PRACTICE 3 Exercise 1

COMPUTATIONAL STRUCTURAL MECHANICS AND DYNAMICS

Marcos Boniquet Aparicio

It’s chosen a problem type: *Plates*

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=3*10*^{10} *Pa*
ν*=0,2*
*Load: q=1*10*^{4} *N/m*^{2}
thickness=0,10 m

θ_x and θ_y are 0 at clamped boundary, as well as z-displacement.

Remember:
Kirchoff
1)Middle plane moves only vertically.
2)Points along a normal to the middle plane have same vertical displacement.
3)σ_z is negligible
4)Points along the normals to the middle plane before deformation remain in straight lines also orthogonal to middle plane after deformation.

Reissner-Middlin
Same points, but assumption 4 changes:
4)Points along the normals to the middle plane before deformation remain in straight lines **NOT NECESSARILY** orthogonal to middle plane after deformation.

GID:
- Linear triangle is DKT triangular
- Quadratic triangle element is R.M
- Linear Quadrilateral element is CLLL

PRACTICE 3 Exercise 1

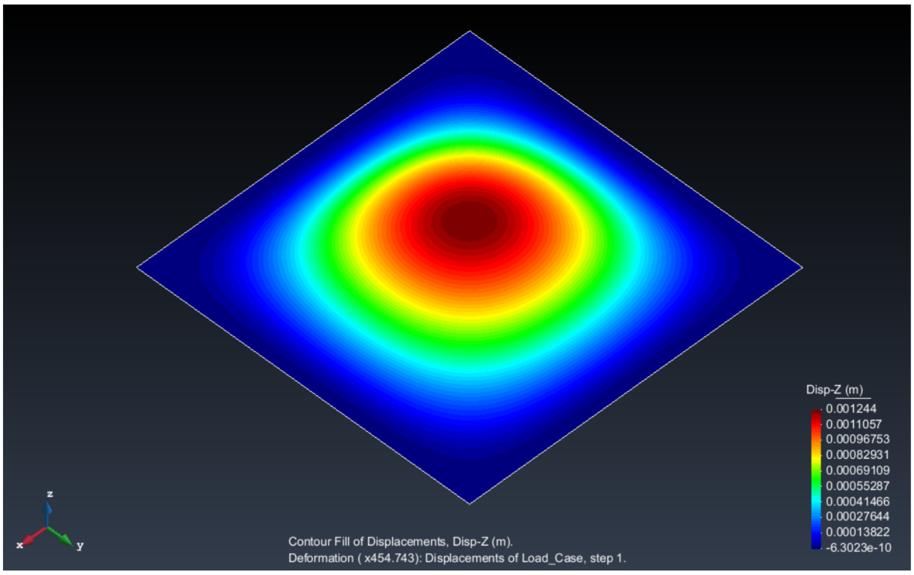
COMPUTATIONAL STRUCTURAL MECHANICS AND DYNAMICS

Marcos Boniquet Aparicio

Triangular linear mesh of 150x150 elements:

Num. of Triangle elements=45000

Num. of nodes=22801



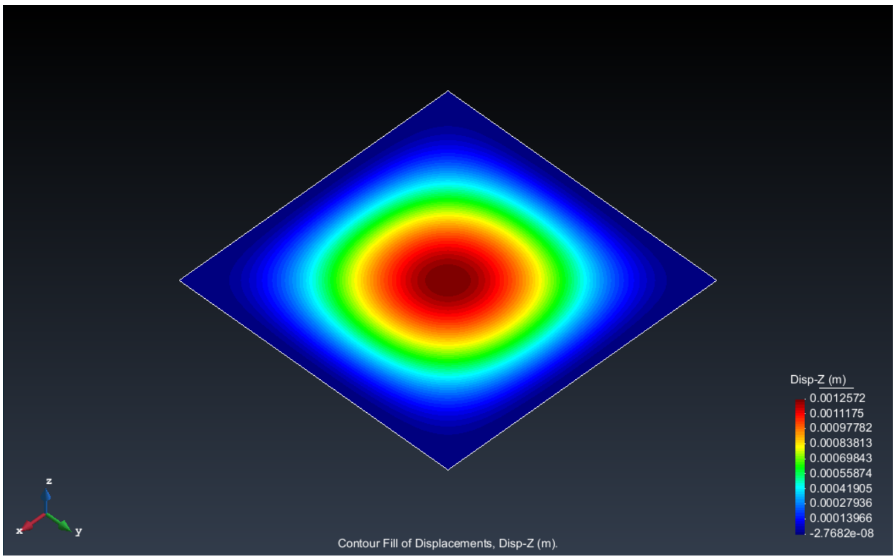
Max. displacement is 1,244mm.

A symmetry with the diagonals (it could be divided in 4 triangular and equal domains) was expected with a linear material behaviour.

With a triangular quadratic mesh, 40x40 elements:

Num. of Triangle elements=3200

Num. of nodes=6561



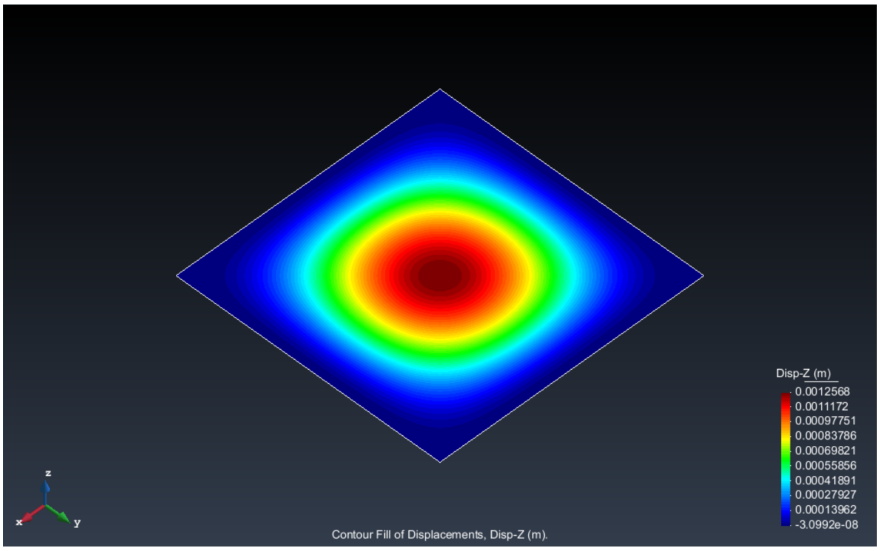
Max. displacement is 1,2572mm.

COMPUTATIONAL STRUCTURAL MECHANICS AND DYNAMICS

Marcos Boniquet Aparicio

With a quadrilateral linear mesh, of 100x100 elements:

Num. of Quadrilateral elements=10000
Num. of nodes=10201



Max. displacement is 1,2568mm.

<u>Analytic result:</u>
$D=E*t^3/12(1-\nu^2)$
$W_{max}=q*b^4/24*D=0,0128$ where b=2, half of the side of plate.

So, comparison between 3 methods and Analytical result:

Linear Triangular	**Quadratic Triangular**	**Linear Quadrilateral**	**Analytic**
1,244	1,2572	1,2568	1,28
97,19%	**98,22%**	**98,19%**	

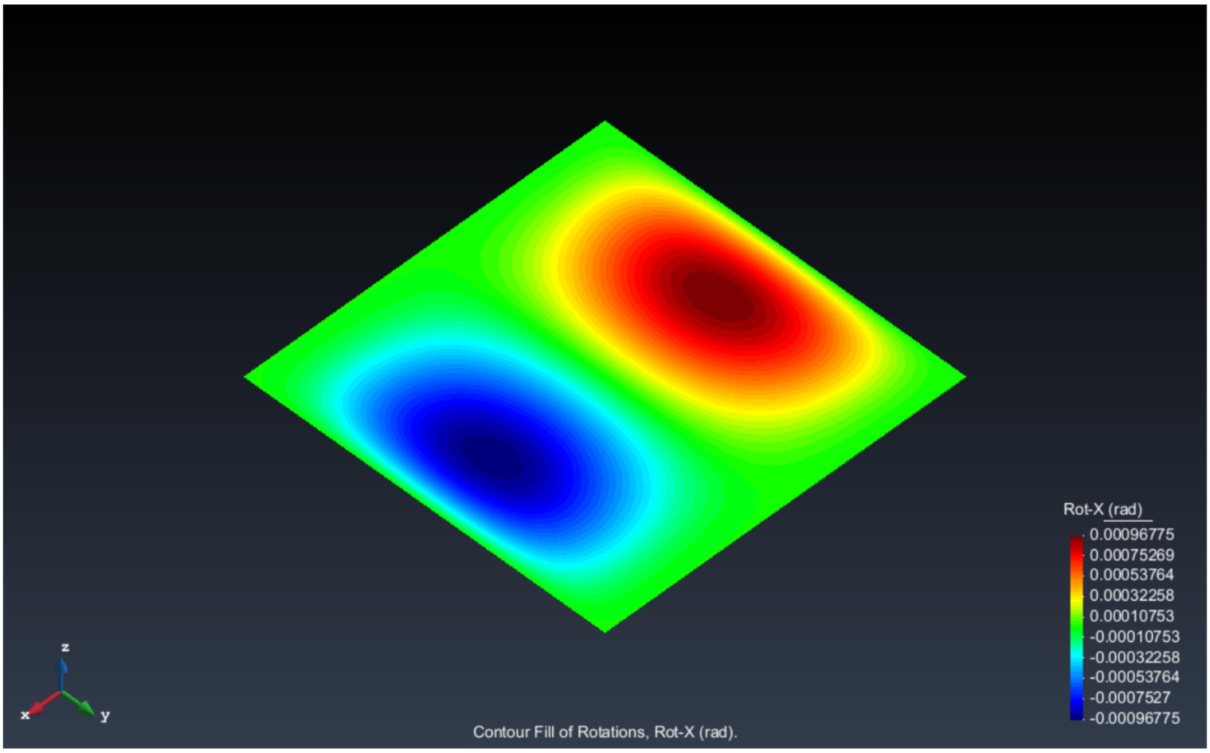
PRACTICE 3 Exercise 1

COMPUTATIONAL STRUCTURAL MECHANICS AND DYNAMICS

Marcos Boniquet Aparicio

Rotations:

x-axis



y-axis