MASTER OF SCIENCE IN COMPUTATIONAL MECHANICS

UNIVERSIDAD POLITÉCNICA DE CATALUÑA

Subject: Computational Structural Mechanics and dynamics
Student: ANTONIO SOLITO

Practice 2
Exercise 1: Circular tank
Solution

Geometry

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

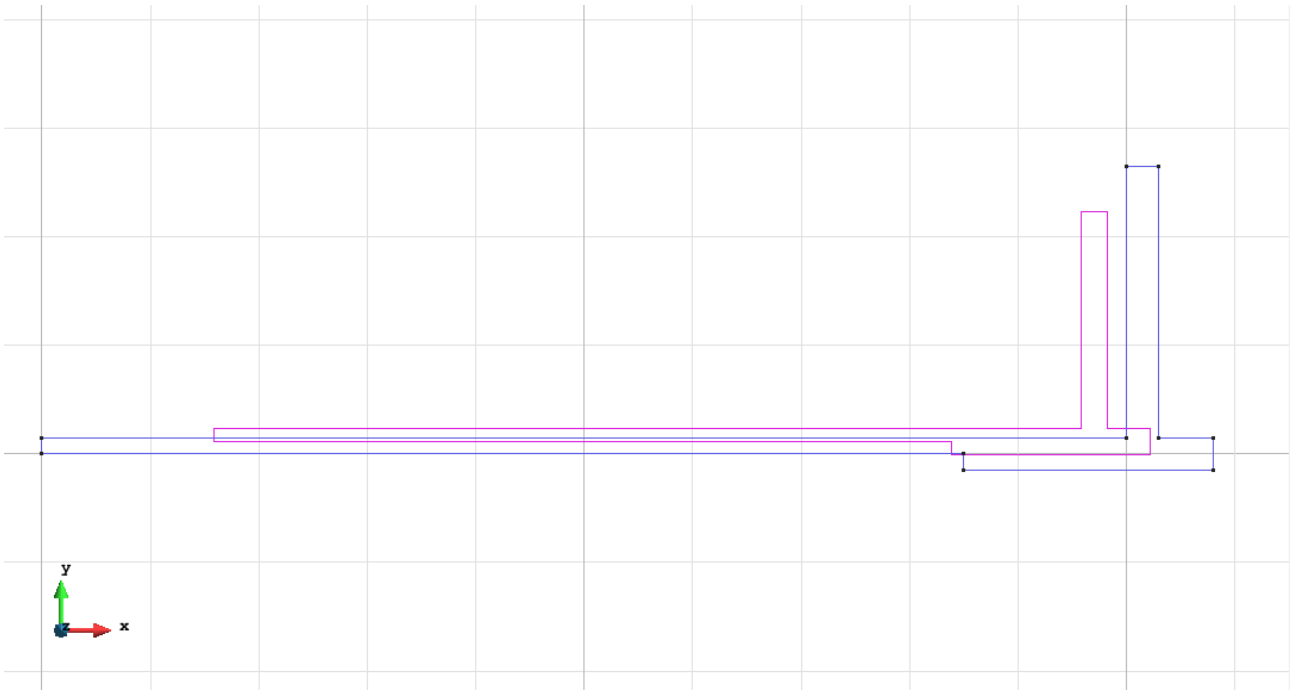

Figure 1 - Geometry of the structure

Data

Problem Type:

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

Data / Problem Type / RamSeries_Eductional_2D / Rev_Solids

Boundary conditions:

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

- Displacements Constraints / Linear Constraints.

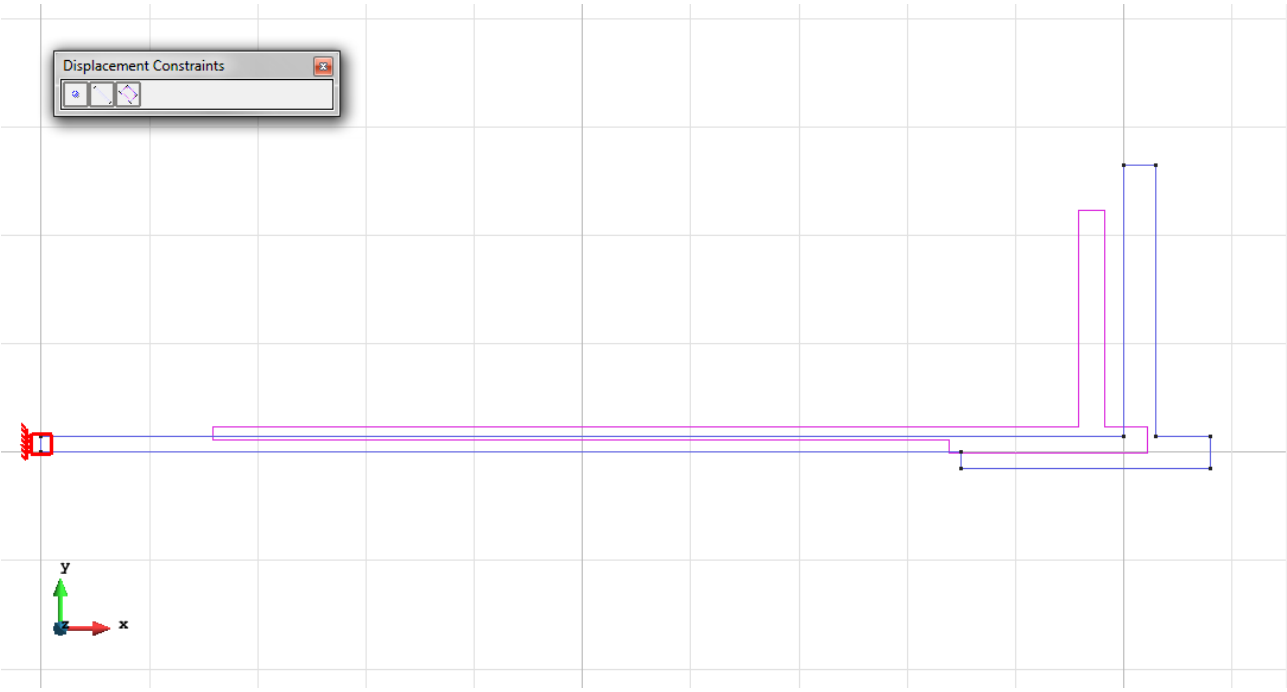

Figure 2 – Displacement Constraints

- Elastic Constraints (for the ground).

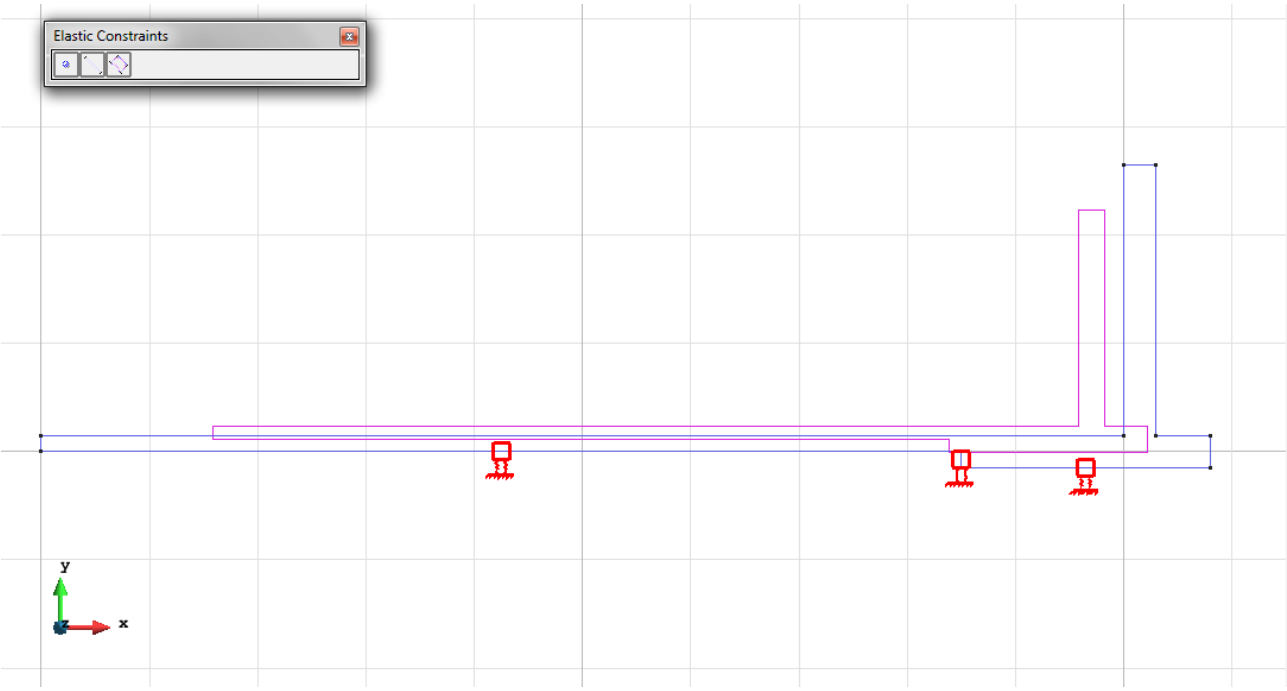

Figure 3 – Elastic Constraints

- Loads / Line loads / Uniform loads. On the bottom of the platform there is a uniform pressure, while in the lateral bulkhead there is calculated a triangular pressure and arranged as seen in figure.

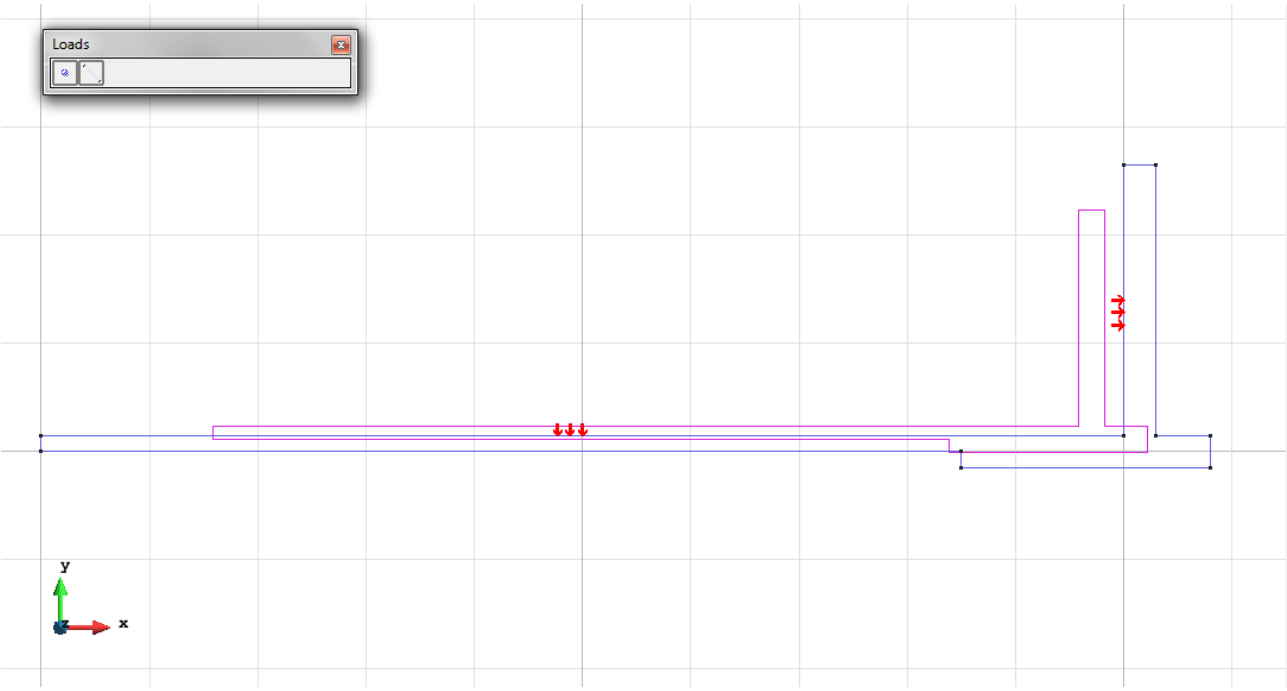

Figure 4 – The uniform load on the bottom plus the triangular load on the lateral bulkhead

Material: We use material with the following mechanical characteristics.

Figure 5 – Material

Meshing / Generate To generate the mesh use the following options:

- Element Type: We use a mesh of quadrilateral elements (Quadrilateral).
- Quadratic elements: We consider linear elements with 4 nodes (Normal).

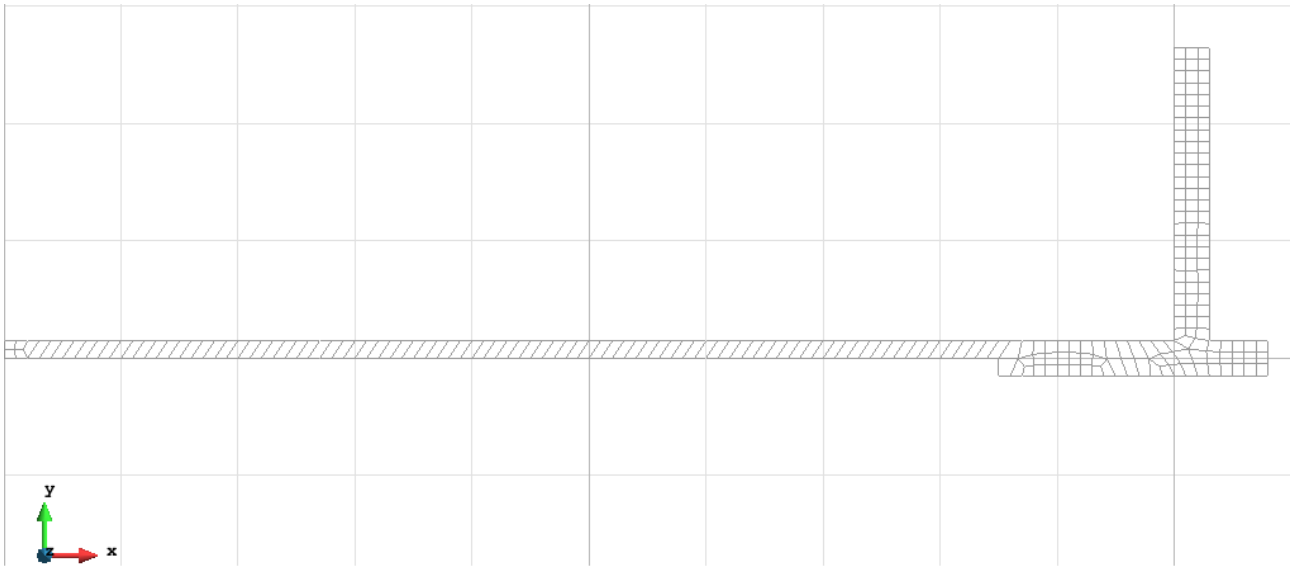

Figure 6 - Mesh of Quadrilaterals Normal

Calculate / Calculate

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

File / Post Process The following figures show the results of the analysis sought after in this exercise.

QUADRILATERAL ELEMENTS WITH 4 NODES

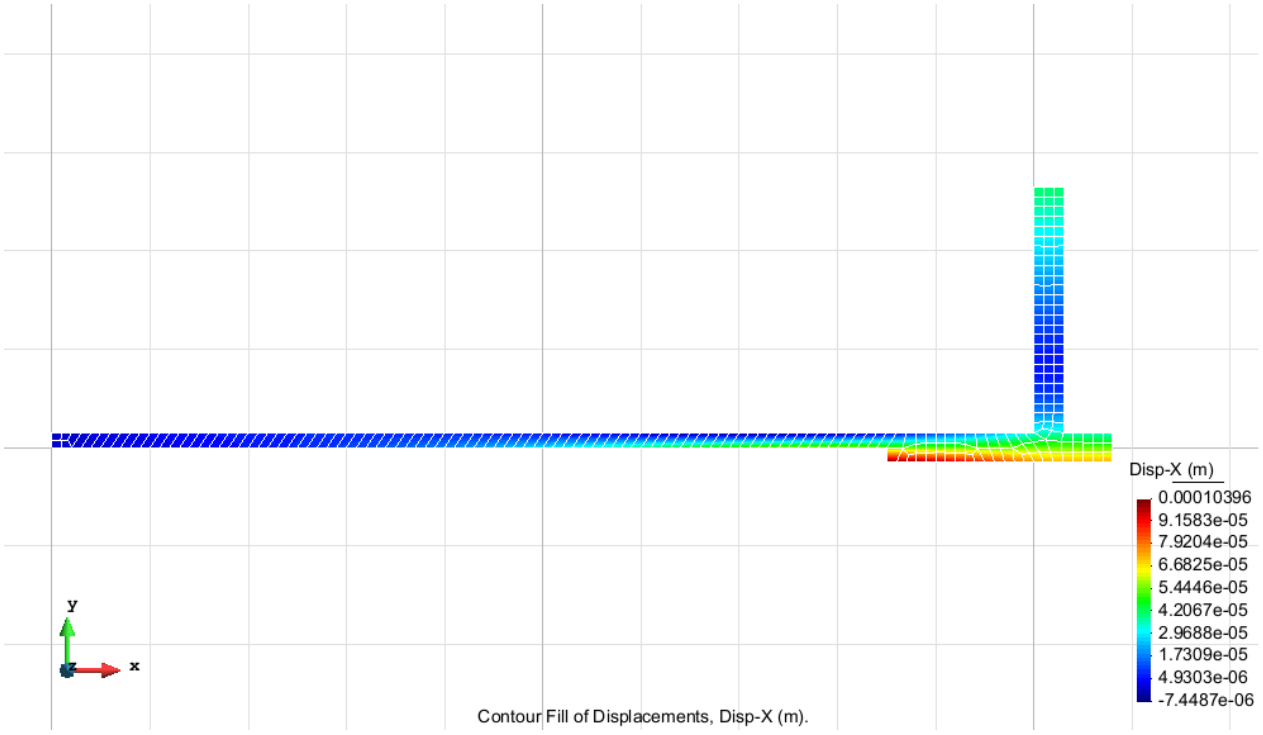

Figure 7 – Displacements on axis x

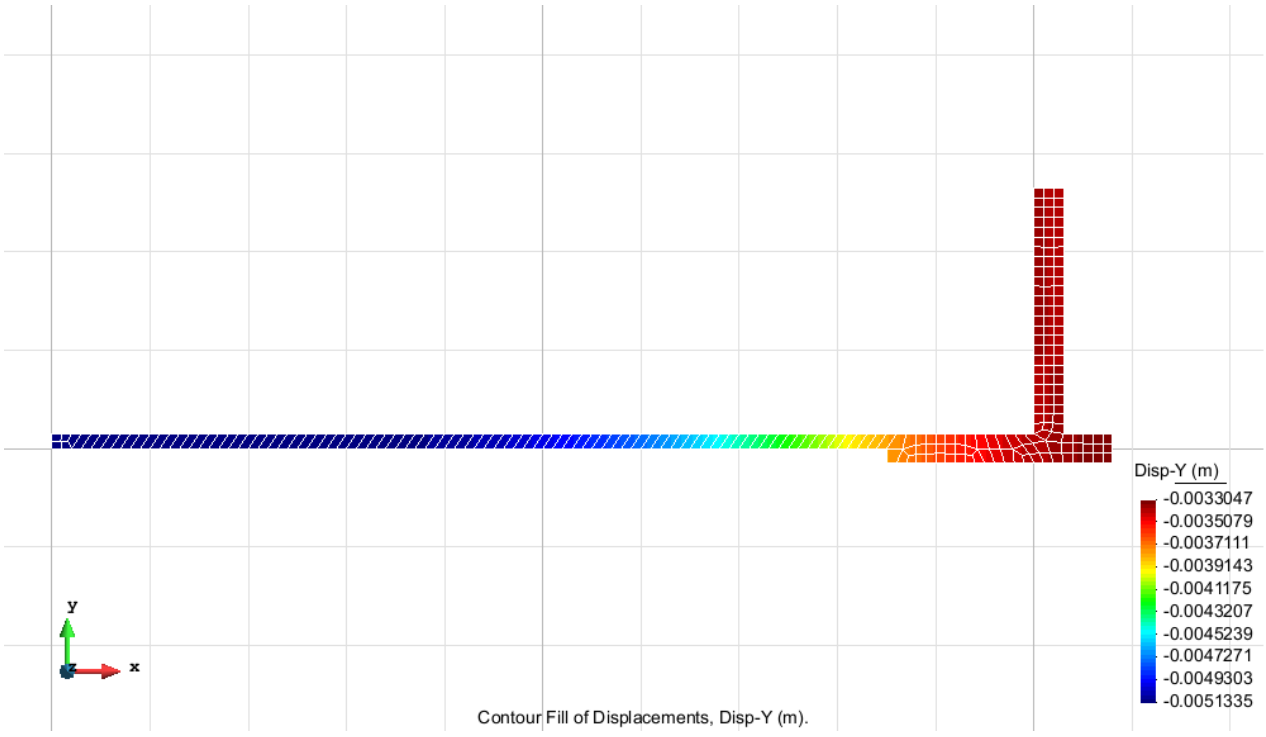

Figure 8 – Displacements on axis y

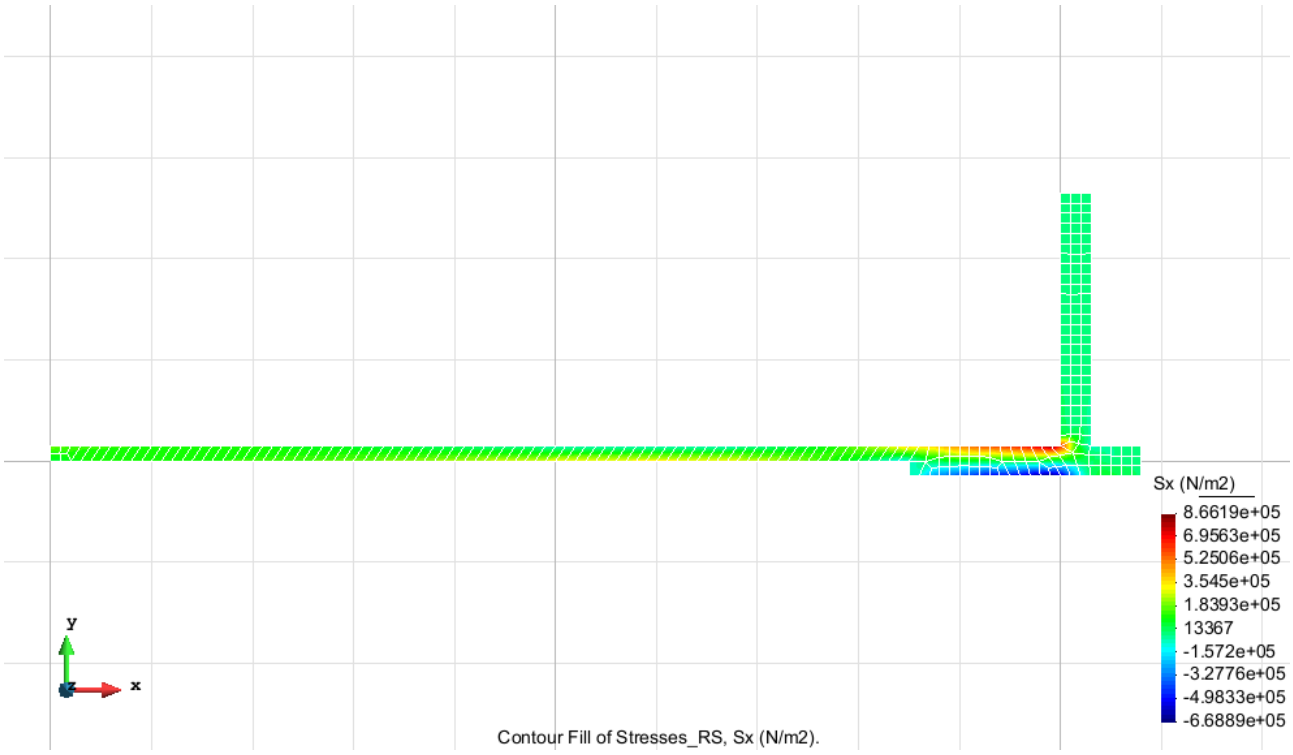

Figure 9 – Stress on axis x

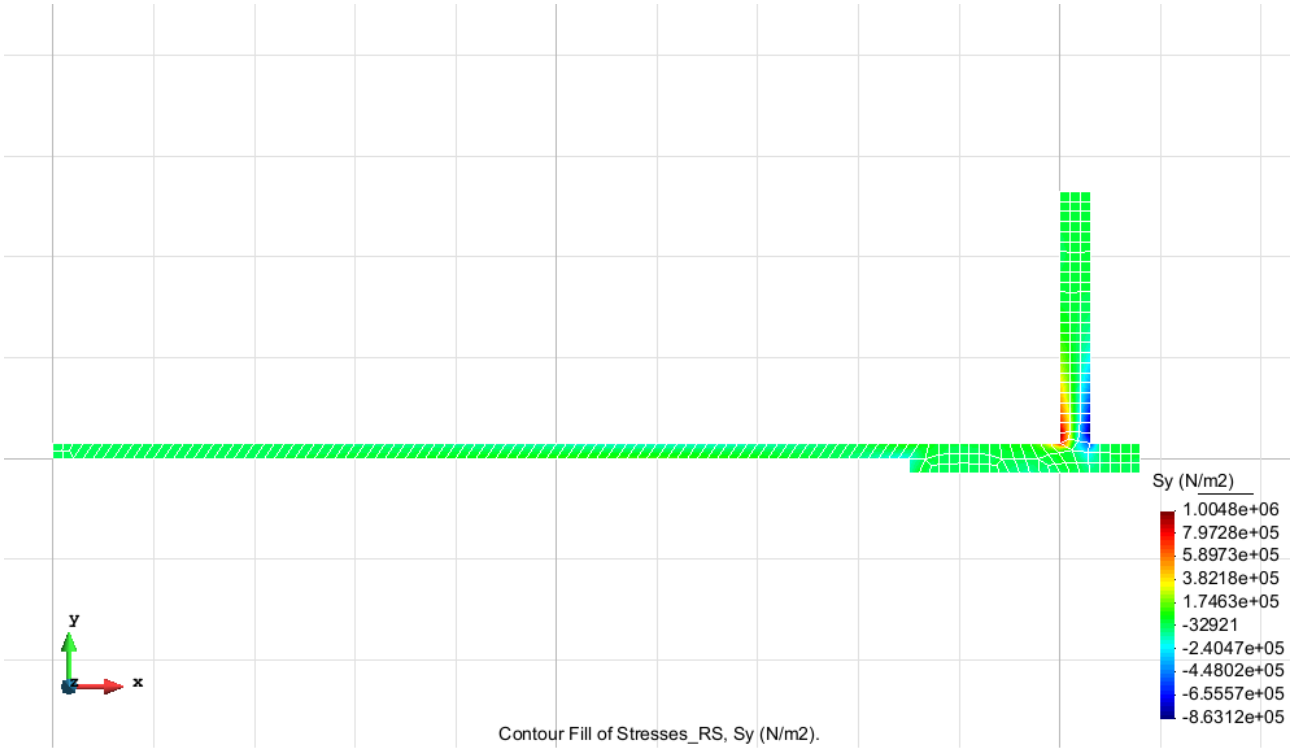

Figure 10 – Stress on axis y

Exercise 2: Analysis of the flexion of a beam using hexahedra elements
Solution

Geometry

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

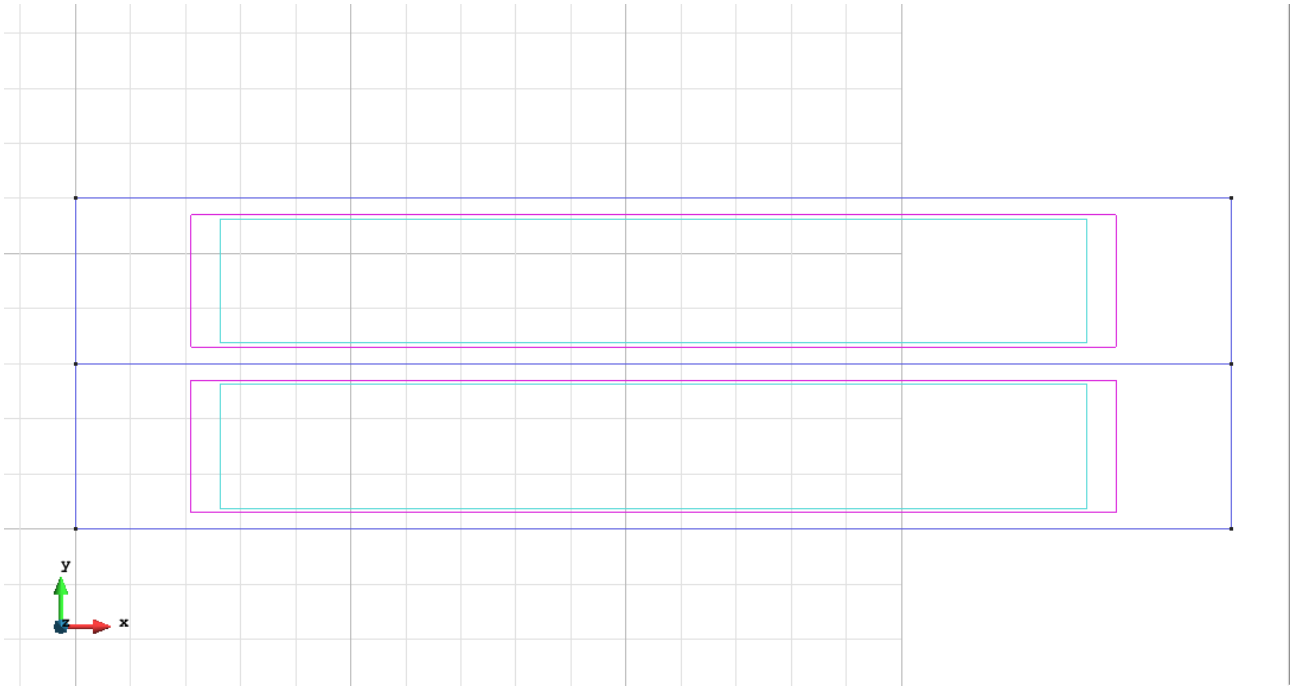

Figure 11 - Geometry of the structure

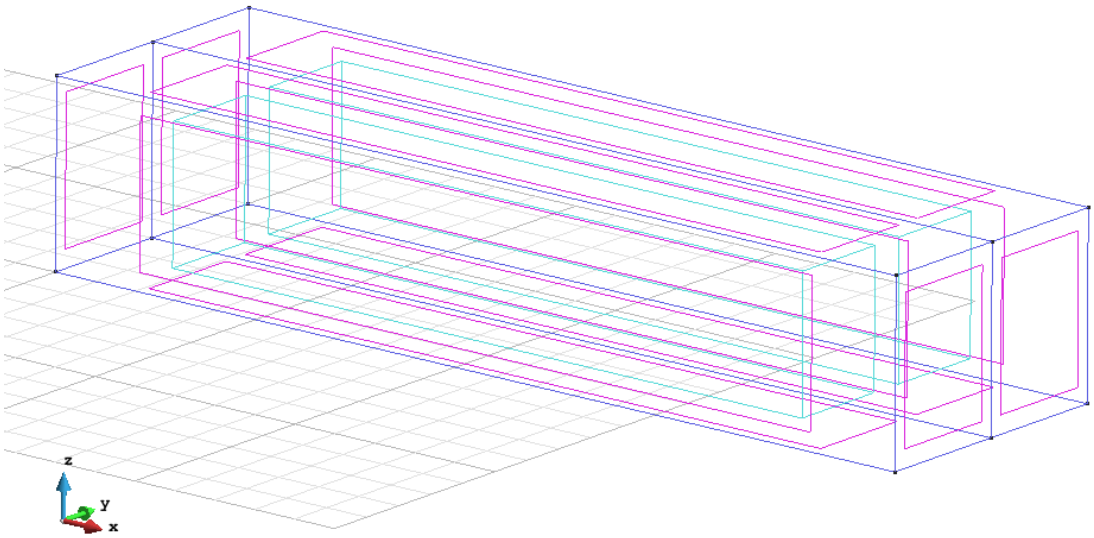

Figure 12 - Geometry of the structure in another view

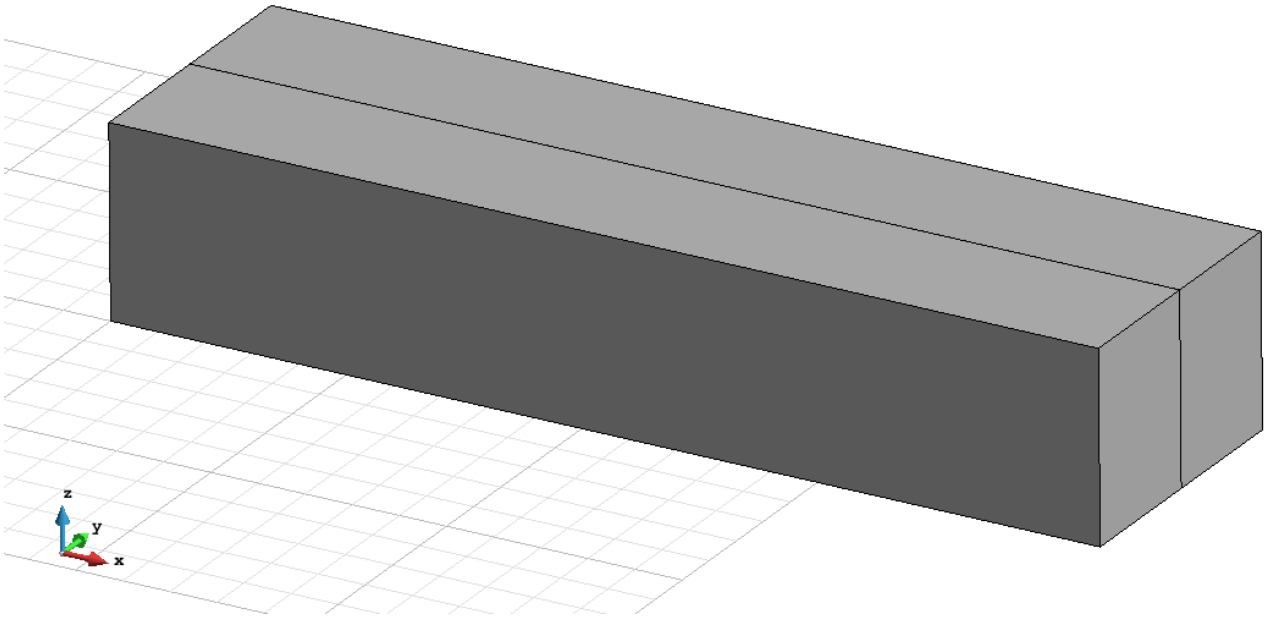

Figure 13 - Geometry of the structure in flat view

Data

Problem Type:

Once the geometry is defined, we can see which type of problem must be solved. In this case we face a solids on 3D; therefore we choose the module RamSeries_Educational_2D/3D Solids using the following sequence of commands:

Data / Problem Type / RamSeries_Eductional_2D / 3D_Solids

Boundary conditions:

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

- Displacements Constraints / Surface Constraints.

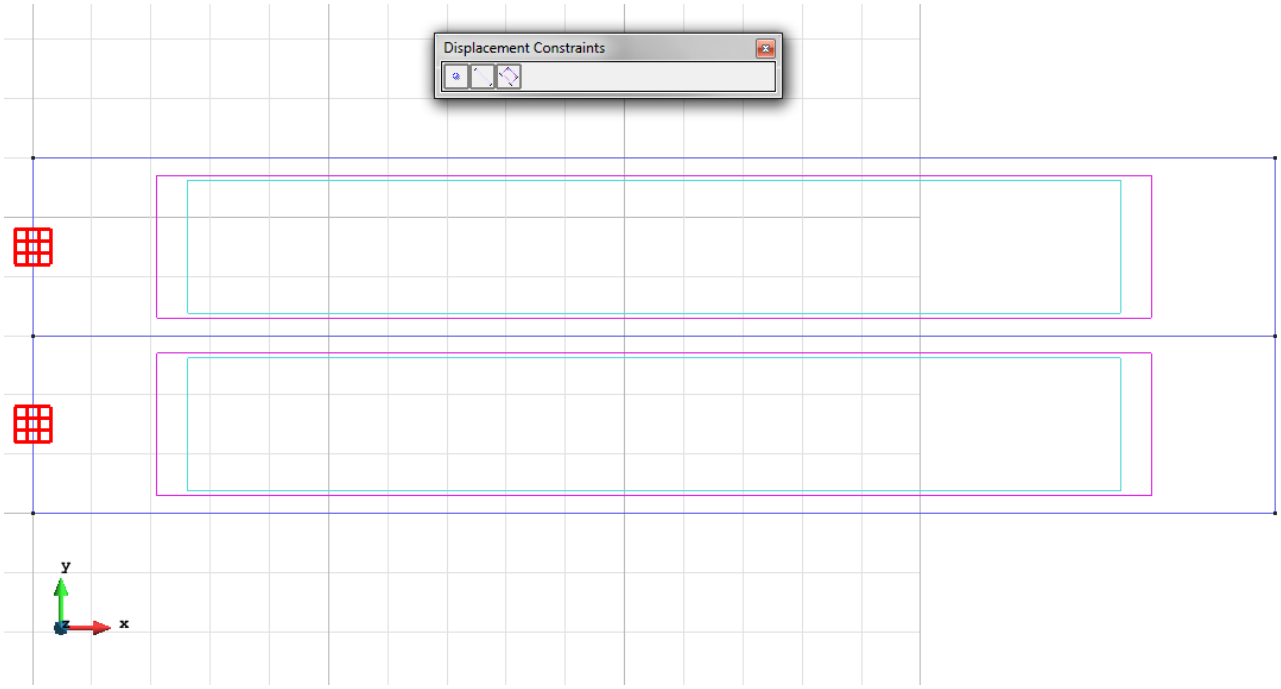

Figure 14 – Surface Constraint

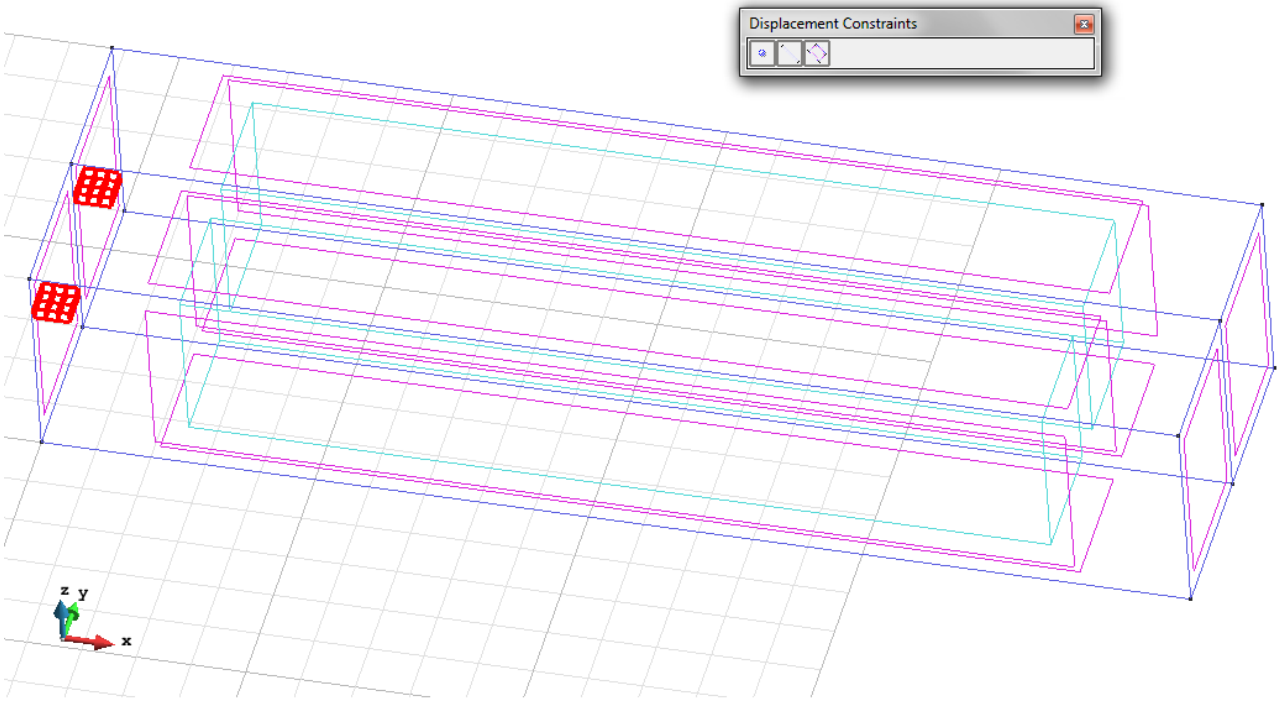

Figure 15 – Surface Constraint on 3D view

- Loads / Line loads / Uniform loads. Point load on the two points of the front surface not bound.

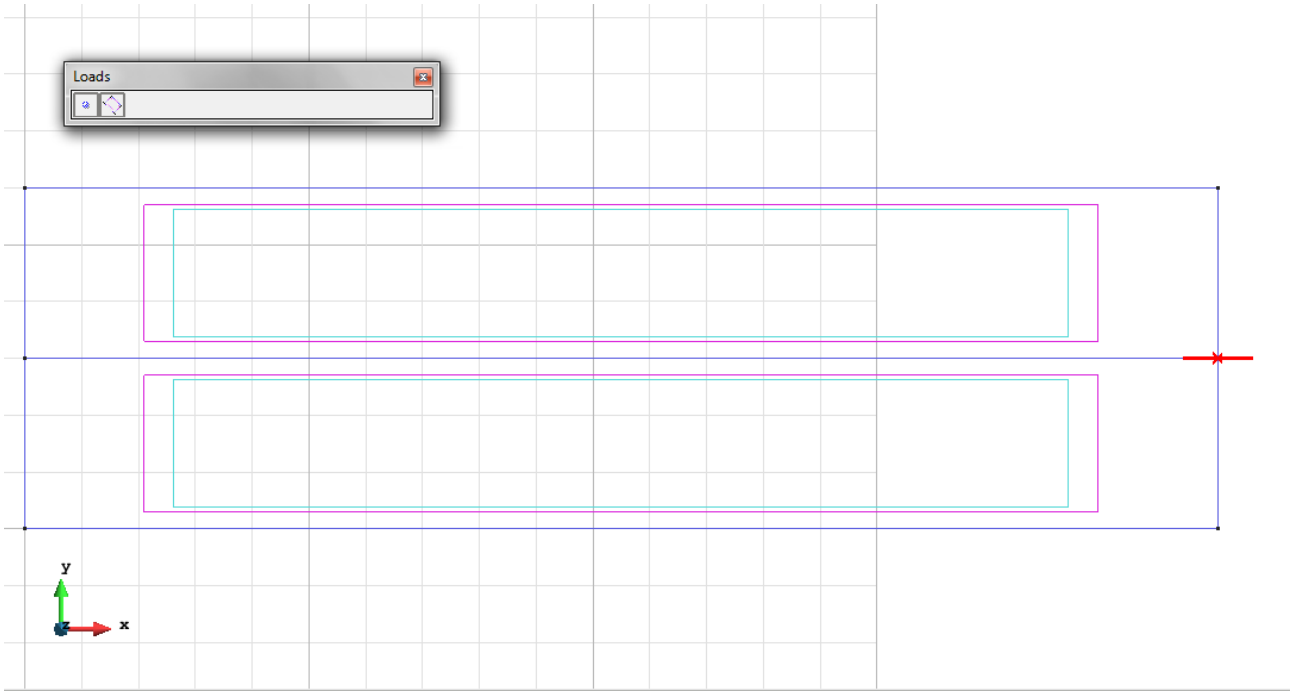

Figure 16 – Points loads

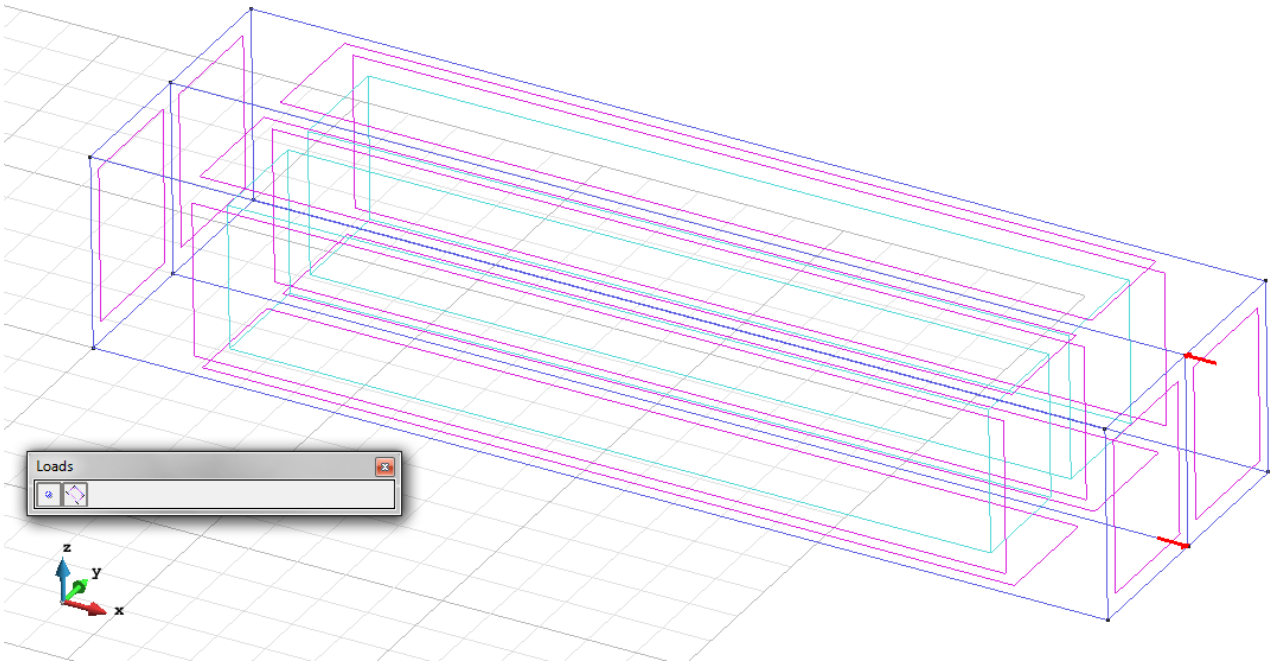

Figure 17 – Points loads on 3D view

Material: We use material with the following mechanical characteristics.

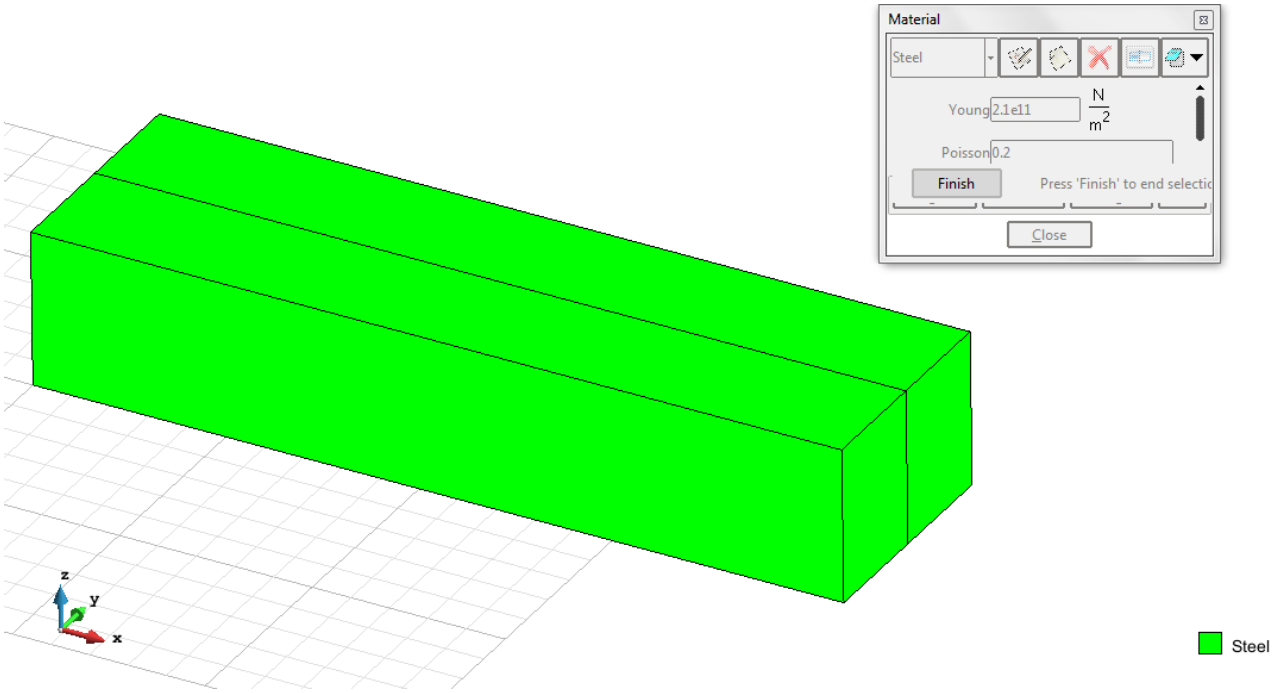

Figure 18 – Material

Meshing / Generate To generate the mesh use the following options:

- Element Type: We use a mesh of Hexahedra elements.
- Quadratic elements: We consider linear elements with 8 nodes (Normal) and with 20 nodes (Quadratic).

Calculate / Calculate

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

File / Post Process The following figures show the results of the analysis sought after in this exercise.

HEXAHEDRA ELEMENTS WITH 8 NODES

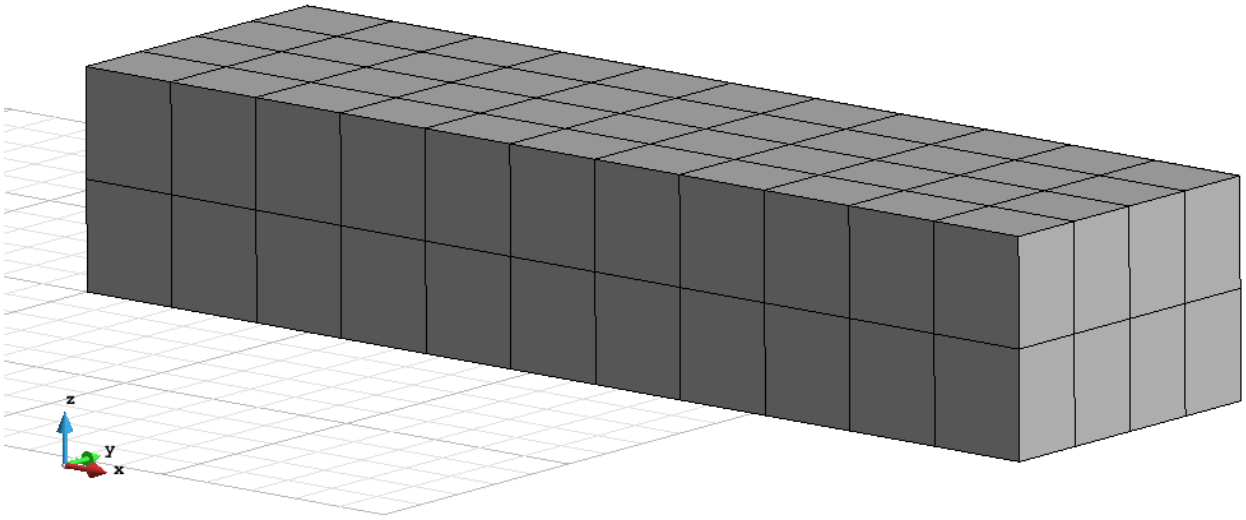

Figure 19 – Mesh of Hexahedra Normal

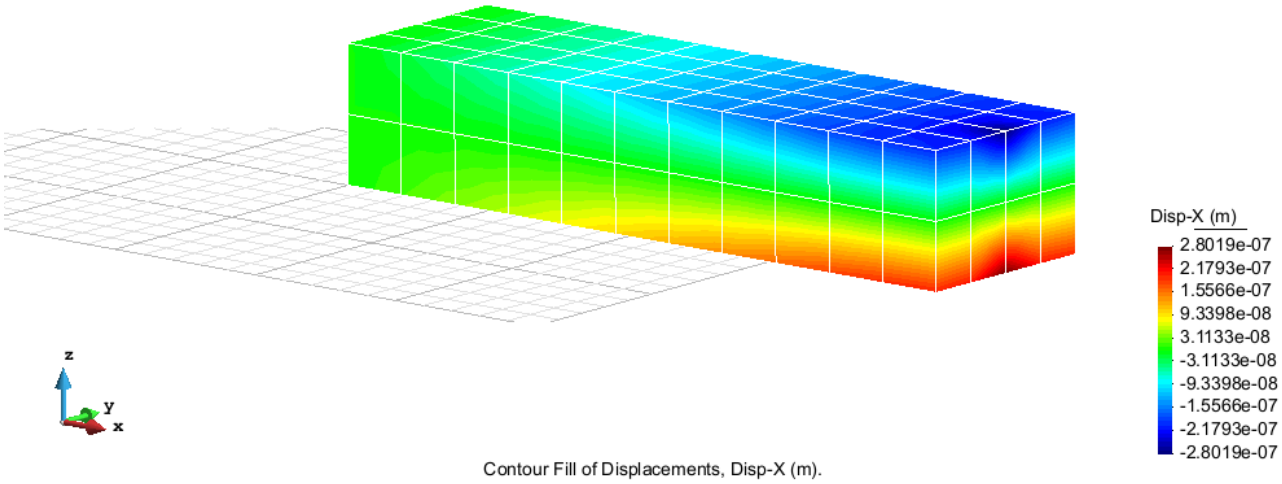

Figure 20 – Displacements on axis x

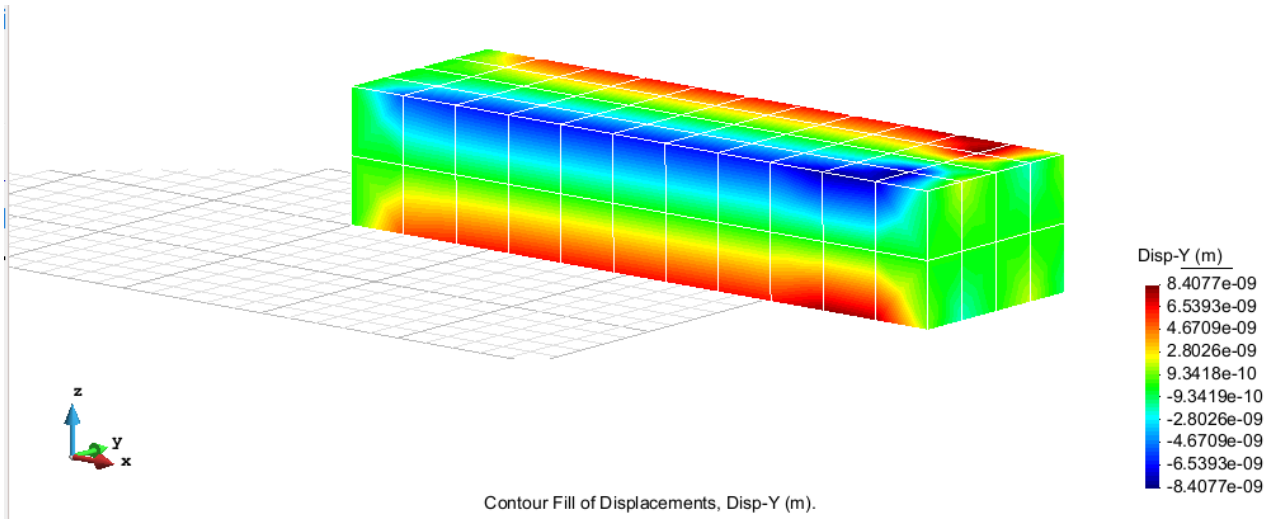

Figure 21 – Displacements on axis y

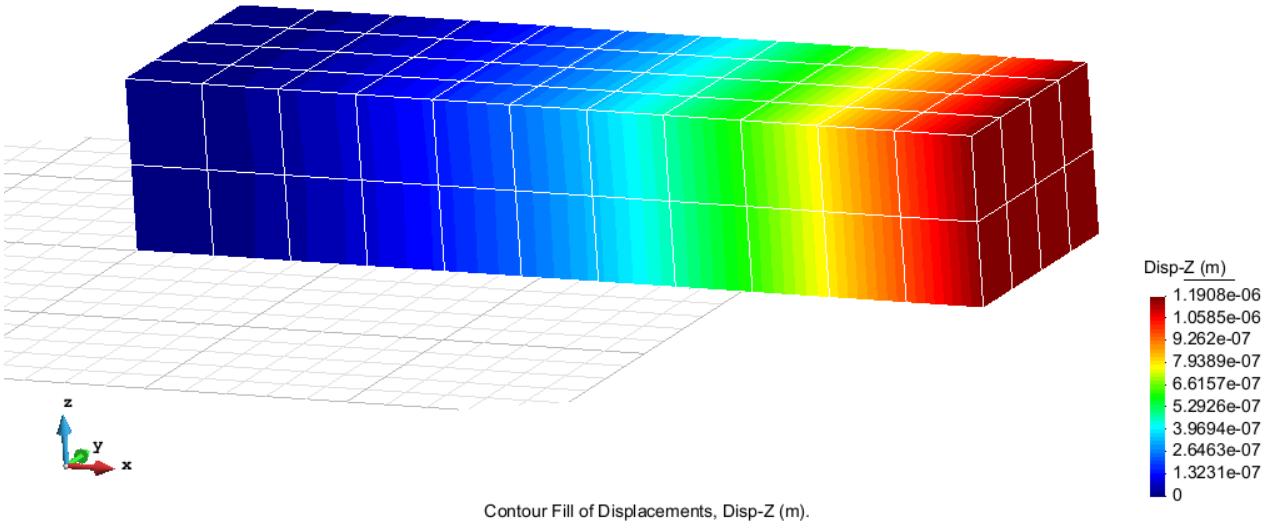

Figure 22 – Displacements on axis z

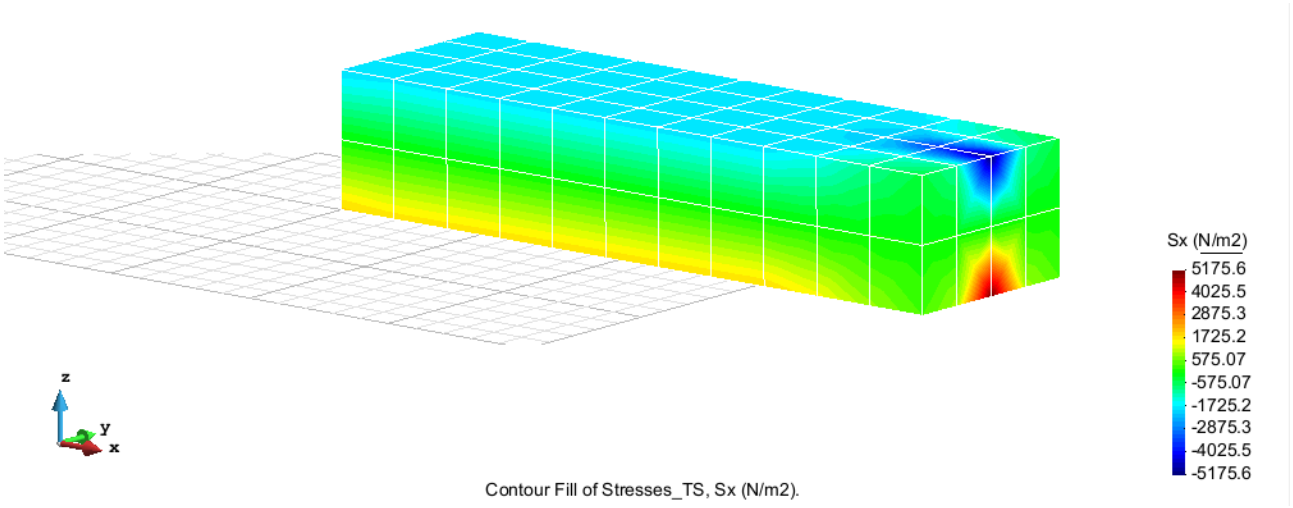

Figure 23 – Stresses on axis x

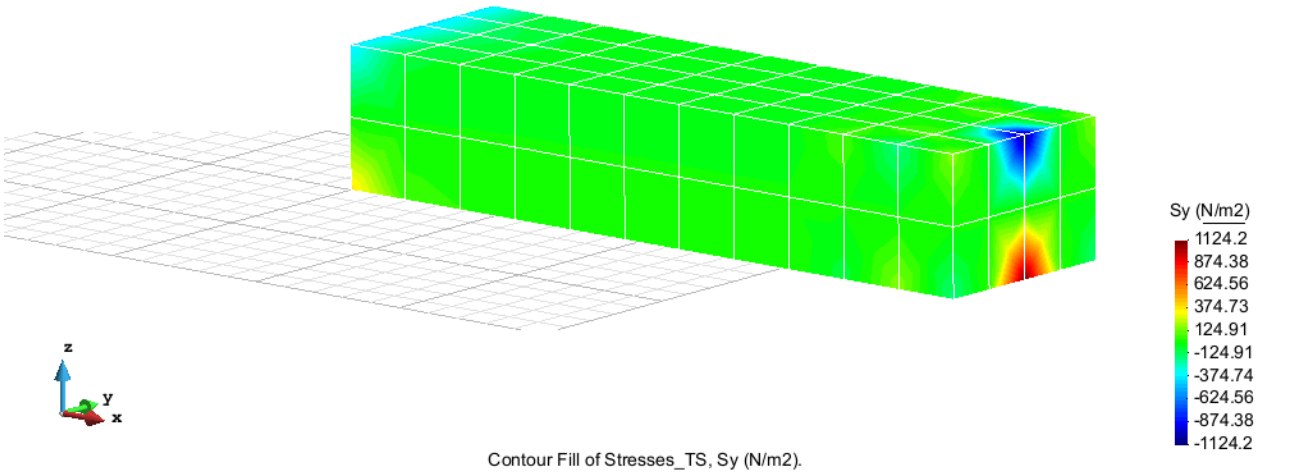

Figure 24 – Stresses on axis y

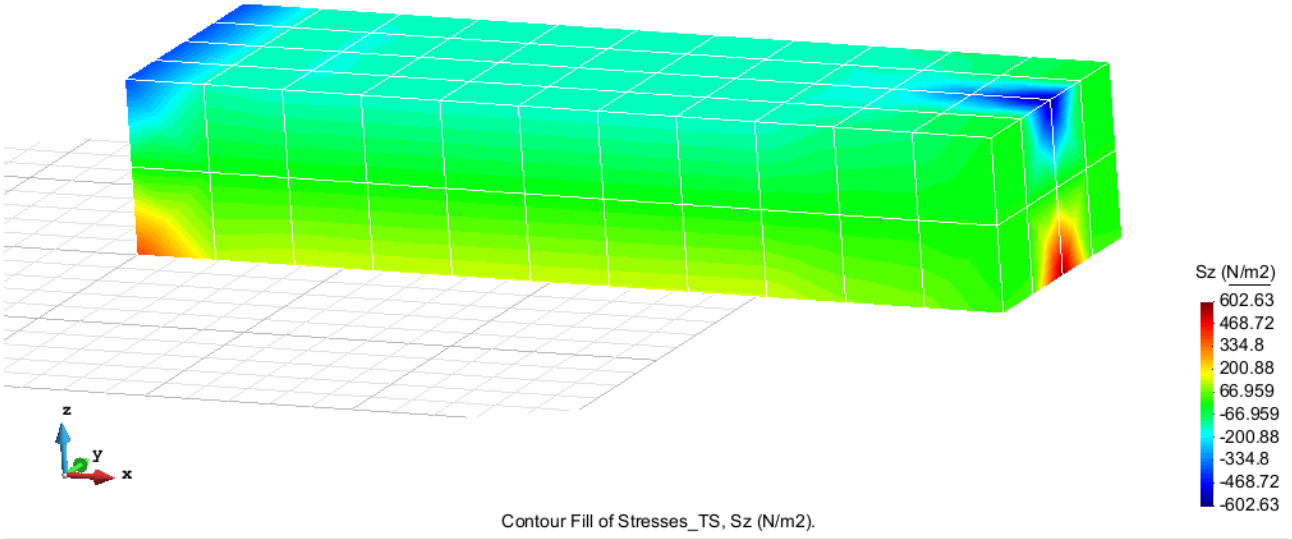

Figure 25 – Stresses on axis z

HEXAHEDRA ELEMENTS WITH 20 NODES

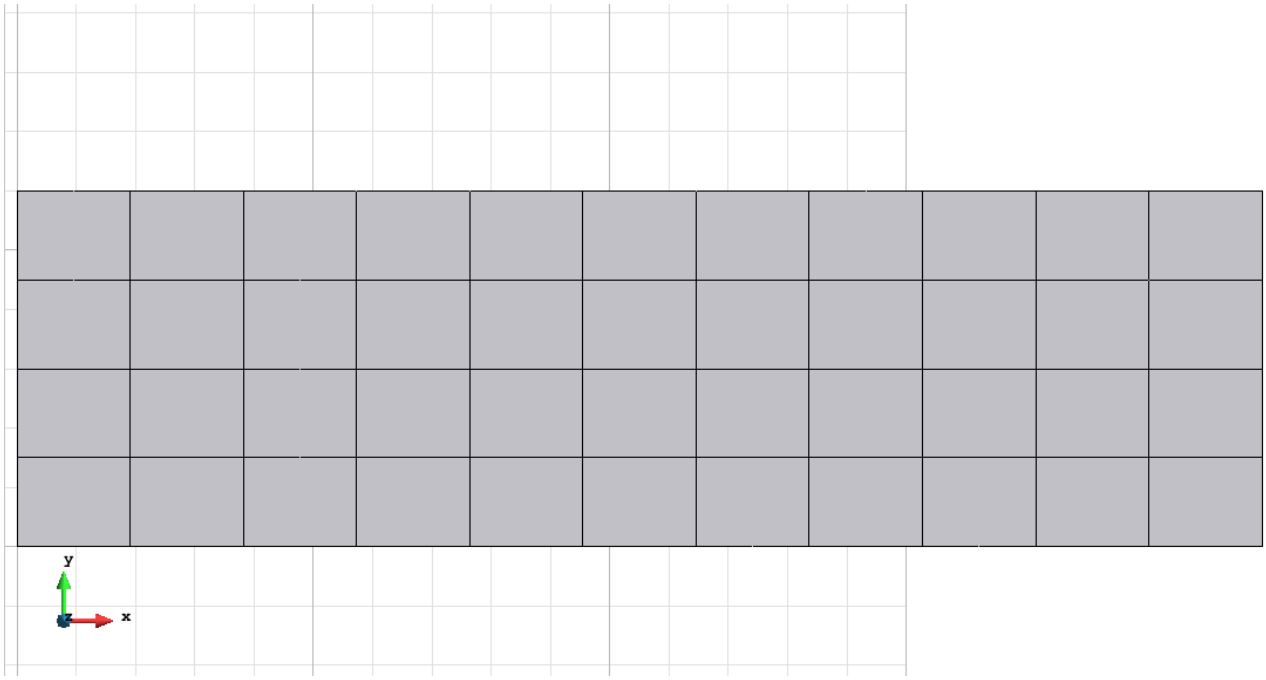

Figure 26 – Mesh of Hexahedra Quadratic (2D)

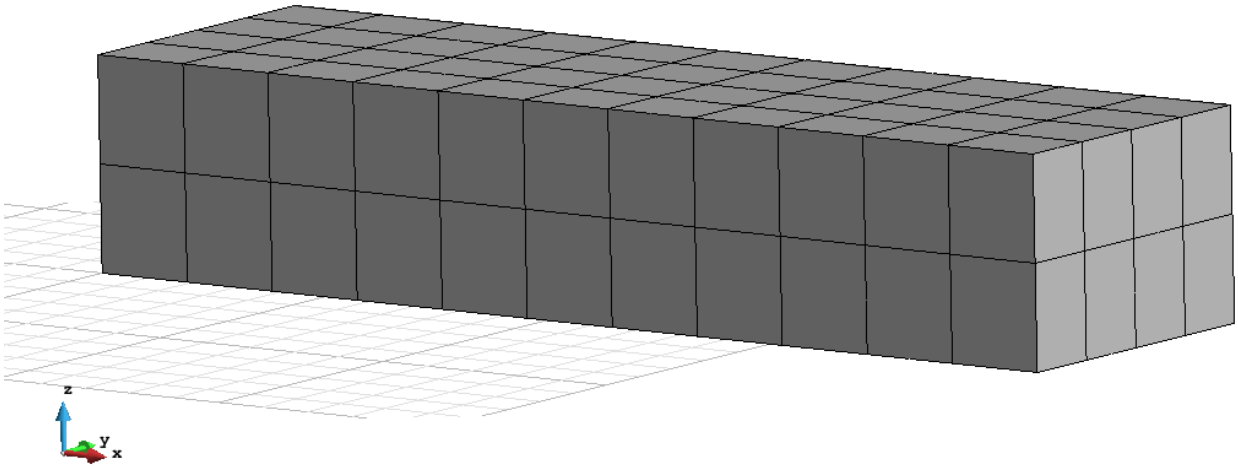

Figure 27 – Mesh of Hexahedra Quadratic (3D)

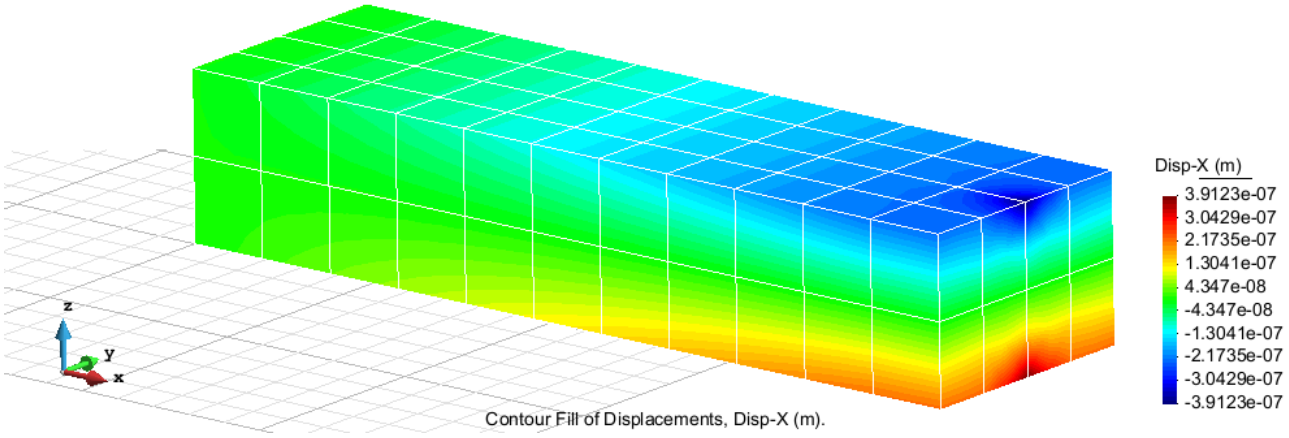

Figure 28 – Displacements on axis x

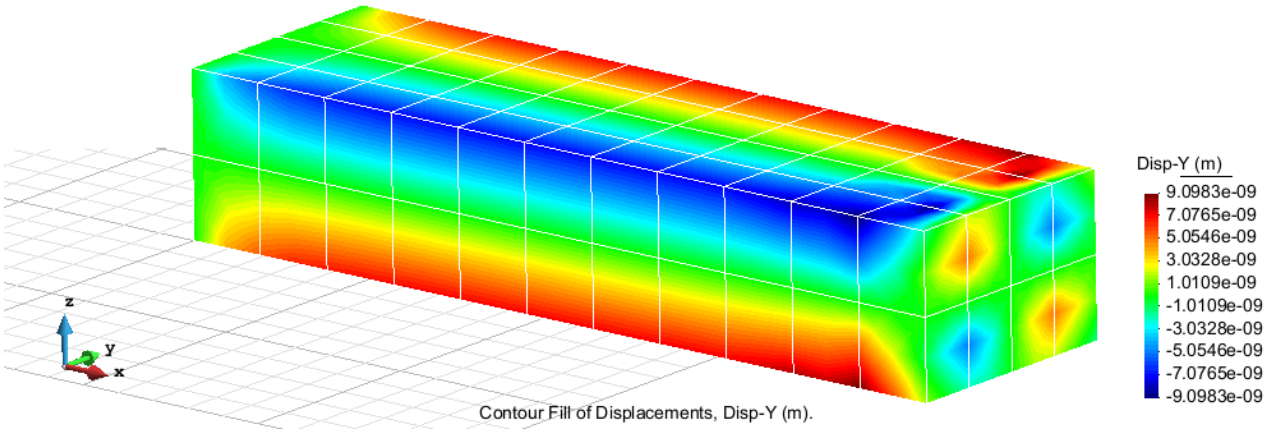

Figure 29 – Displacements on axis y

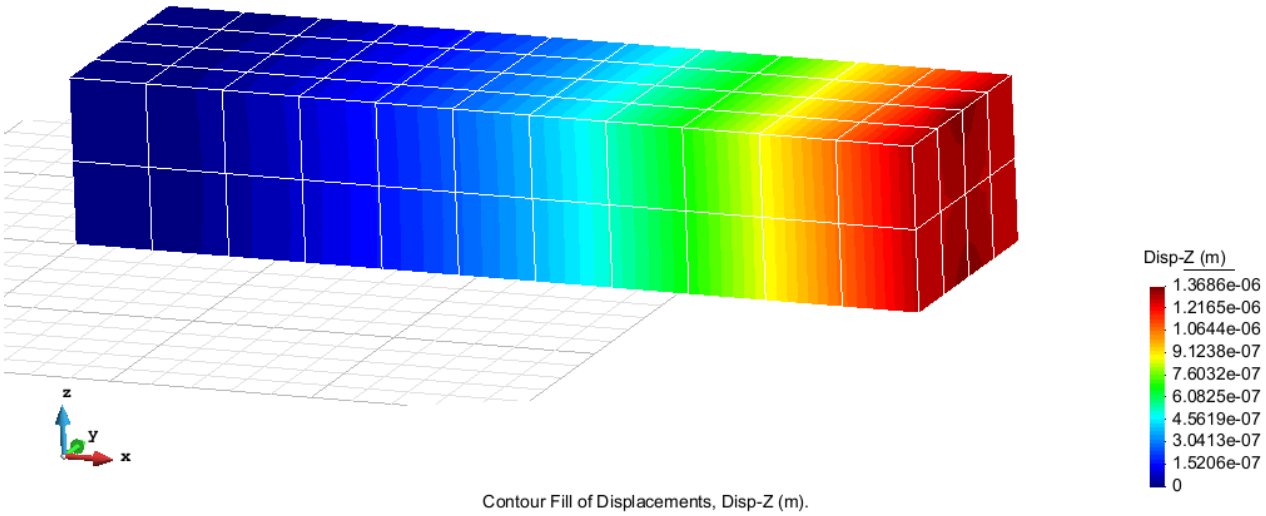

Figure 30 – Displacements on axis z

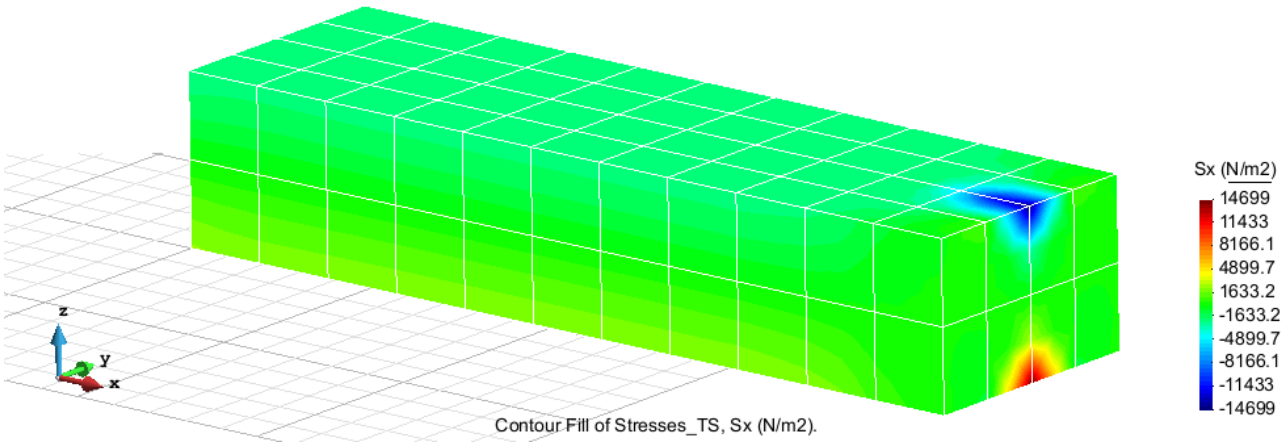

Figure 31 – Stresses on axis x

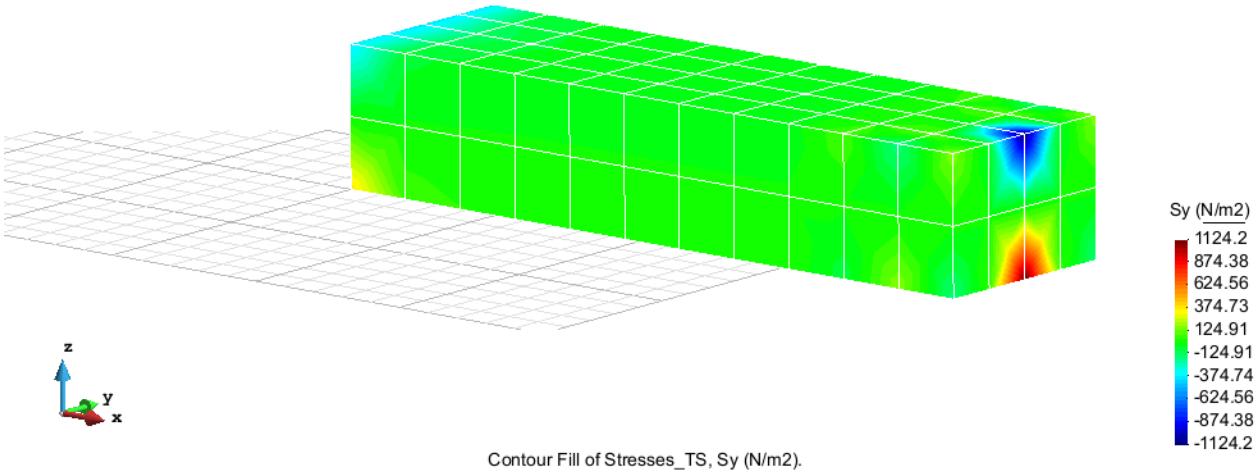

Figure 32 – Stresses on axis y

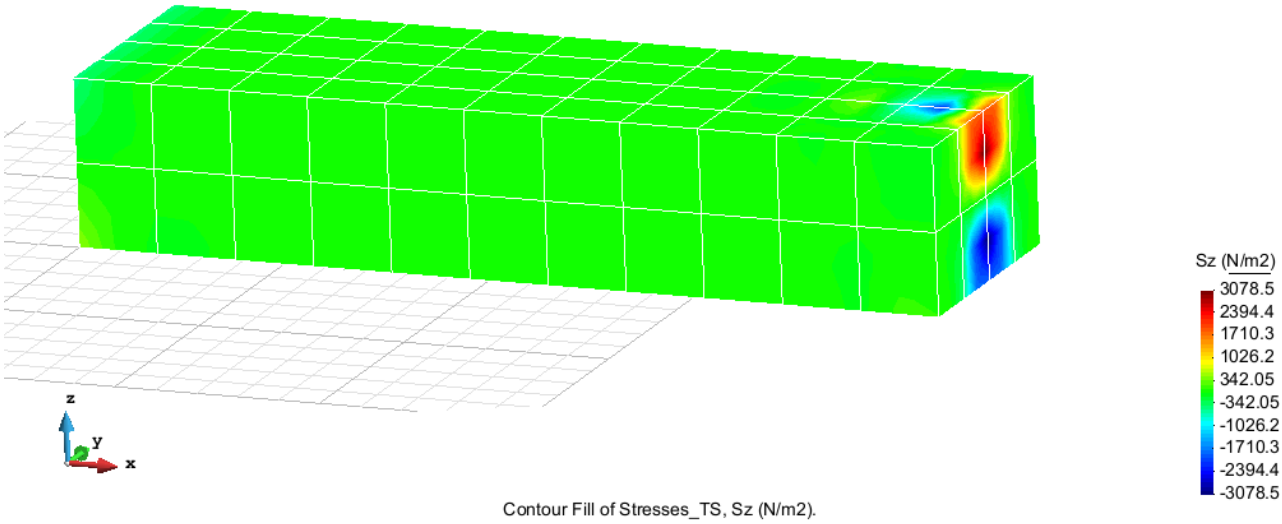

Figure 33 – Stresses on axis z

Exercise 3: Foundation of a corner column

Solution

Geometry

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

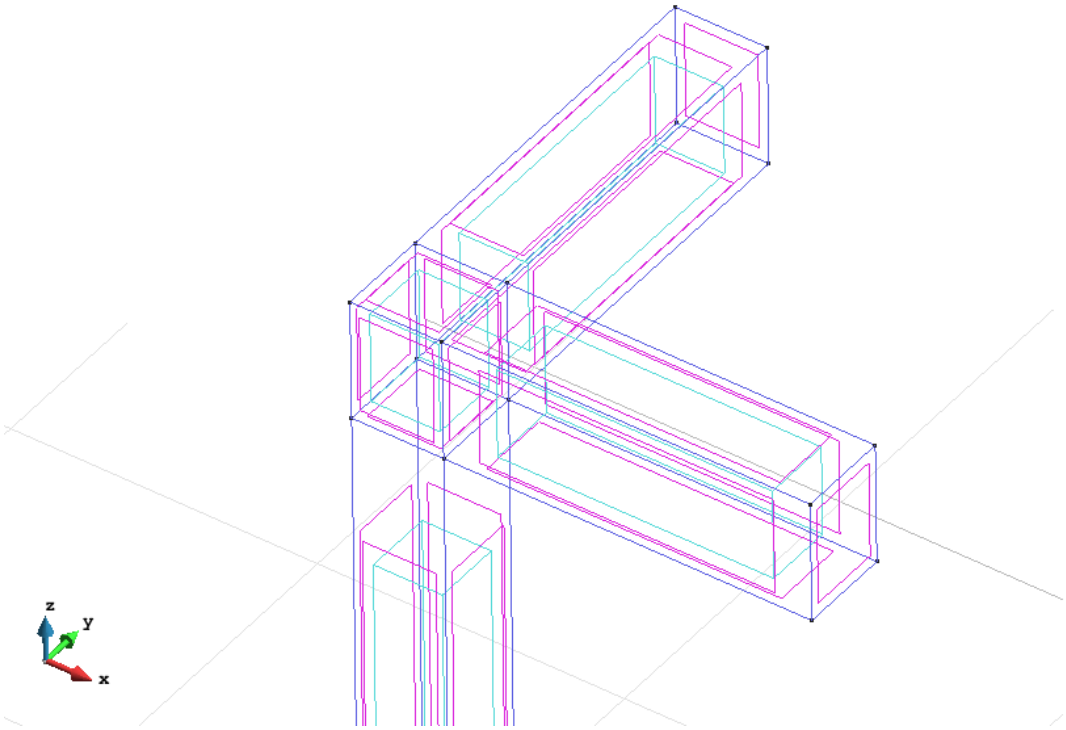

Figure 34 – Geometry of the structure (upper part)

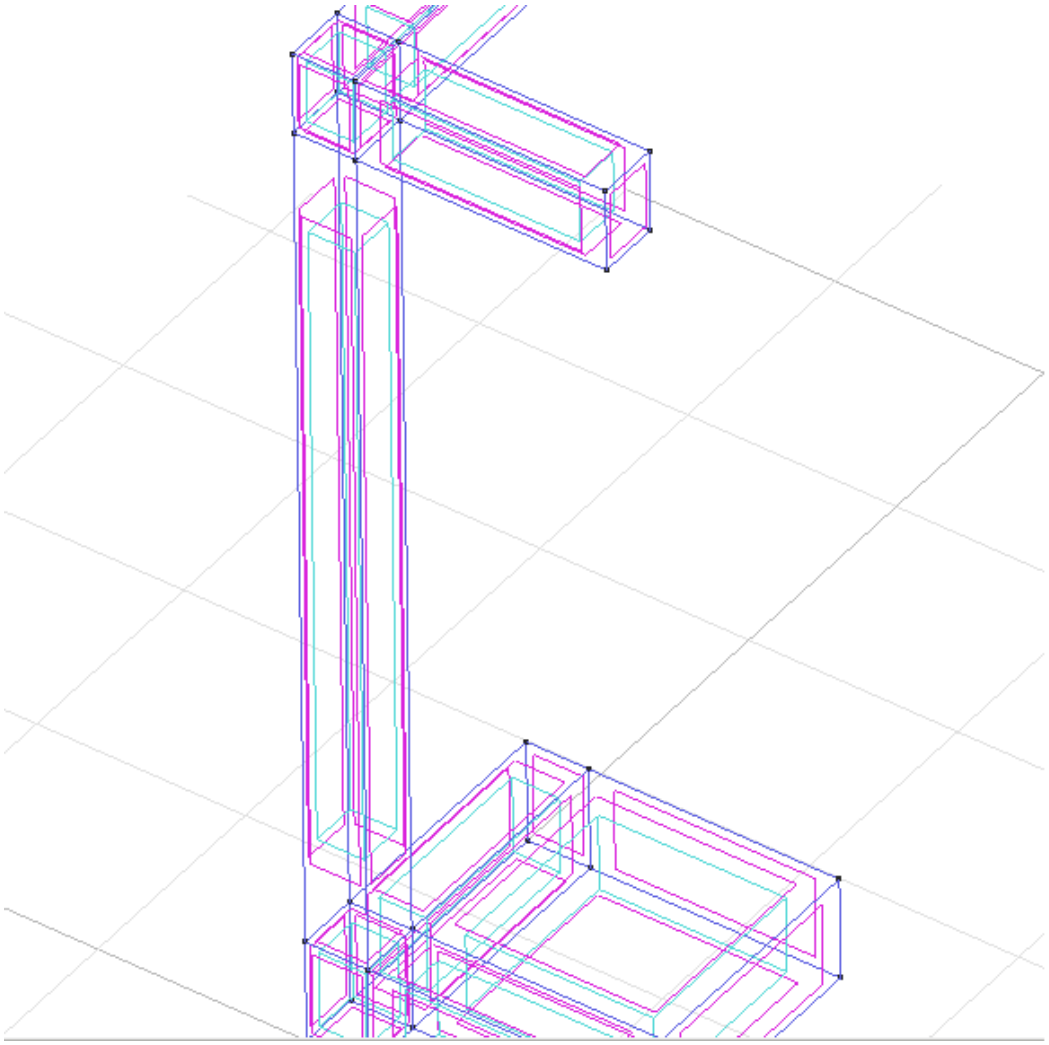

Figure 35 – Geometry of the structure (central part)

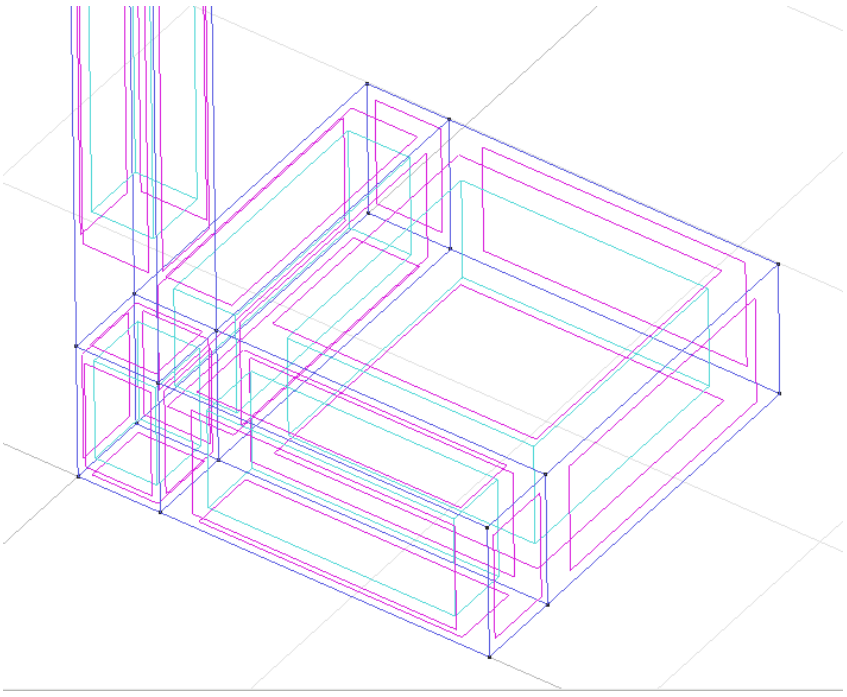

Figure 36 – Geometry of the structure (bottom)

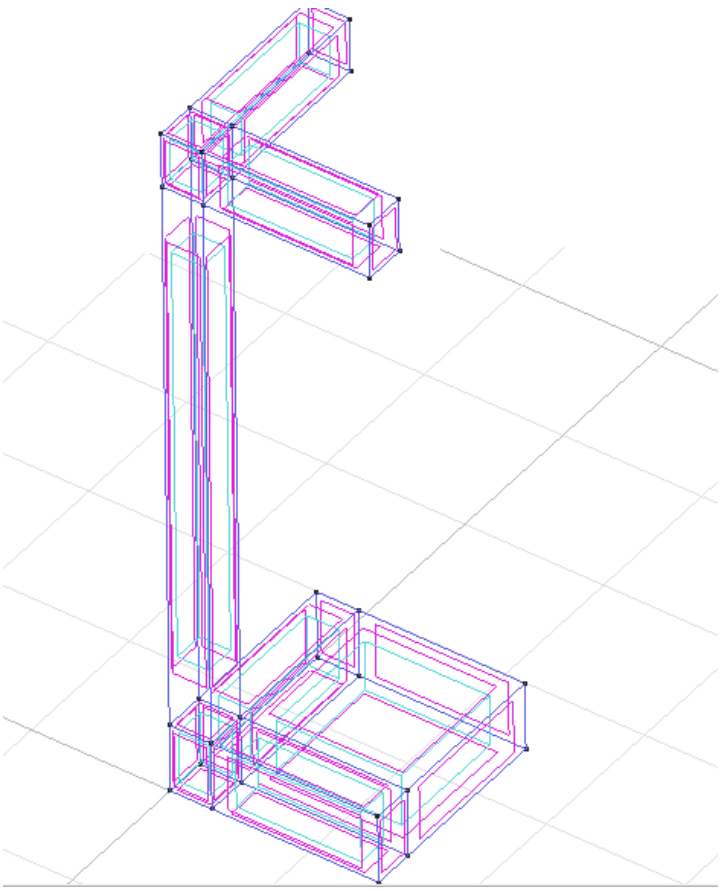

Figure 37 – Geometry of the structure

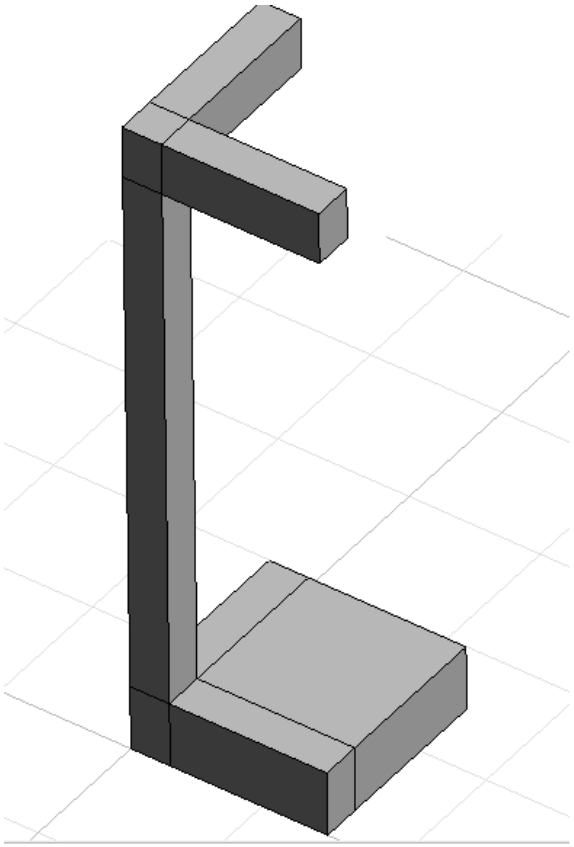

Figure 38 - Geometry of the structure in flat view

Data

Problem Type:

Once the geometry is defined, we can see which type of problem must be solved. In this case we face a solids on 3D; therefore we choose the module RamSeries_Educational_2D/3D Solids using the following sequence of commands:

Data / Problem Type / RamSeries_Eductional_2D / 3D_Solids

Boundary conditions:

The types of boundary conditions that are enforced in this example are the following: Displacements Constraints / Surface Constraints.

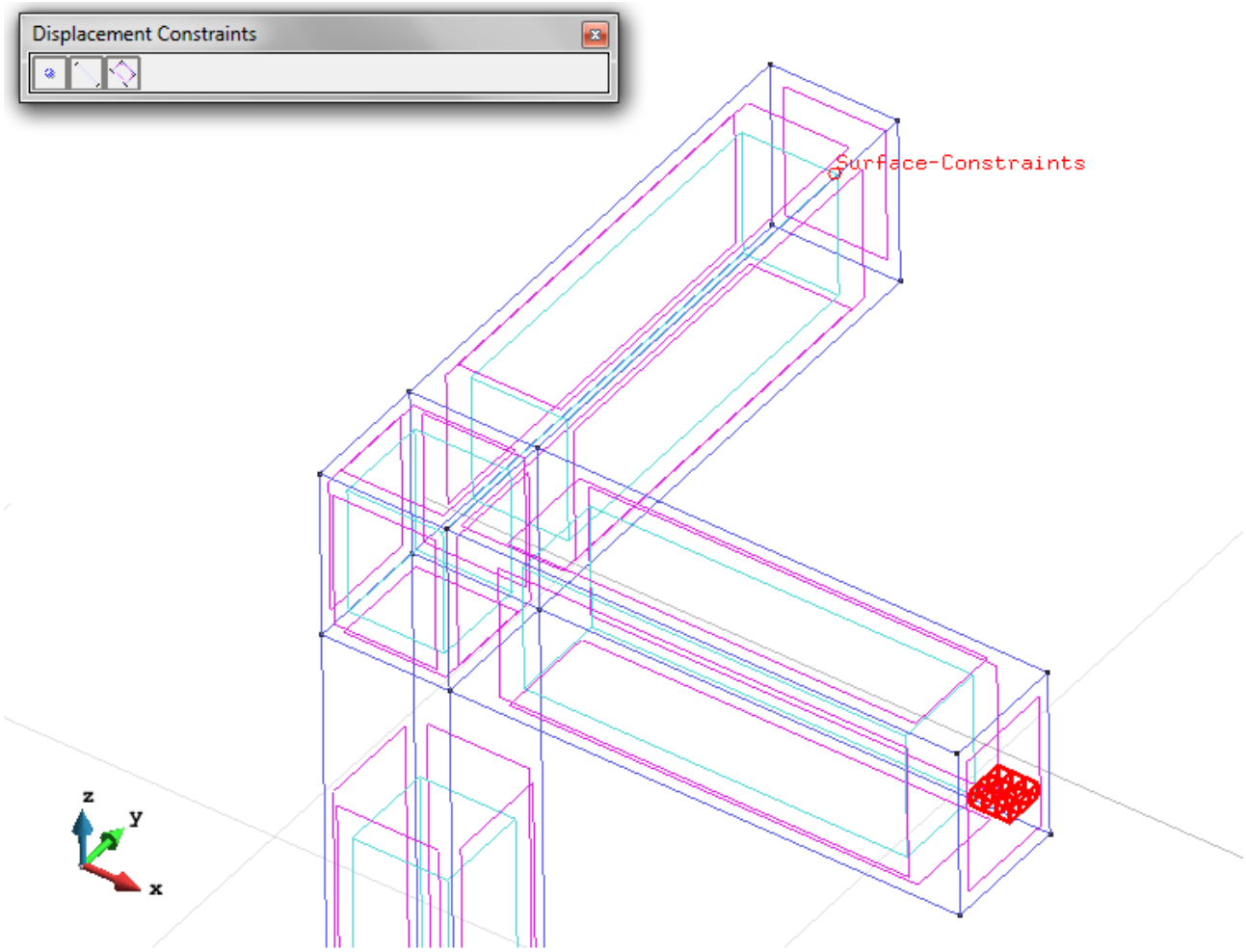

Figure 39 – Surface Constraint

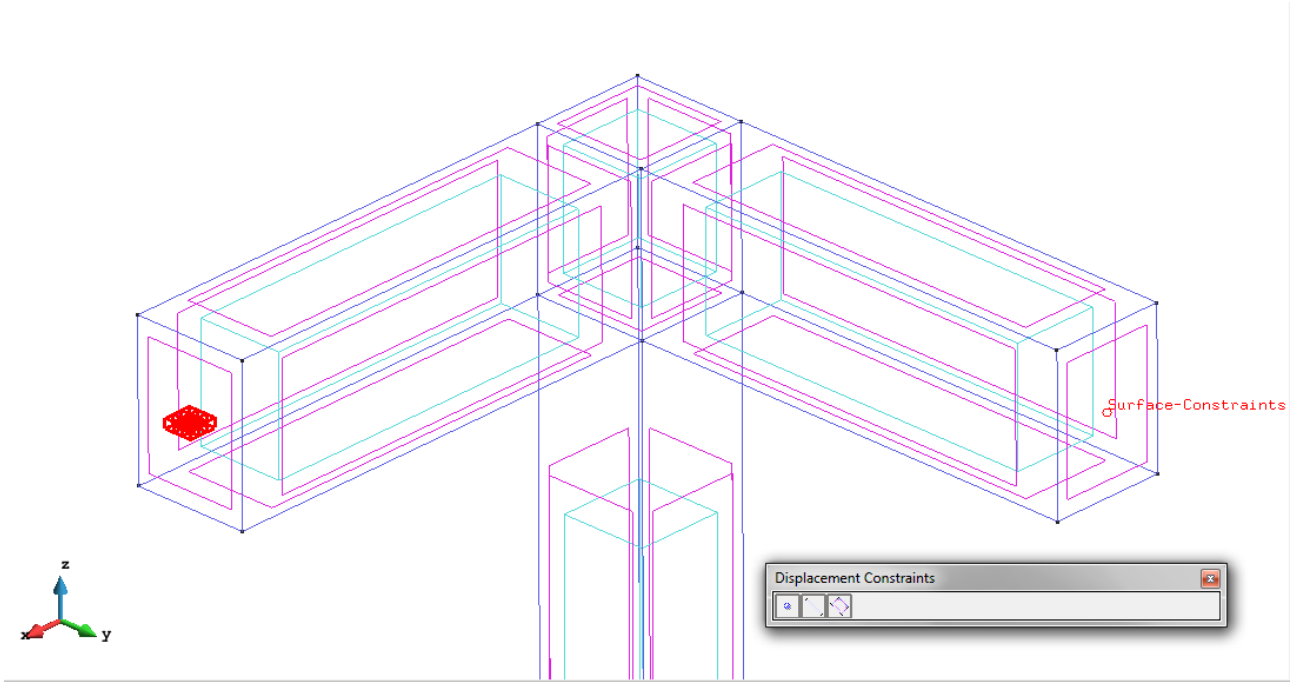

Figure 40 – Surface Constraint from another view

- Loads / Line loads / Uniform loads. Setting the eccentric load on the upper face on the corner with the command “Global Proyected pressure”.

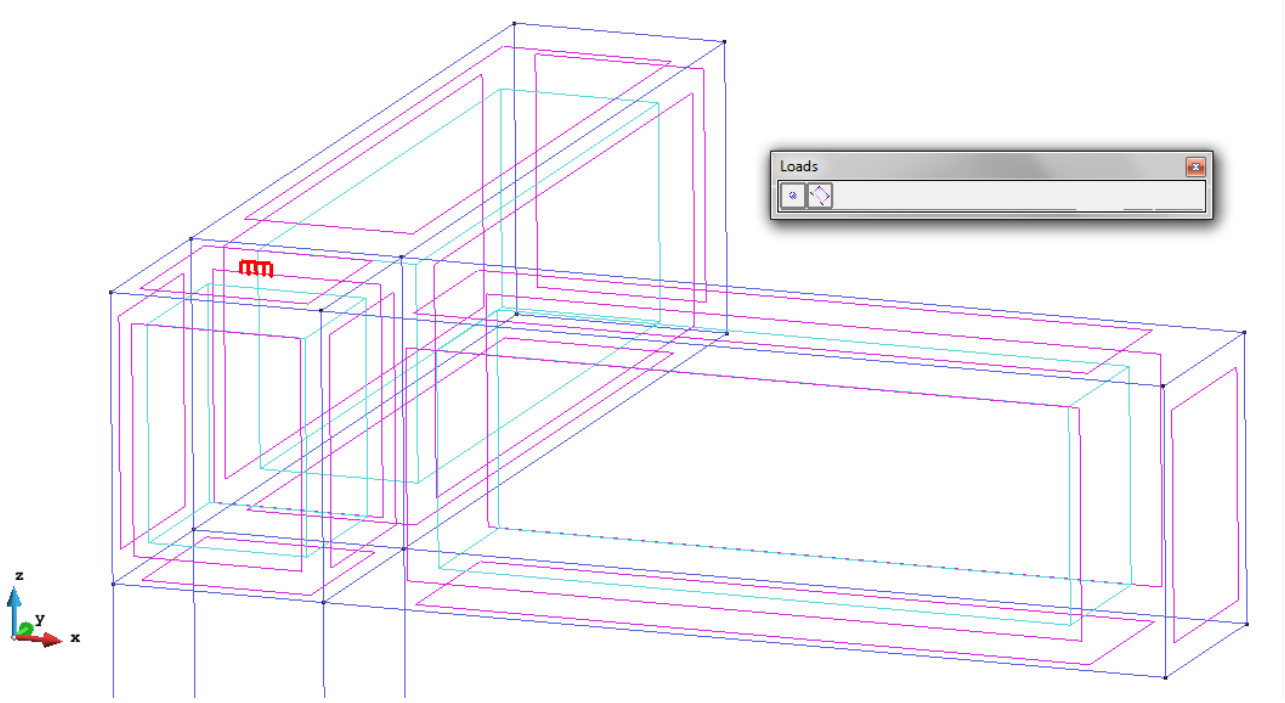

Figure 41 - Eccentric load on the upper face

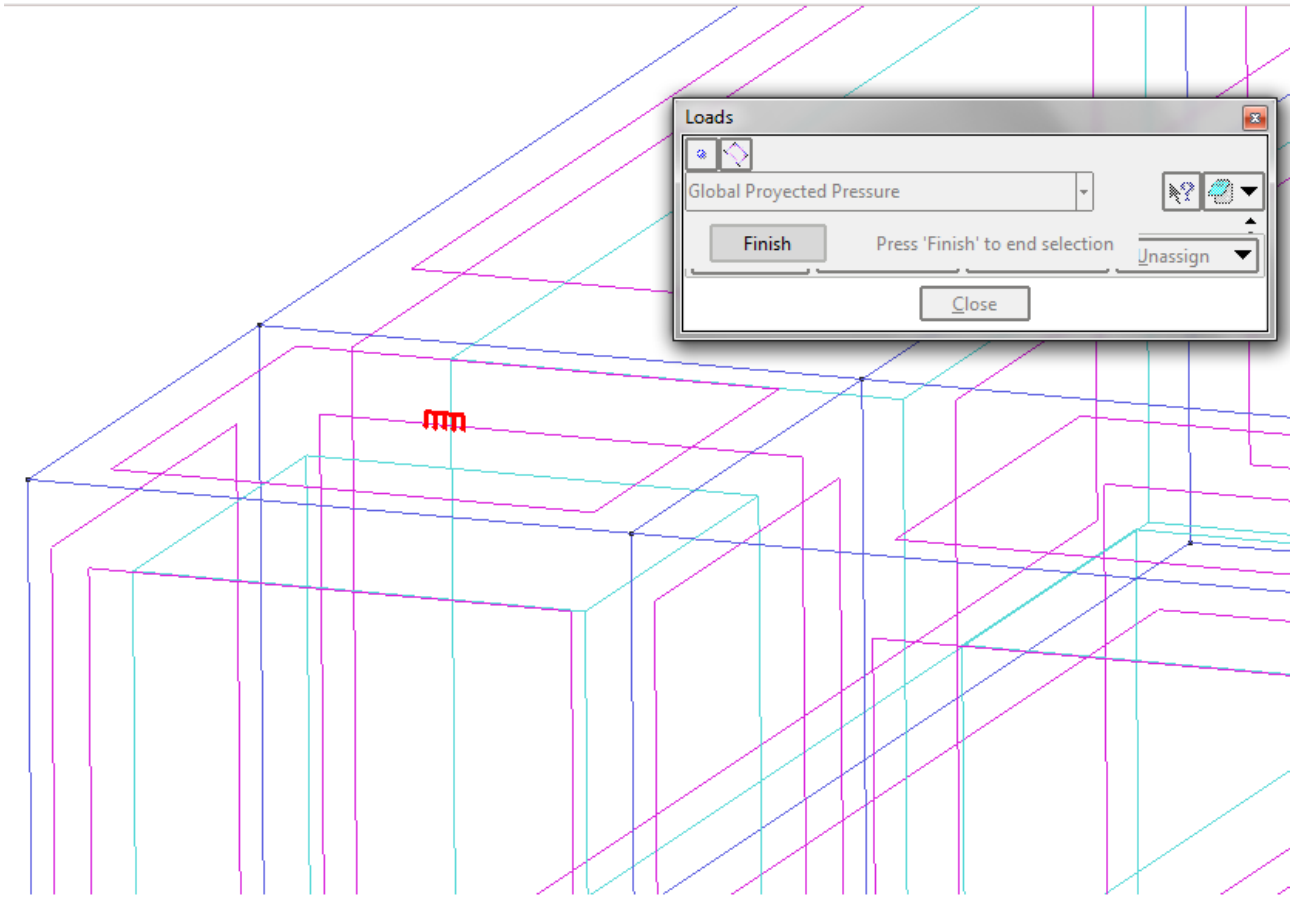

Figure 42 - Eccentric load on the upper face (zoom)

- Elastic Constraints (for the ground).

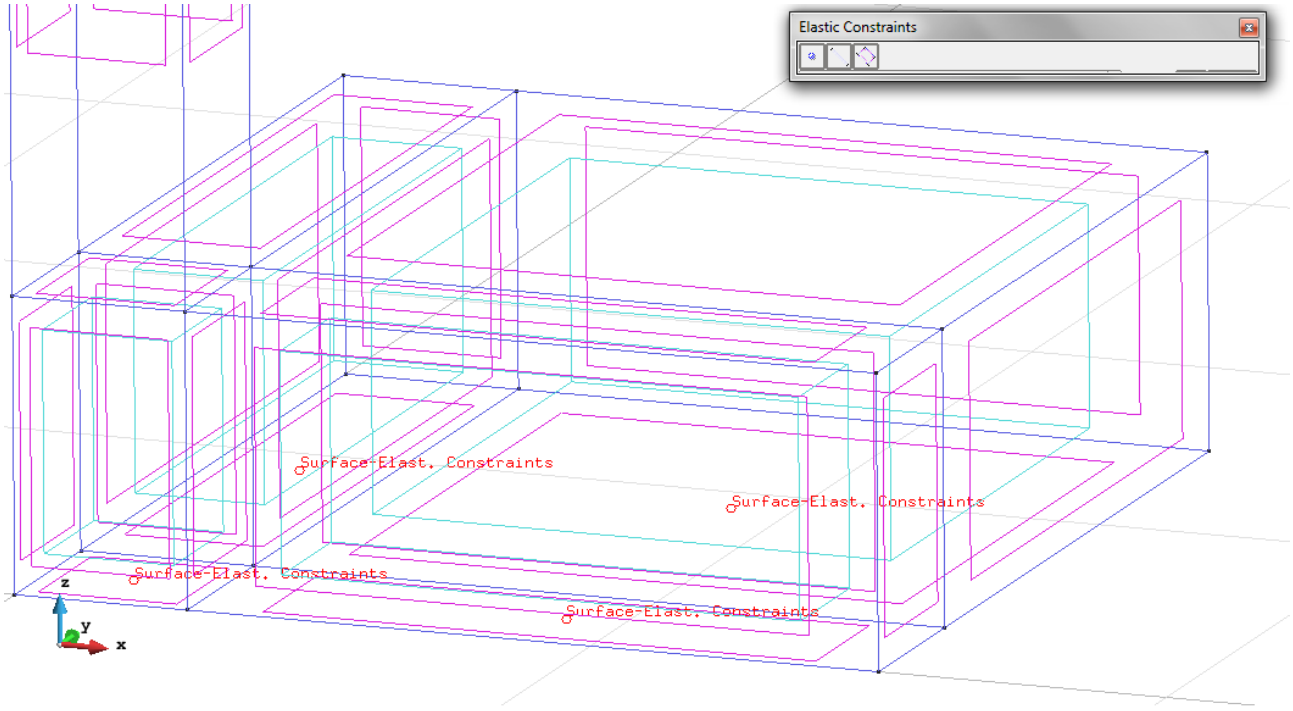

Figure 43 - Elastic Constraints

Material: We use material with the following mechanical characteristics.

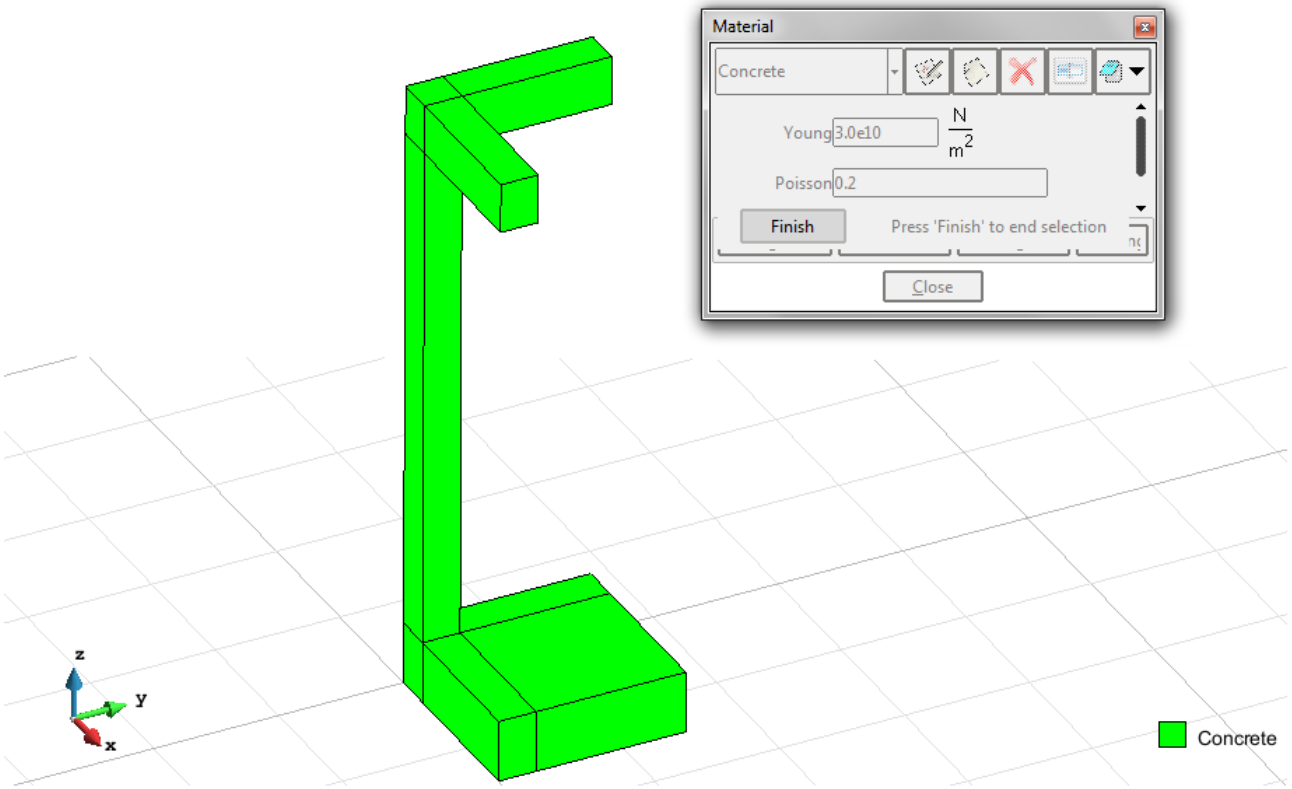

Figure 44 – Material

Meshing / Generate To generate the mesh use the following options:

- Element Type: We use a mesh of Hexahedra elements.
- Quadratic elements: We consider linear elements with 8 nodes (Normal).

Calculate / Calculate

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

File / Post Process The following figures show the results of the analysis sought after in this exercise.

HEXAHEDRA ELEMENTS WITH 8 NODES

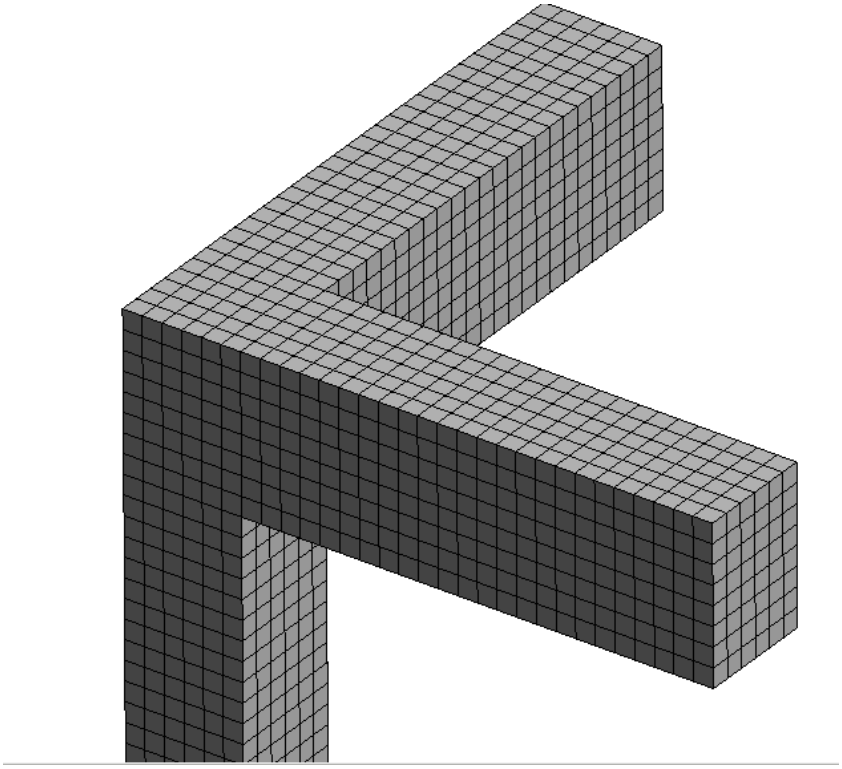

Figure 45 - Mesh of Hexahedra Normal (upper part)

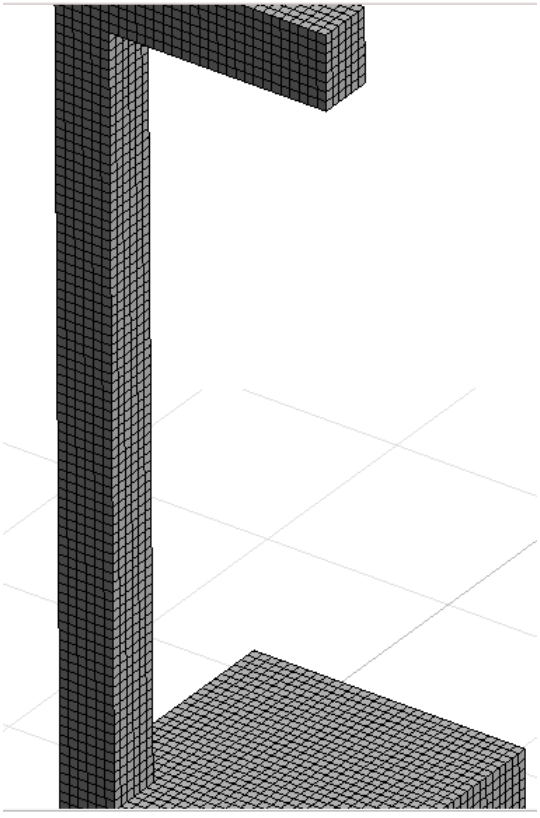

Figure 46 – Mesh of Hexahedra Normal (central part)

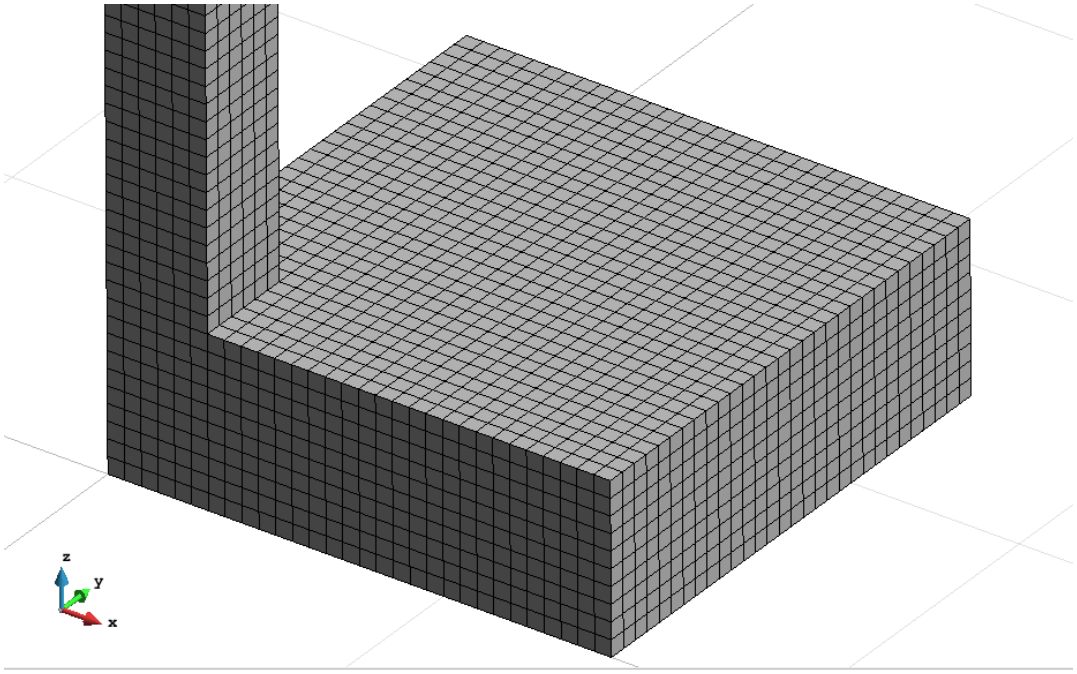

Figure 47 – Mesh of Hexahedra Normal (bottom)

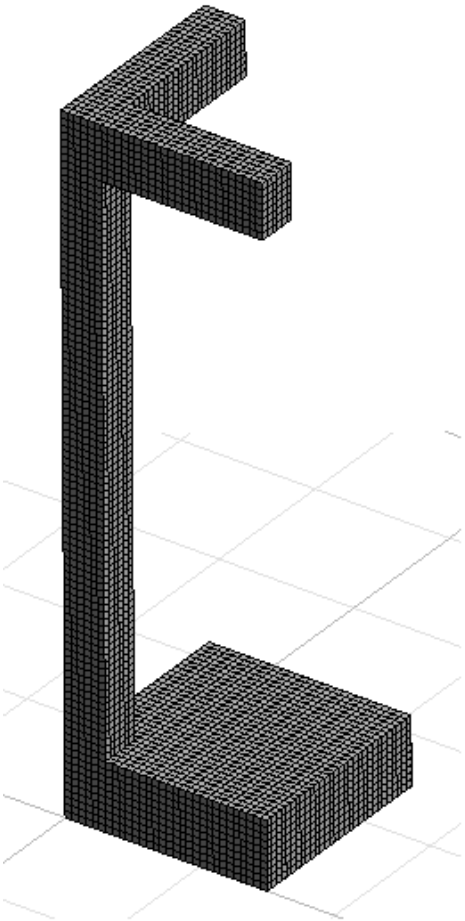

Figure 48 - Mesh of Hexahedra Normal

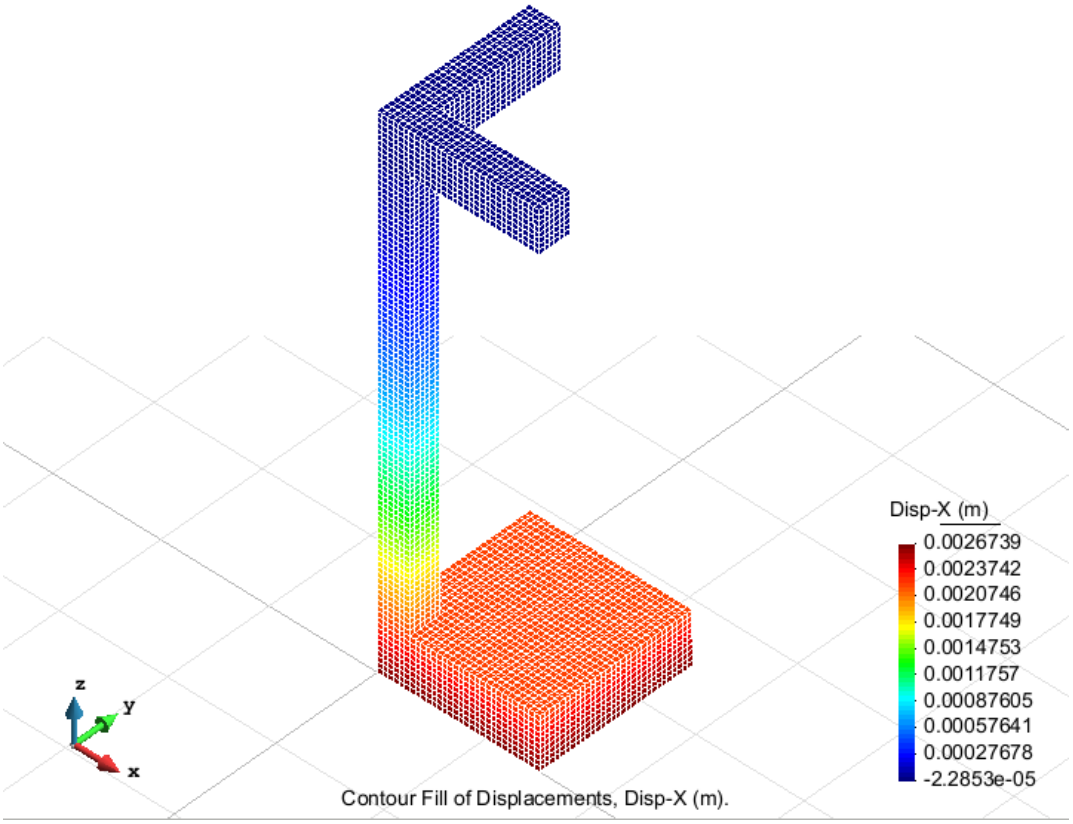

Figure 49 – Displacements on axis x

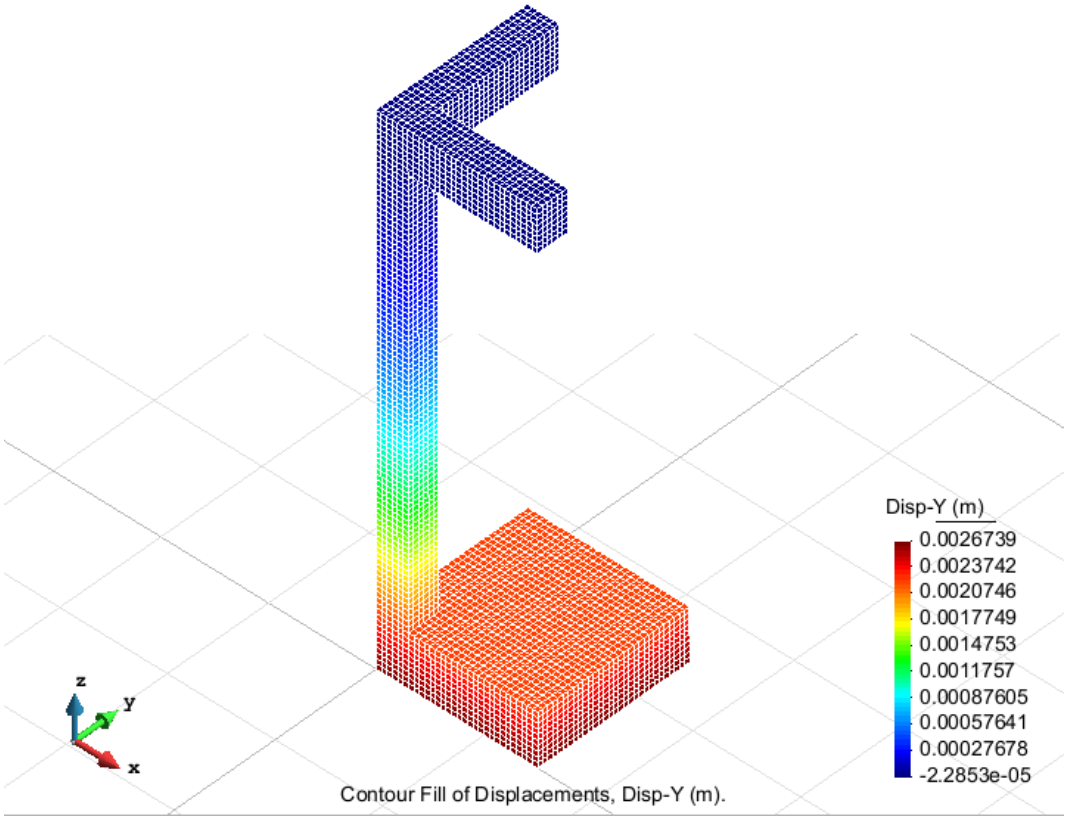

Figure 50 – Displacements on axis y

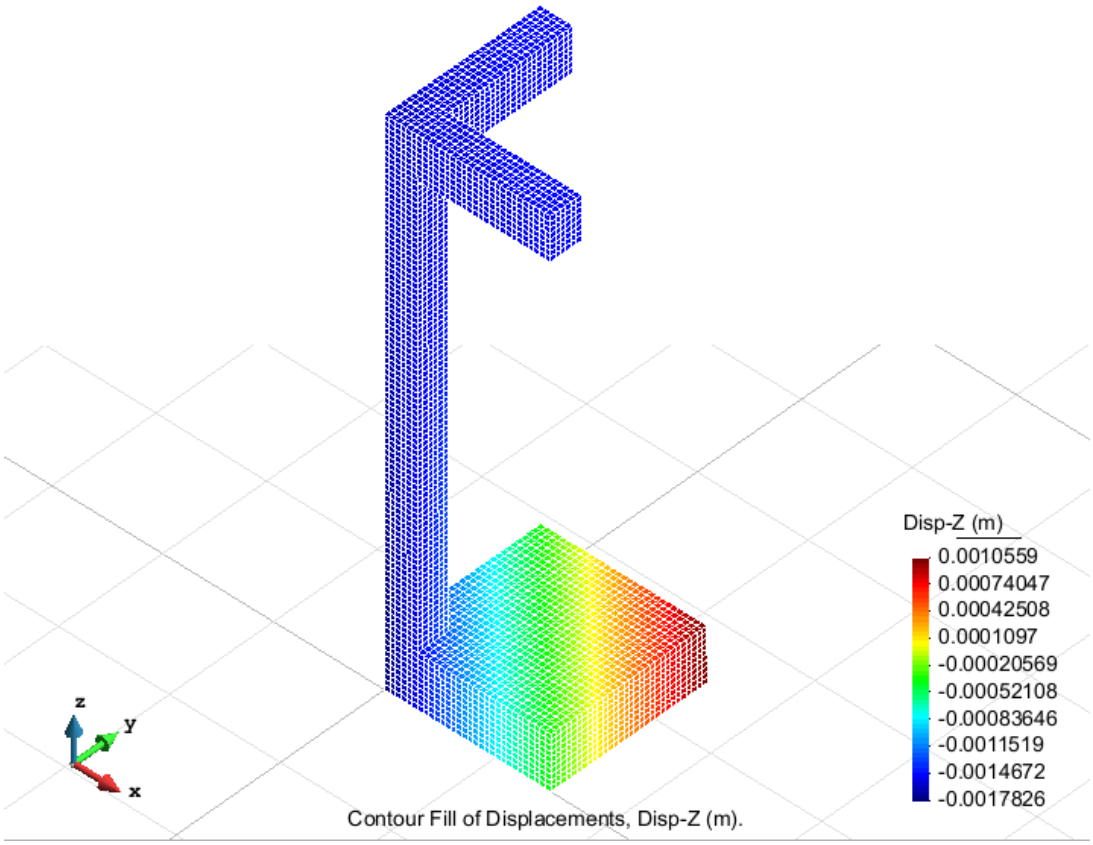

Figure 51 – Displacements on axis z

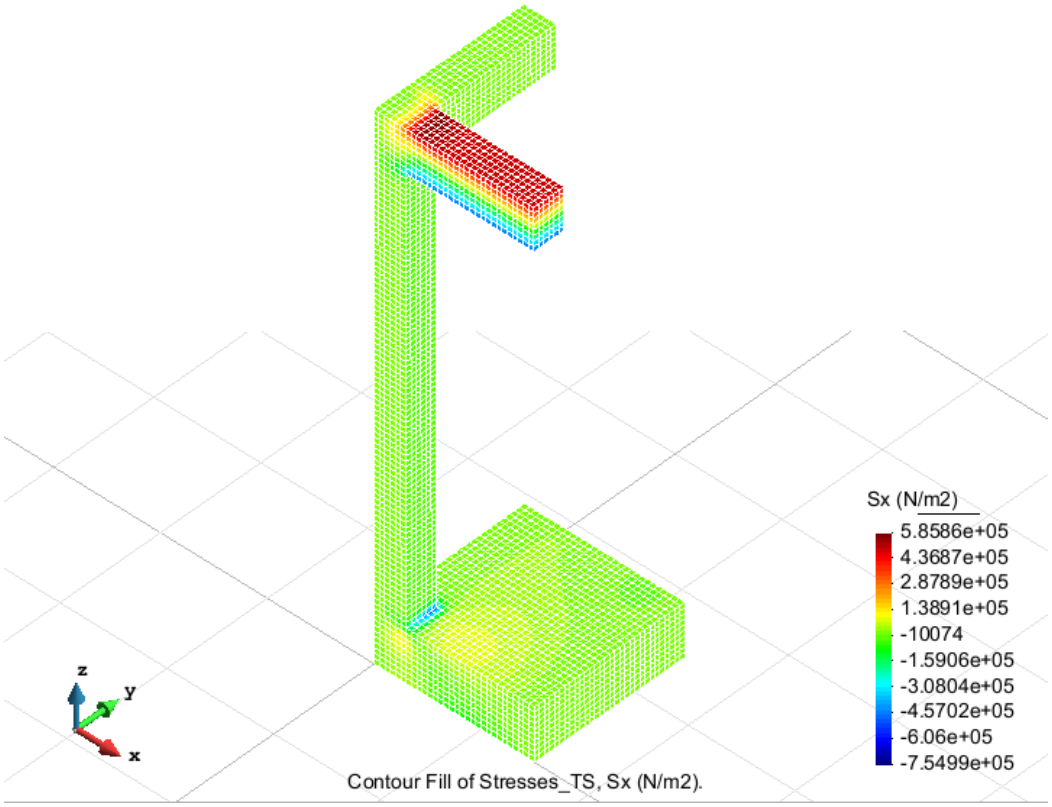

Figure 52 – Stresses on axis x

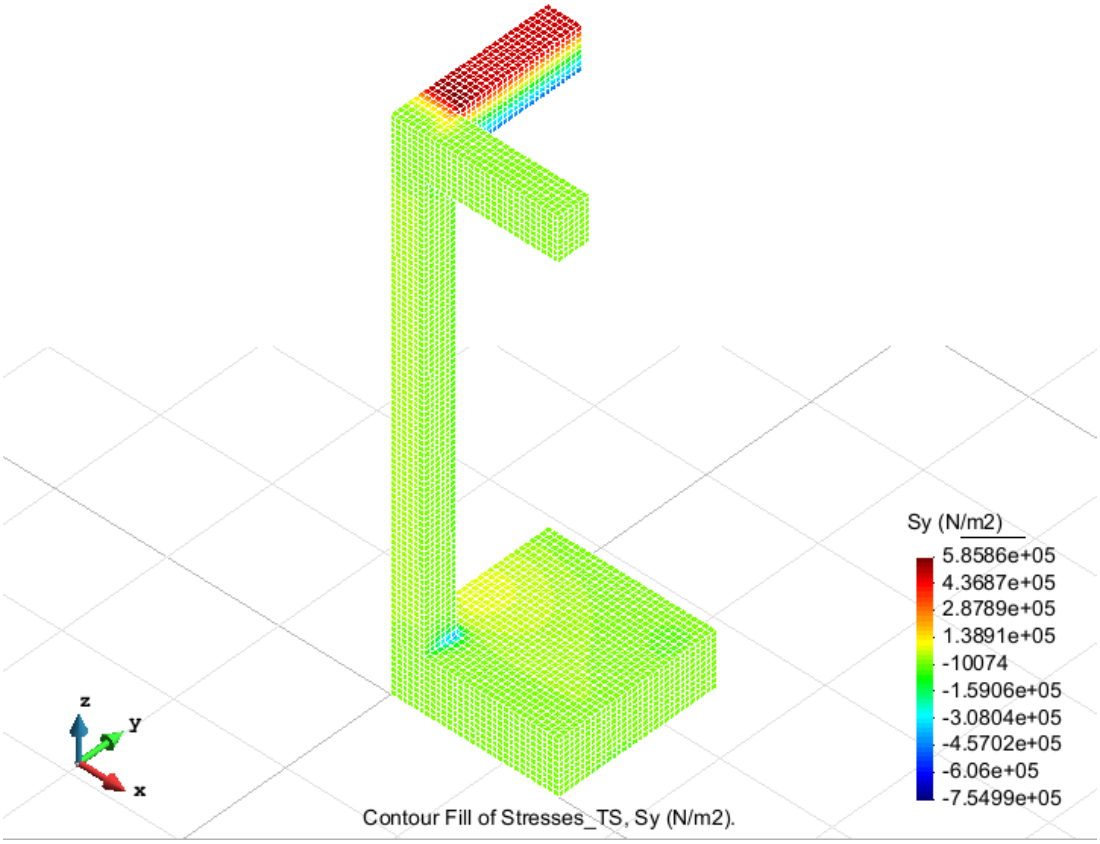

Figure 53 – Stresses on axis y

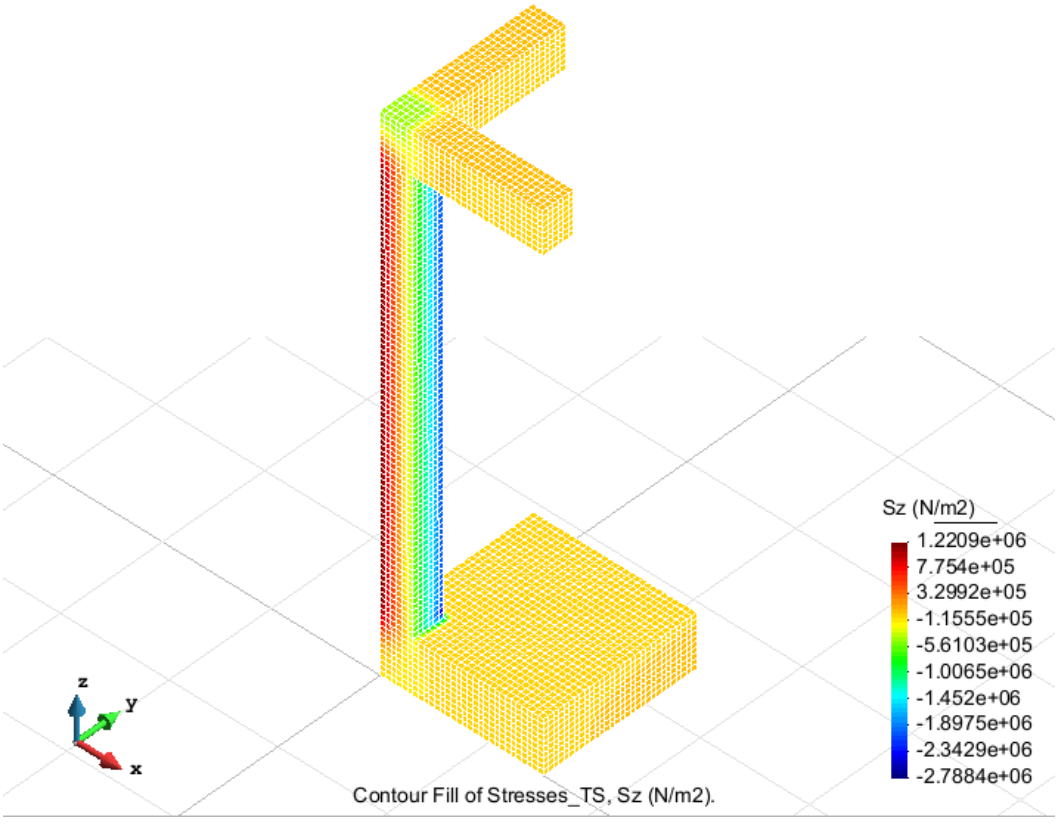

Figure 54 - Stresses on axis z