PRACTICE 1 Exercise 1

COMPUTATIONAL STRUCTURAL MECHANICS AND DYNAMICS

Marcos Boniquet Aparicio

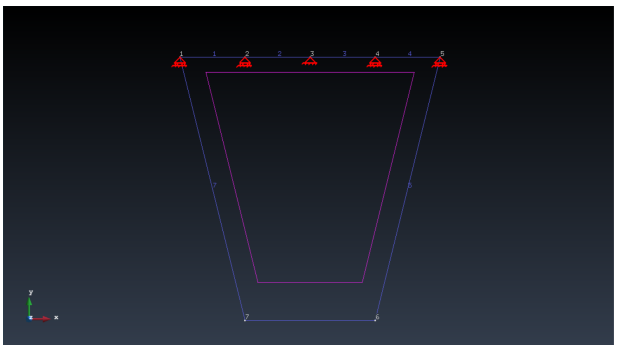
It's chosen a problem type: *Plane_State.*

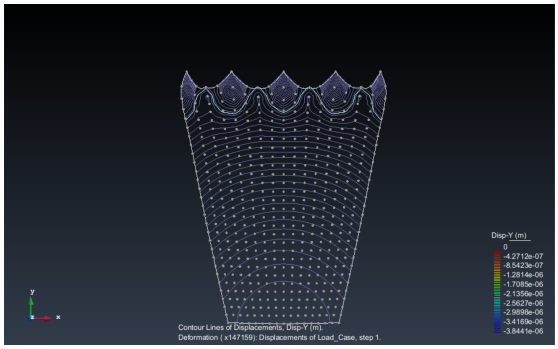
Material, self weight condition, and constraints are settled.

The material chosen for the unique surface defined by the four sides has the following properties:

$E=2,1*10^{11}$ *Pa*
$\nu=0,3$
$\gamma=70000N/m^3$
thickness=0,10 m

The constraints as settled as demanded. A preliminary check is done with the highest demand models, this is 9-node quadrilateral and 6-node triangle.





The finest mesh is chosen, being 8x14, delivering a maximum of 980 DoF *structurate* mesh, with good proportions between sides of elements.

Two more meshes are defined, 4x4, and 4x8.

ELEMENT TYPE	MESH1	MESH2	MESH3	DoF_1	DoF_2	DoF_3
3-nodeTriangle	4X4	4X8	8X14	44	84	264
6-node Triangle				156	300	980
4-node quadrilateral				44	84	264
8-node quadrilateral				124	236	756
9-node quadrilateral				156	300	980

The results of stress and displacements for each of the element type are shown for the mesh, as followed:

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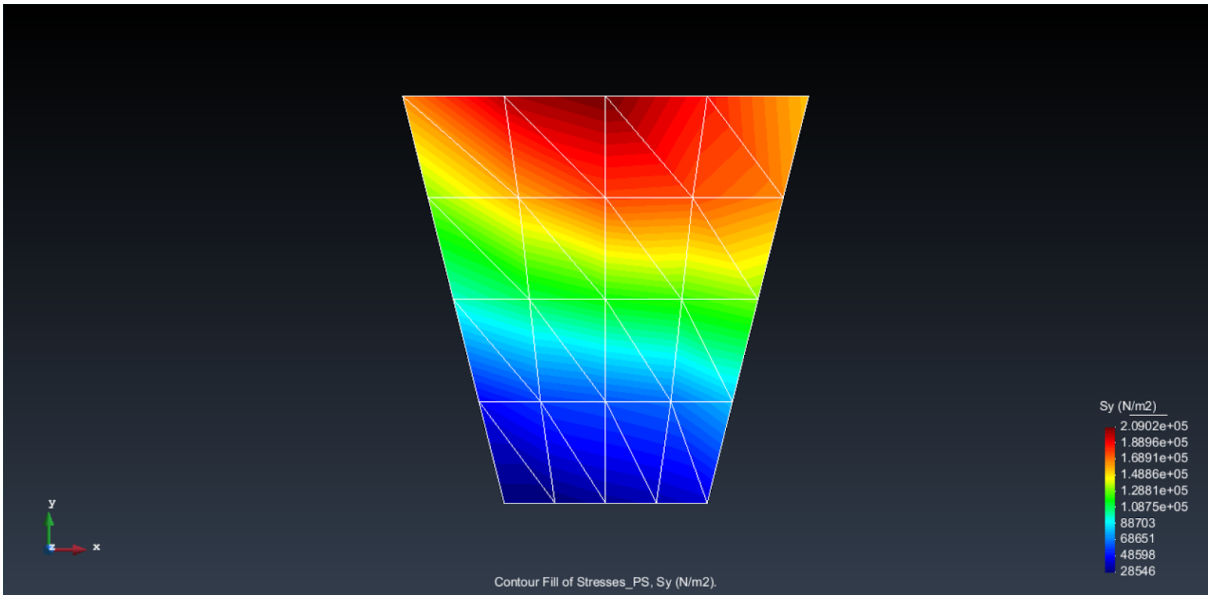
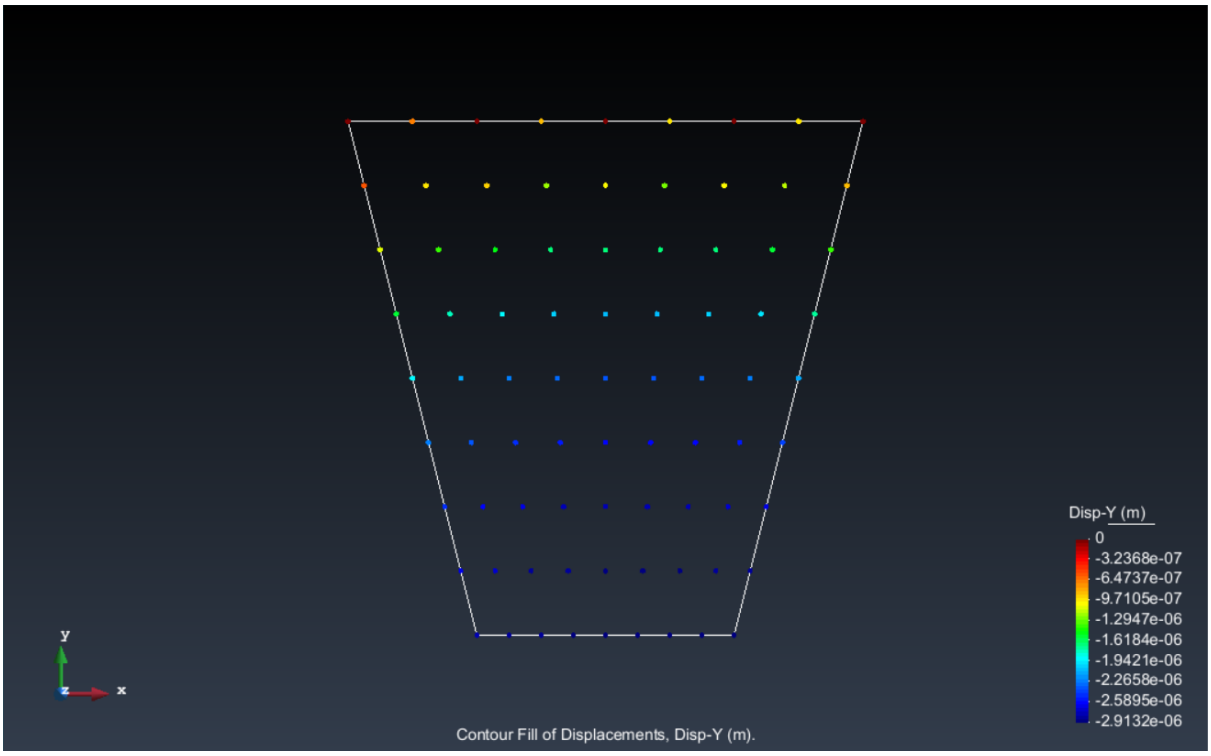
3-NODE TRIANGULAR:



6-NODE TRIANGULAR:



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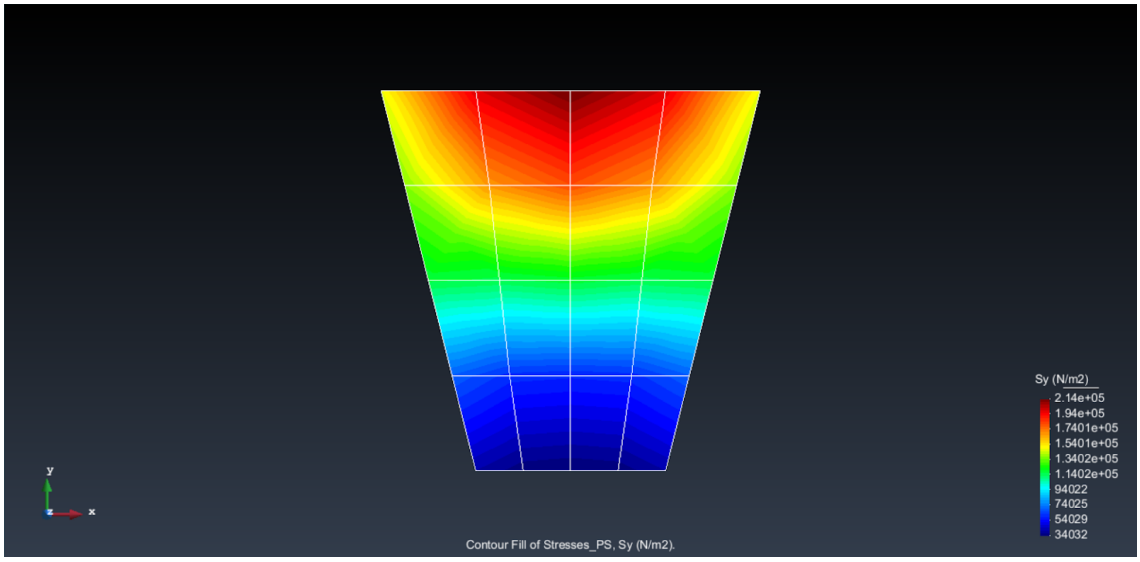
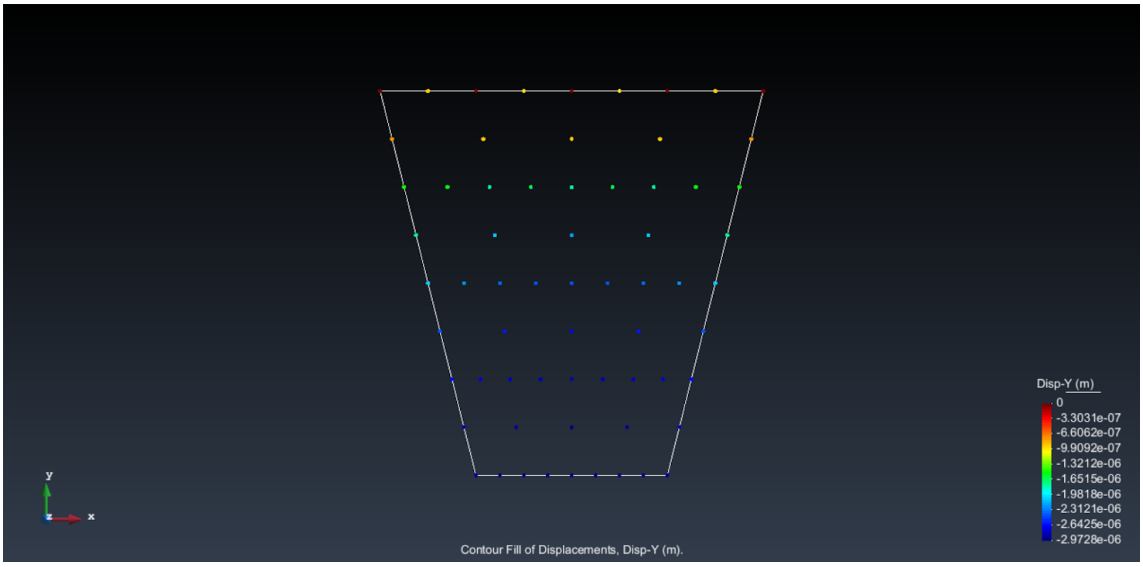
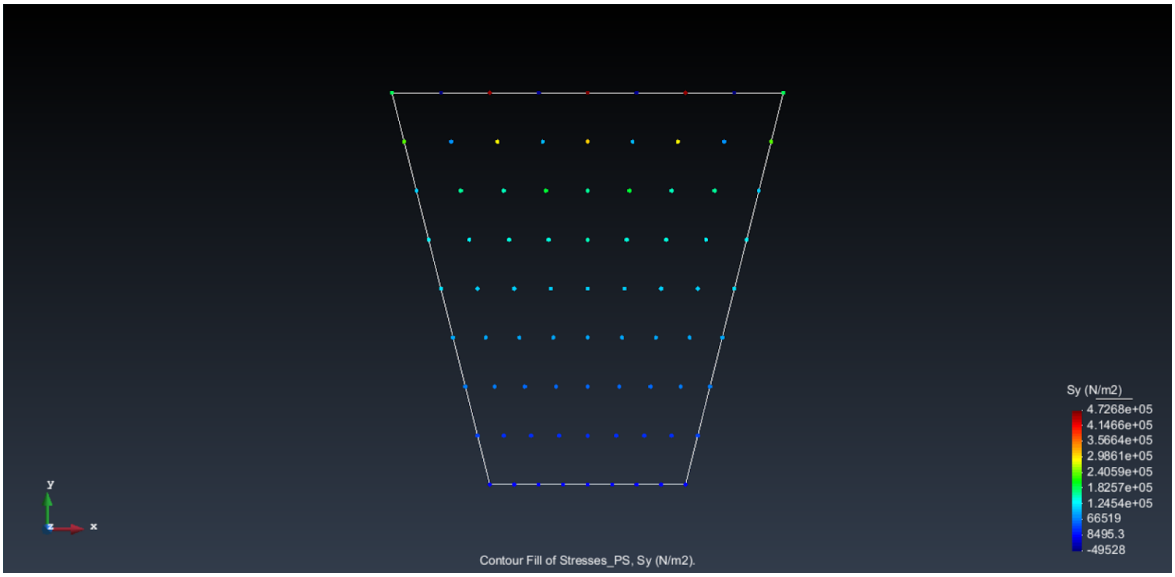
4-NODE QUADRILATERAL:



8-NODE QUADRILATERAL:



9-NODE QUADRILATERAL:



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RESULTS

Comparison is with Exact Solution,
Point B, σ_y=,2,47*10^5 N/m^2
Center of ED SIDE y-displ. =2,26*10^{-6} m

ELEMENT TYPE	σ_y^1 [N/m^2]	σ_y^2 [N/m^2]	σ_y^3 [N/m^2]
3-nodeTriangle	2,09E+05	2,24E+05	3,08E+05
6-node Triangle	2,55E+05	2,63E+05	5,83E+05
4-node quadrilateral	2,14E+05	2,32E+05	4,82E+05
8-node quadrilateral	3,18E+05	4,26E+05	8,85E+05
9-node quadrilateral	4,73E+05	5,94E+05	1,13E+06
ELEMENT TYPE	**δ^1 [m]**	**δ^2 [m]**	**δ^3 [m]**
3-nodeTriangle	2,30E-06	2,29E-06	2,75E-06
6-node Triangle	2,90E-06	3,01E-06	3,56E-06
4-node quadrilateral	2,31E-06	2,30E-06	3,00E-06
8-node quadrilateral	2,97E-06	3,26E-06	3,66E-06
9-node quadrilateral	3,33E-06	3,45E-06	3,84E-06

ELEMENT TYPE	$\varepsilon_\sigma^{MESH1}$ %	$\varepsilon_\sigma^{MESH2}$%	$\varepsilon_\sigma^{MESH3}$ %	$\varepsilon_\delta^{MESH1}$ %	$\varepsilon_\delta^{MESH2}$ %	$\varepsilon_\delta^{MESH3}$ %
3-nodeTriangle	84,62%	90,88%	124,77%	101,83%	101,44%	121,66%
6-node Triangle	103,25%	106,66%	236,16%	128,47%	133,40%	157,45%
4-node quadrilateral	86,64%	94,09%	195,11%	102,20%	101,78%	132,72%
8-node quadrilateral	128,85%	172,52%	358,48%	131,54%	144,06%	162,09%
9-node quadrilateral	191,37%	240,48%	459,03%	147,28%	152,73%	170,09%