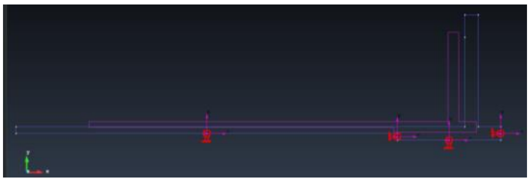
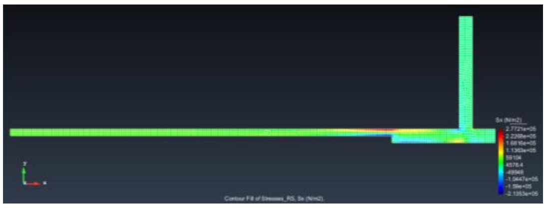
PRACTICE 2

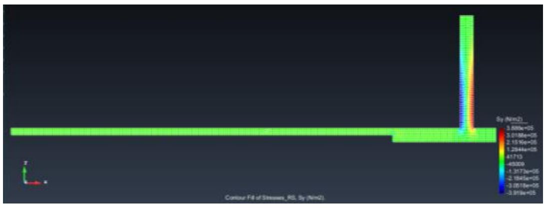
EXERCISE 1: Thin plate under dead weight

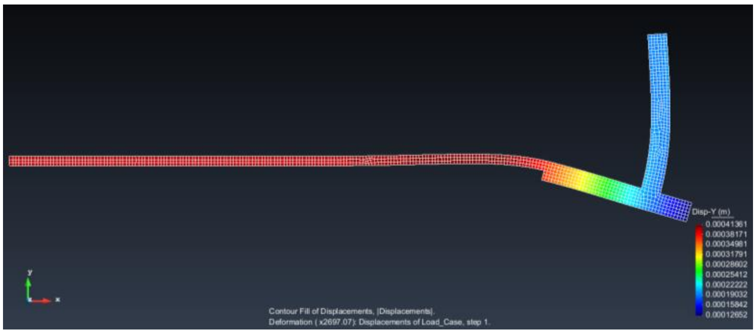
The boundary condition of the tank should be introduced in the informatics program. There is a constant pressure upon the horizontal plate and a triangular pressure upon the dam. Lastly, the problem has been solved using Rev_Solids.gid.



As expected, the greater displacements are concentrated near the wall. The vertical pressure is distributed along the slab and generates the same displacement. However, the horizontal pressure upon the wall generates a bending moment, which turns the wall.



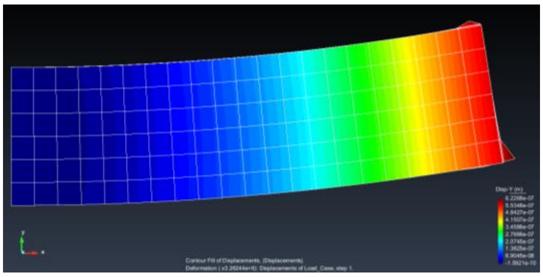




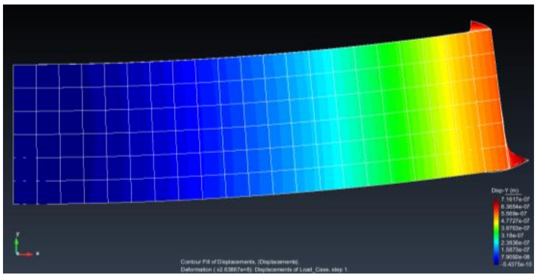
EXERCISE 2: Analysis of the flexion of a beam using hexahedra elements

The showed cantilever beam will be solved using the informatic program GID (3D_solids.gid) and the results would be compared with the beam theory.

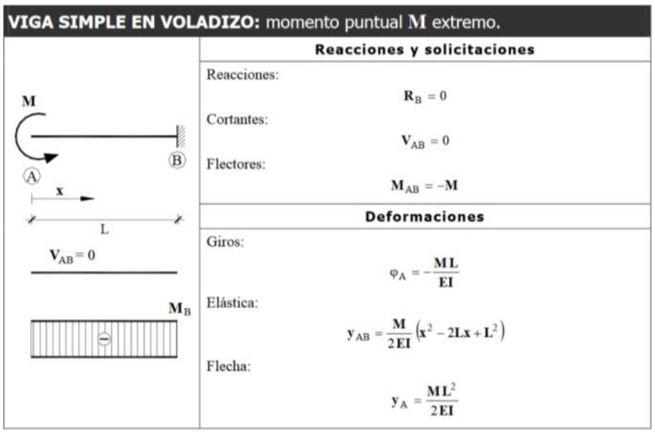
- **Hexahedra elements with 8 nodes:** The results obtained with the linear hexahedral element will be plotted with the other results at the end of the exercise.



- **Hexahedra elements with 20 nodes:** The displacements calculated with quadratic hexahedral element are slightly greater than with 8 nodes elements but the strain pattern is almost the same.



- **Beam theory:** The deflection of the beam is obtained from a technical handbook. The data of the problem should be introduced in the given formulation.



VIGA SIMPLE EN VOLADIZO: momento puntual M extremo.

Reacciones y solicitaciones

Reacciones: $R_B = 0$

Cortantes: $V_{AB} = 0$

Flectores: $M_{AB} = -M$

Deformaciones

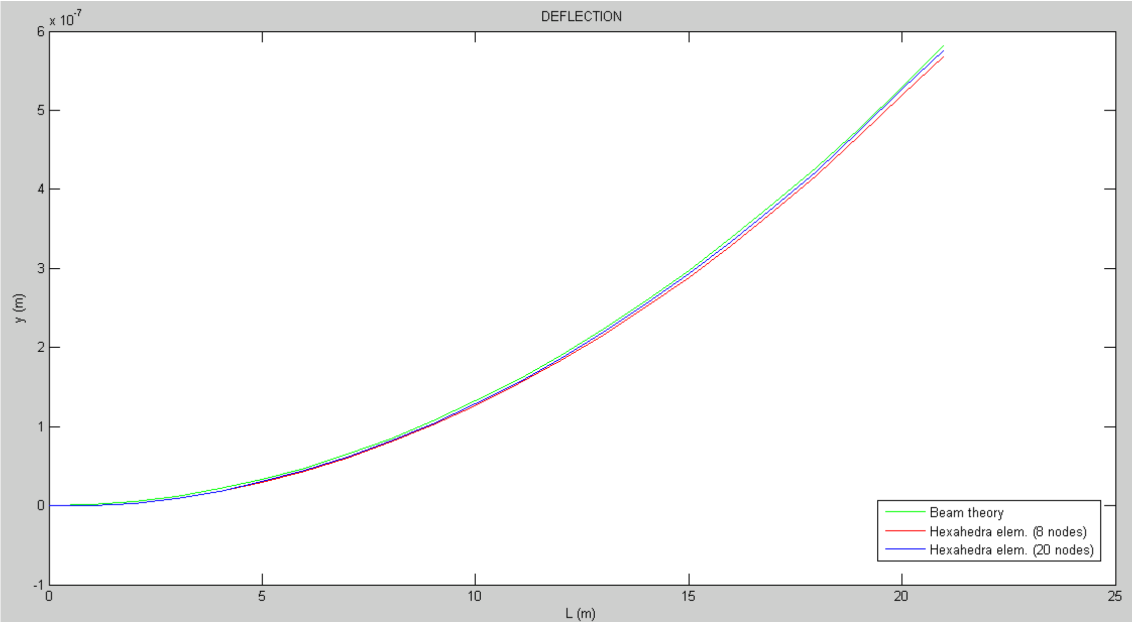
Giros: $\varphi_A = -\frac{ML}{EI}$

Elástica: $y_{AB} = \frac{M}{2EI}\left(x^2 - 2Lx + L^2\right)$

Flecha: $y_A = \frac{ML^2}{2EI}$

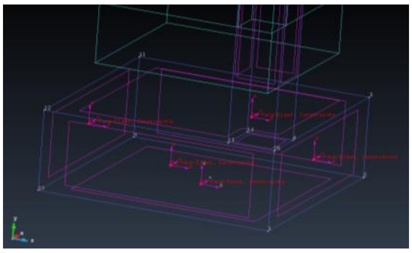
$$y(x) = \frac{M}{2EI}(x^2 - 2Lx + L^2) = \frac{60000\ \text{Nm}}{2 \cdot 2.1e11 \frac{\text{N}}{\text{m}^2} \frac{1}{12} 6 \cdot 6^3 \text{m}^4}(x^2 - 42x - 21^2)$$

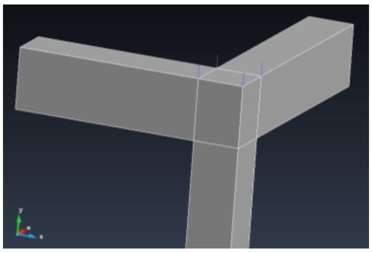
The following figure summarizes the deflections obtained for the three cases. For the 3D representation, the central fiber of the beam has been chosen to draw the displacements. They are mainly the same for the three cases. In the fixed extreme the results are more similar than in the free extreme.



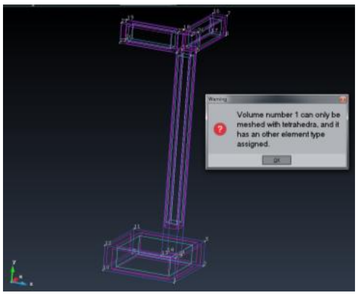
EXERCISE 3: Foundation of a corner column

The problem has been solved using a 3D model. The forces and boundary condition have been introduces as is showed in the following figure.

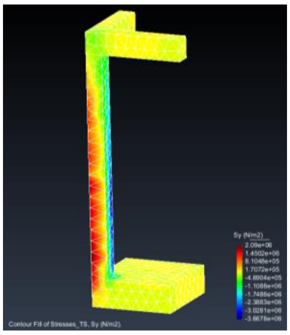


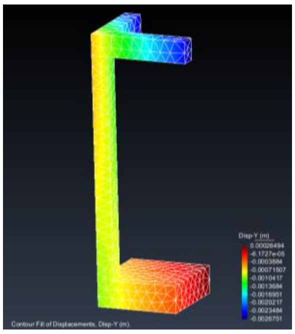


It was meshed using tetrahedral elements. Despite different volumes and surfaces has been used to define the column, it wasn't able to mesh with hexahedral elements.



The stresses are concentrated in the column and they would push down the part of the foundation close to the column. The eccentric loading will cause different displacement across the foundation. The displacements of three points of the contact surface are showed in the table. The node 656 is located below the column, the node 604 is in the center and 631 in the opposite edge. As expected, the node under the column suffers higher displacement than the other points and the furthest point will be displaced in the opposite direction of the other points





Nodes	Coordinates	Disp-Y (m)	Sy (N/m2)
656	0,0,0	-0.00097109	159110
604	0.75,0,0.75	-0.00036617	-15846
631	1.5,0,-1.5	0.00026466	33589