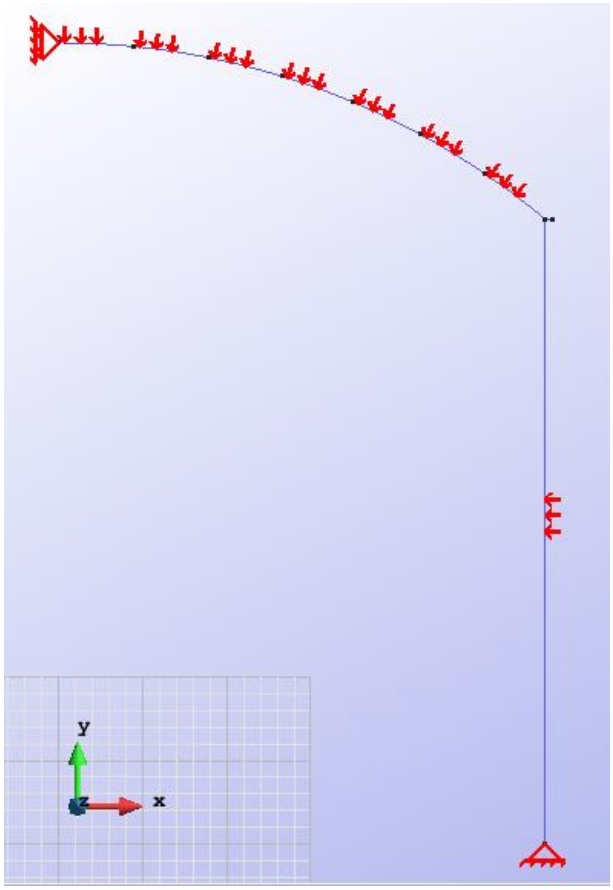

Figure 27 - All conditions on the structure

Material: We use material with the following mechanical characteristics.

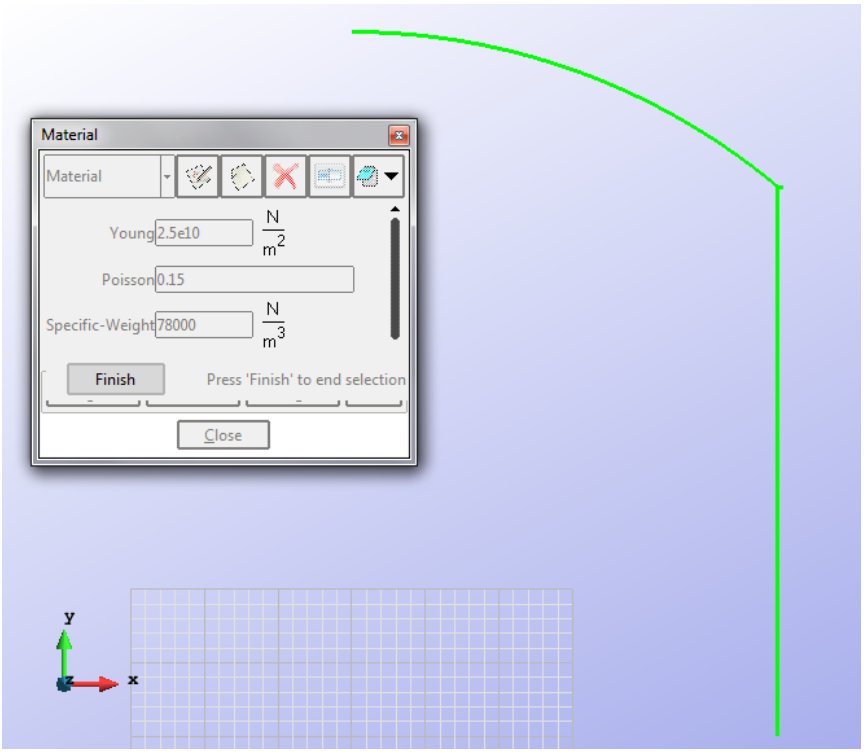

Figure 28 – Material

Meshing / Generate: To generate the mesh we have used the following option:

- For elements with two nodes: Quadratic type= Normal;

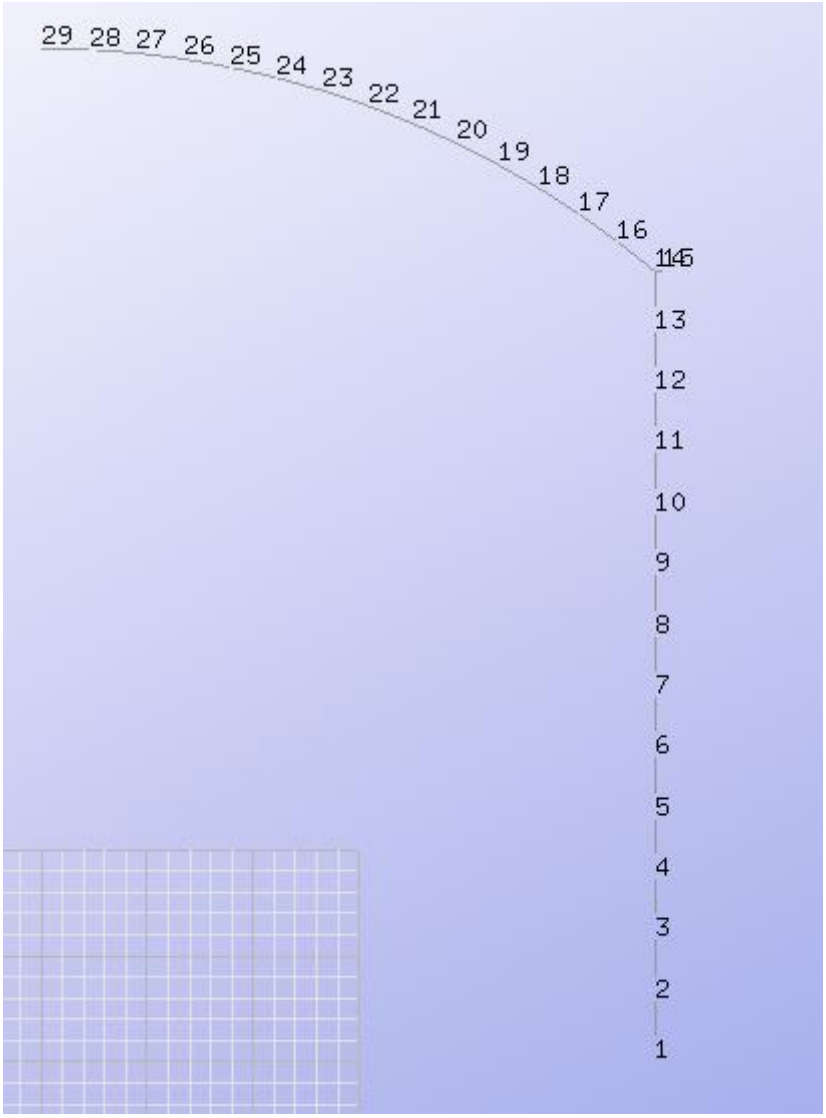

Figure 29 – Meshe with nodes numbered

Calculate / Calculate

Once the mesh is generated, we proceed to calculate the problem for the meshe proposed.

File / Post Process

The following figures show the results of the analysis sought after in this exercise.

RESULTS WITH ELEMENTS OF 2 NODES

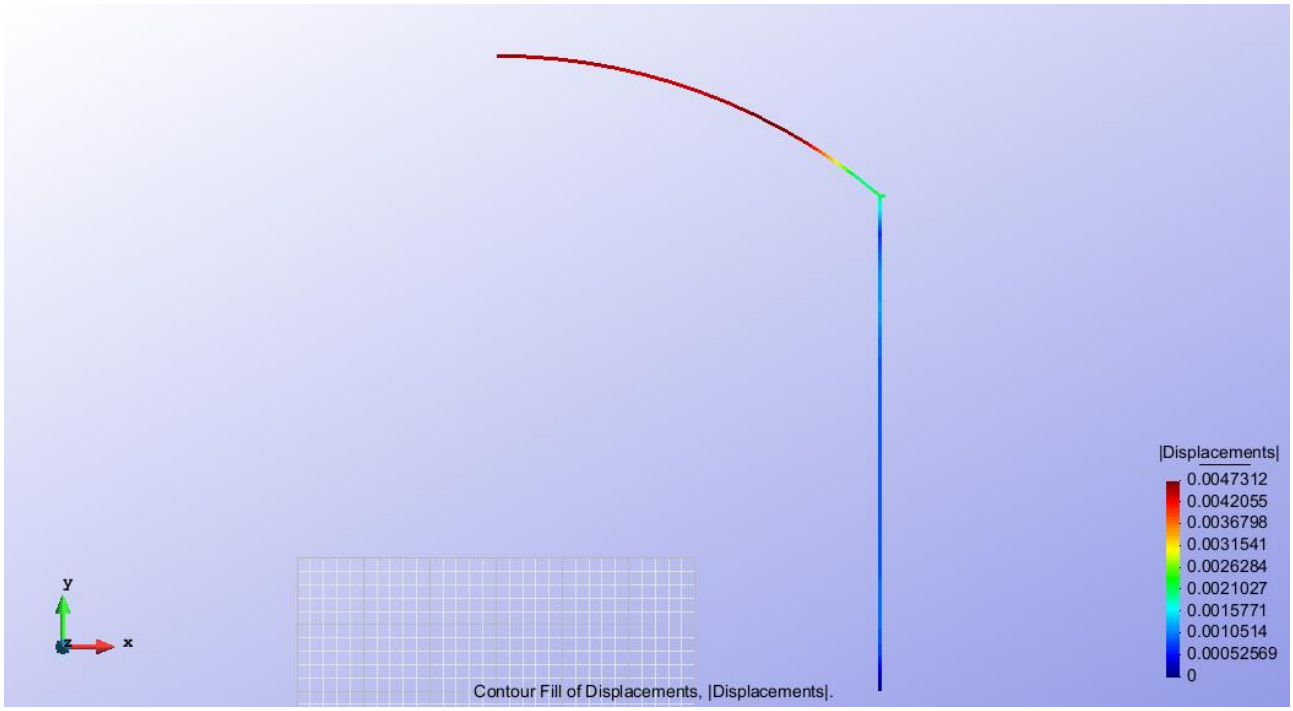

Figure 30 – Displacements

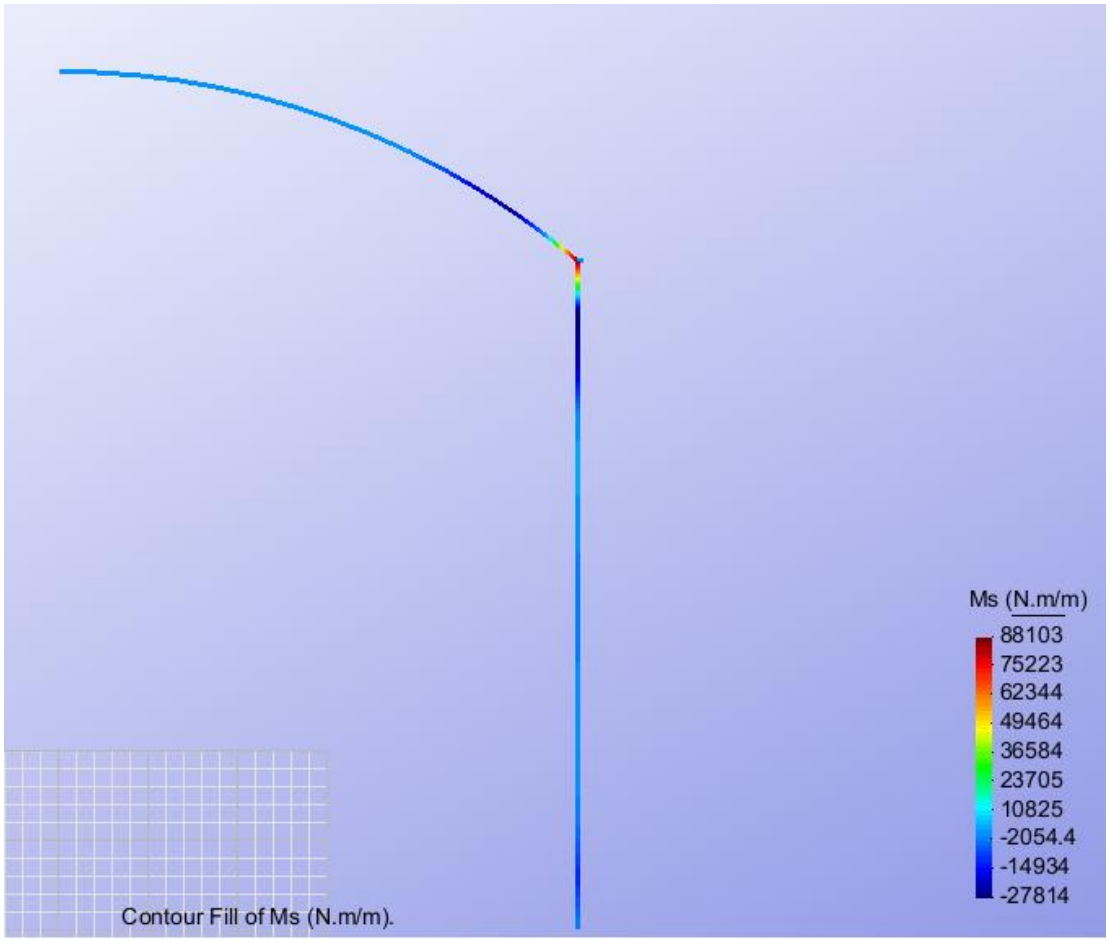

Figure 31 – Ms

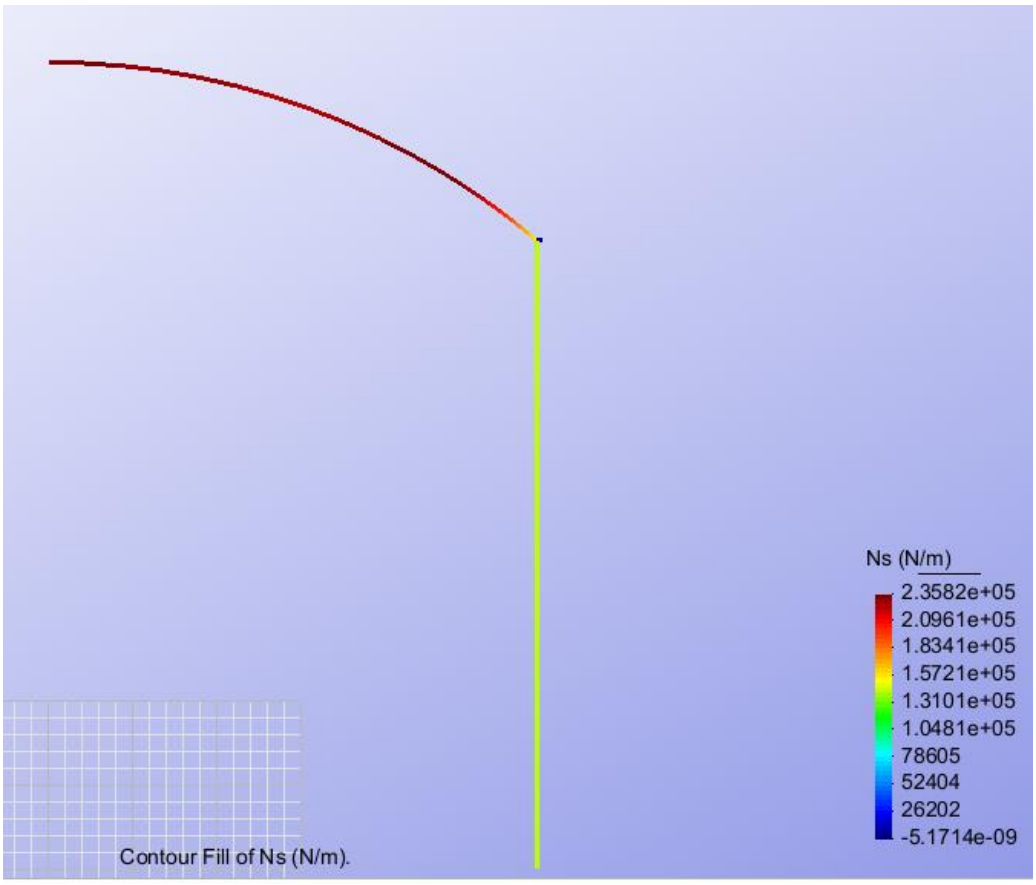

Figure 32 – Ns

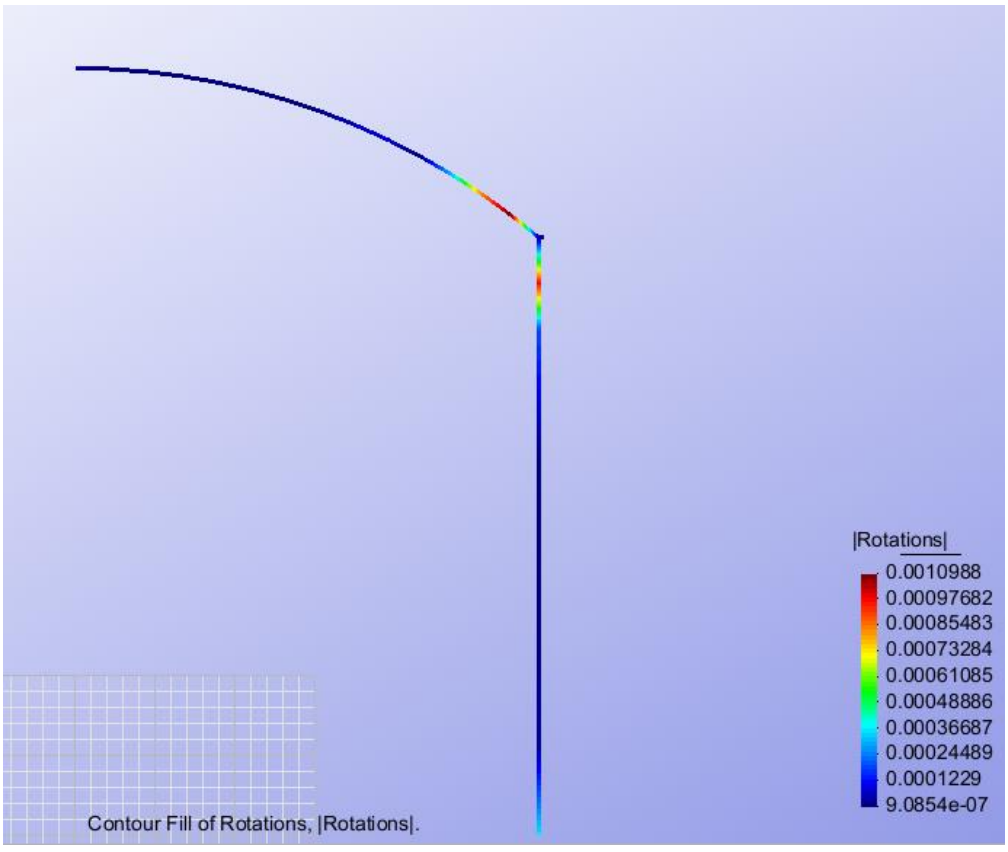

Figure 33 - Rotations

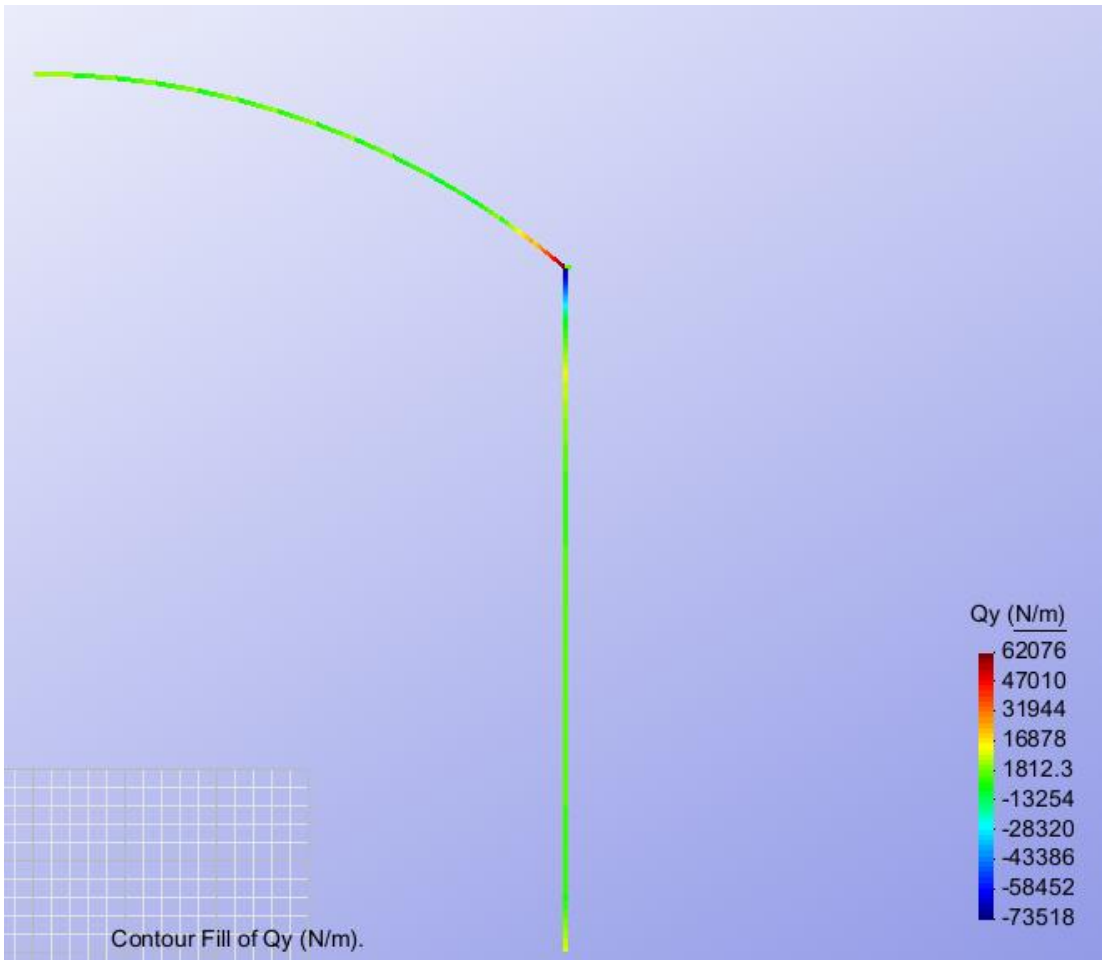
Qy (N/m)
62076
47010
31944
16878
1812.3
-13254
-28320
-43386
-58452
-73518
Contour Fill of Qy (N/m).

Figure 34 - Qy