Computational Structural Mechanics and Dynamics

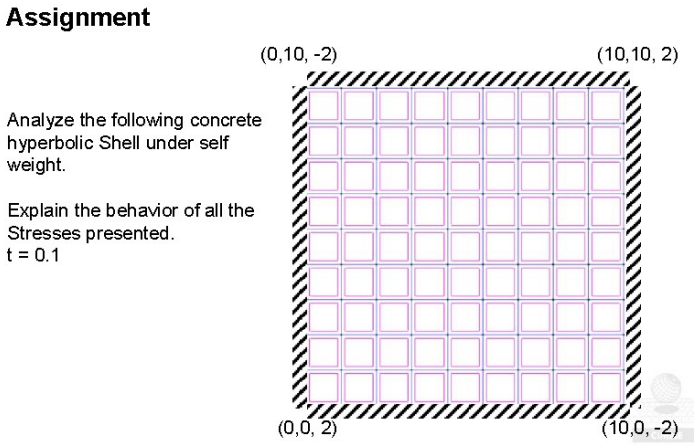
Shells HomeWork

GiD + MATLab

Adnan Ali Imran

MS-Computational Mechanics

Assignment (Problem Data-a1)



Answer

In GiD the geometry is created, with all edges of the shell are constrained and meshed with triangular3 node elements. Self weight is active for this problem. FE model can be seen in figure below.

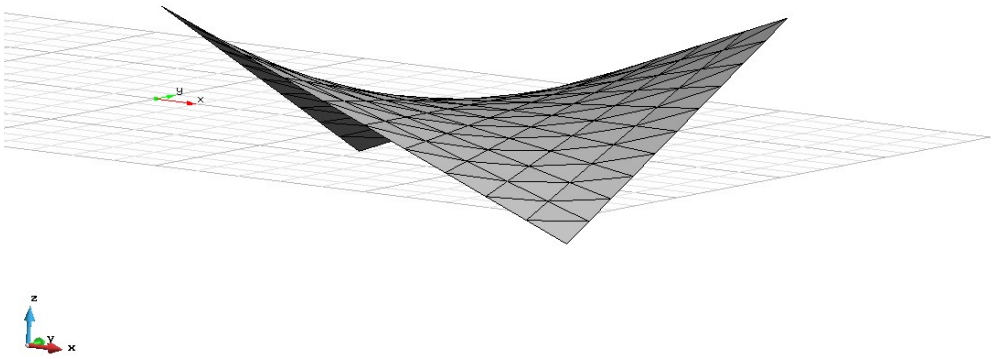


Figure-1 Shell with 3 node Triangular Elements

Simulation Results

The simulation results are presented below.

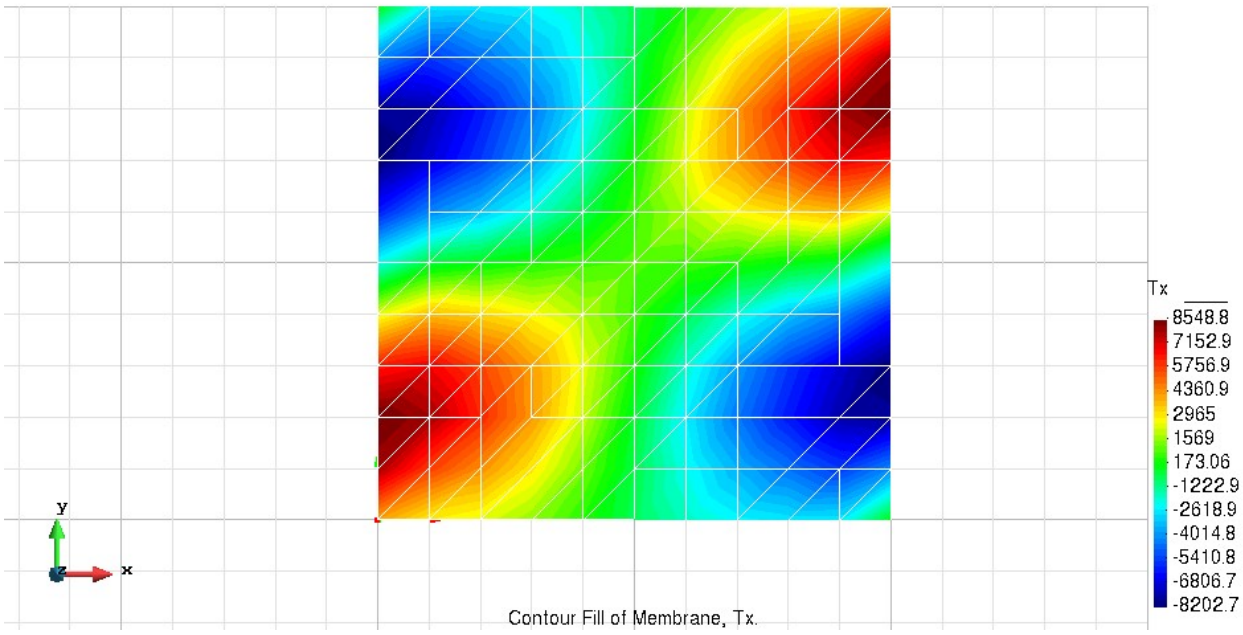


Figure-2 In plan Membrane stress T_x in X direction

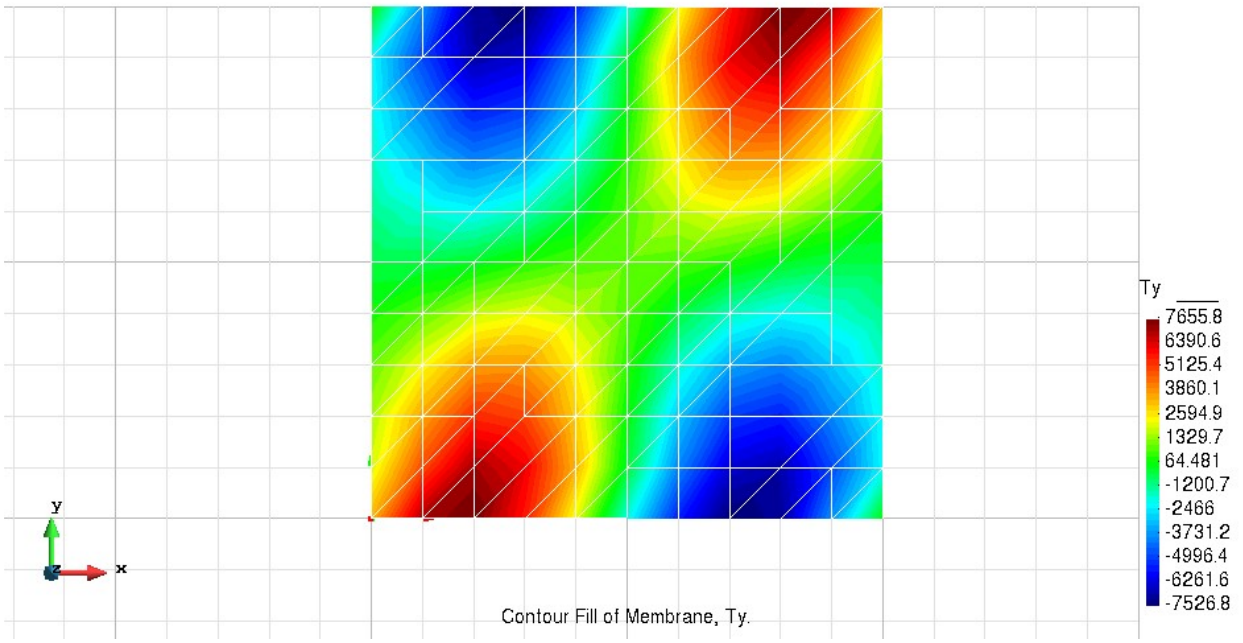


Figure-3 In plan Membrane stress T_y in Y direction

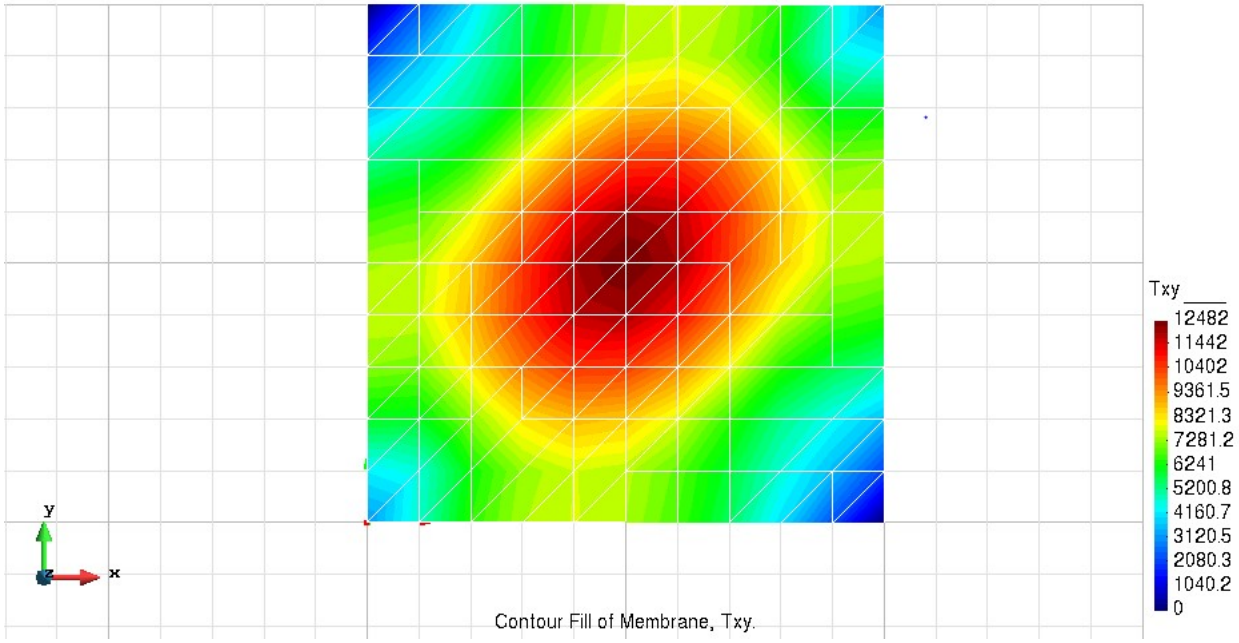


Figure-4 In plan Membrane stress T_{xy} in X-Y plan

In X and Y direction, membrane stress values are high at corners due to hyperbolic shape of shell and also of the in plan directional stress. While in case of T_{xy} X-Y plan, the maximum value of membrane stress is at centre of shell due to self weight acting dominantly in the middle area.

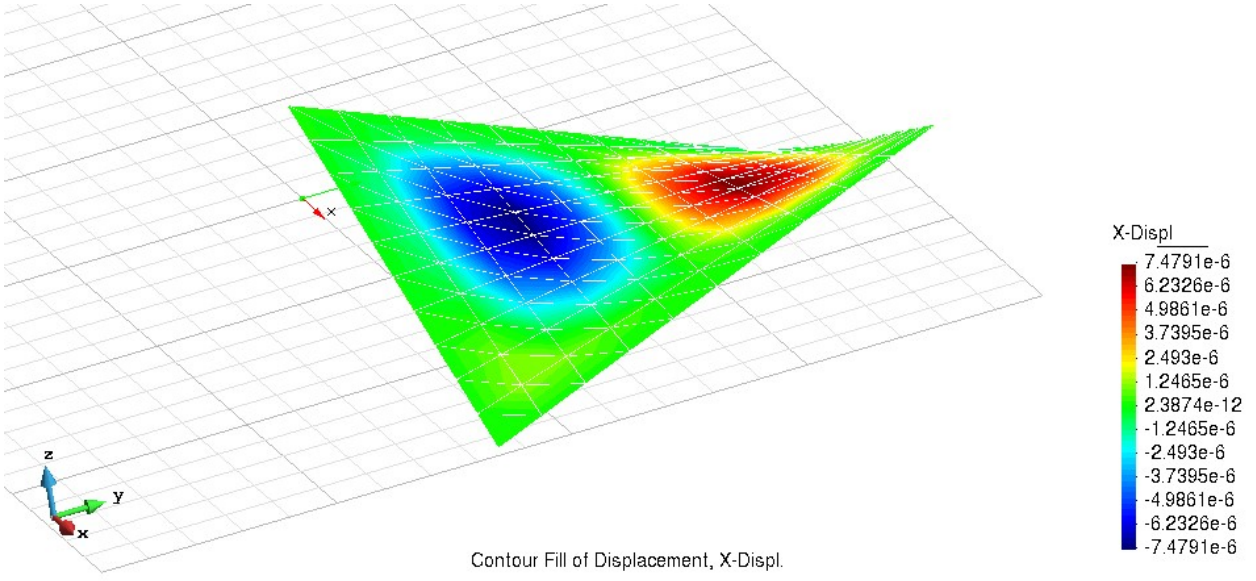


Figure-5 Displacement in X Direction

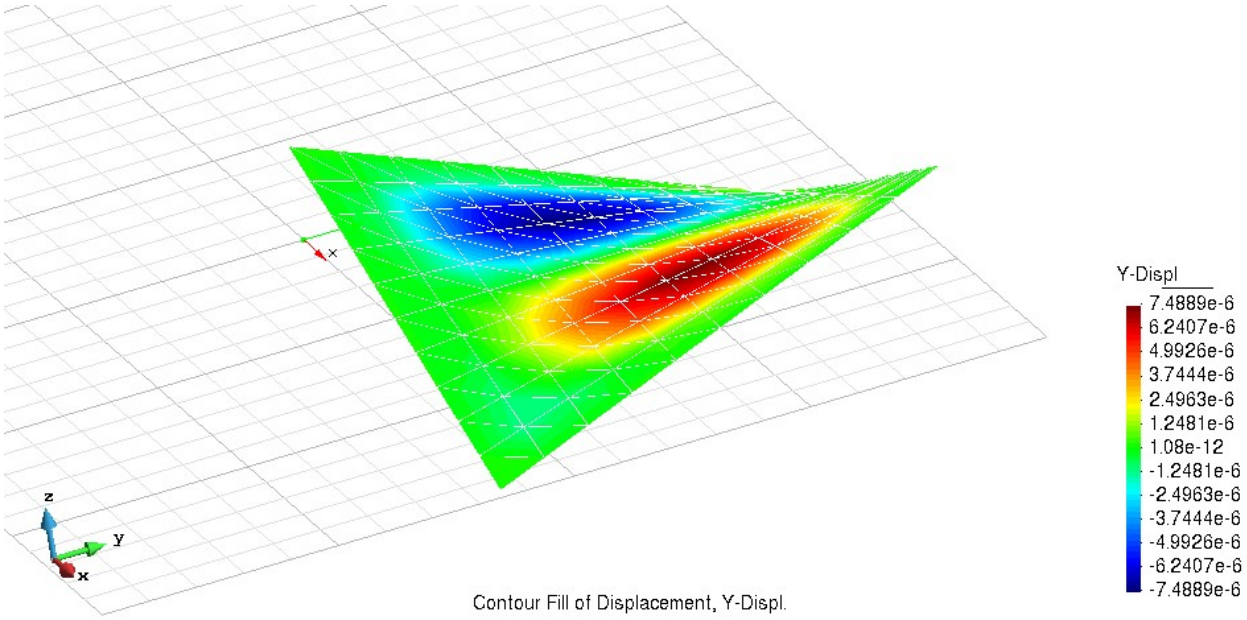


Figure-6 Displacement in Y Direction

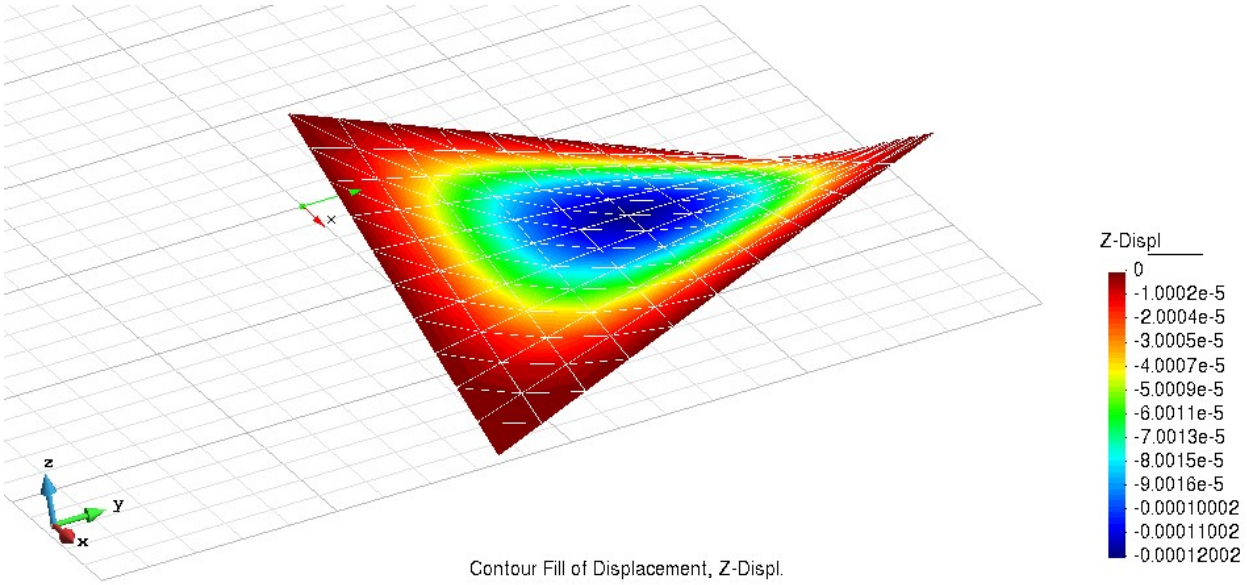


Figure-7 Displacement in Z Direction

In X & Y direction the displacement due to self weight is almost negligible at boundaries and that is oblivious due to edge constraints. While in case of (both in plan directions) X & Y directions the displacement is relatively very small in the middle of shell, when compared with the displacement in case of out of plan direction. There is a significant value of displacement at centre in Z direction and that is due to self weight effect which is always acting in centre.

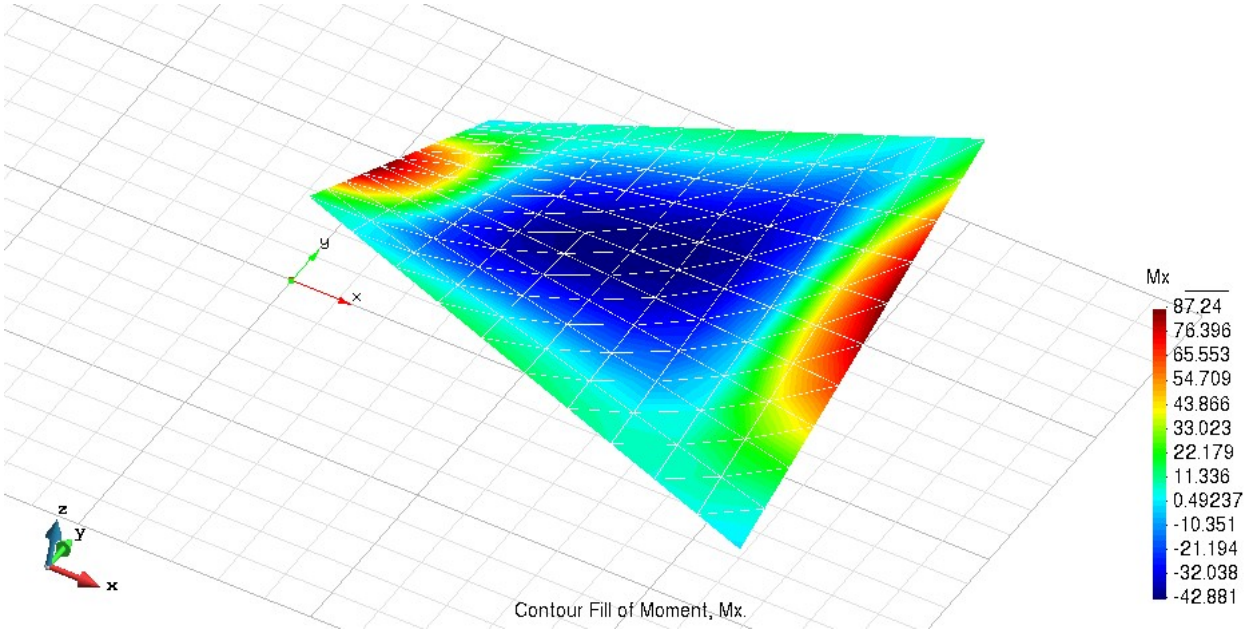


Figure-8 Moment M_x in X plan

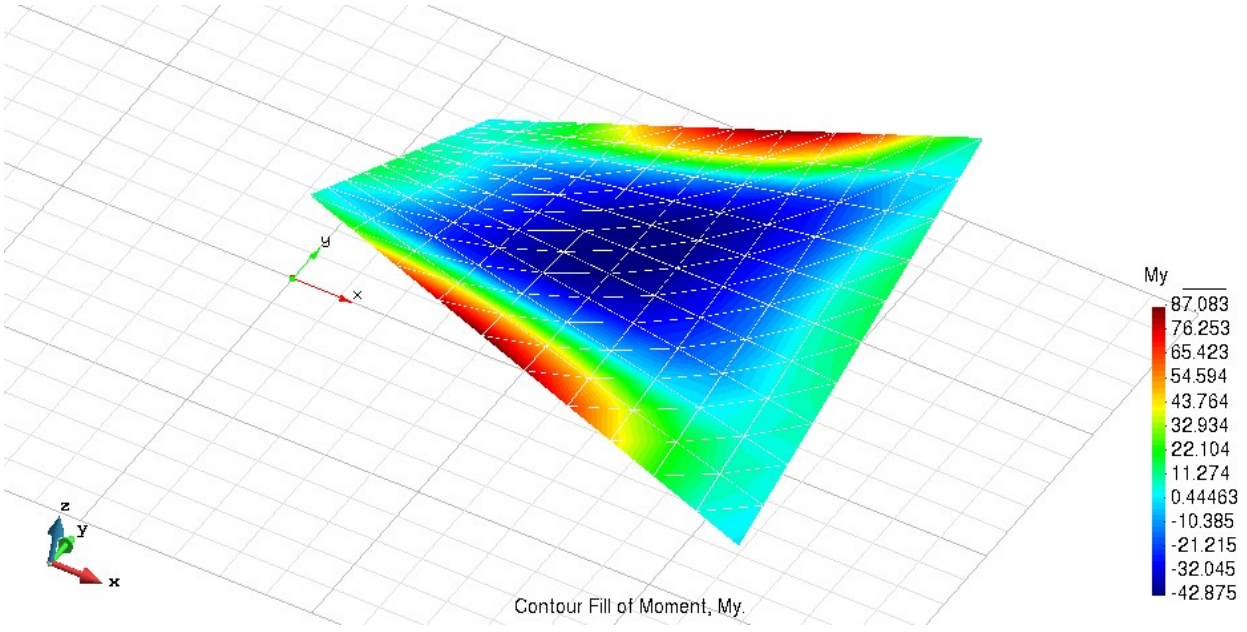


Figure-9 Moment M_y in Y plan

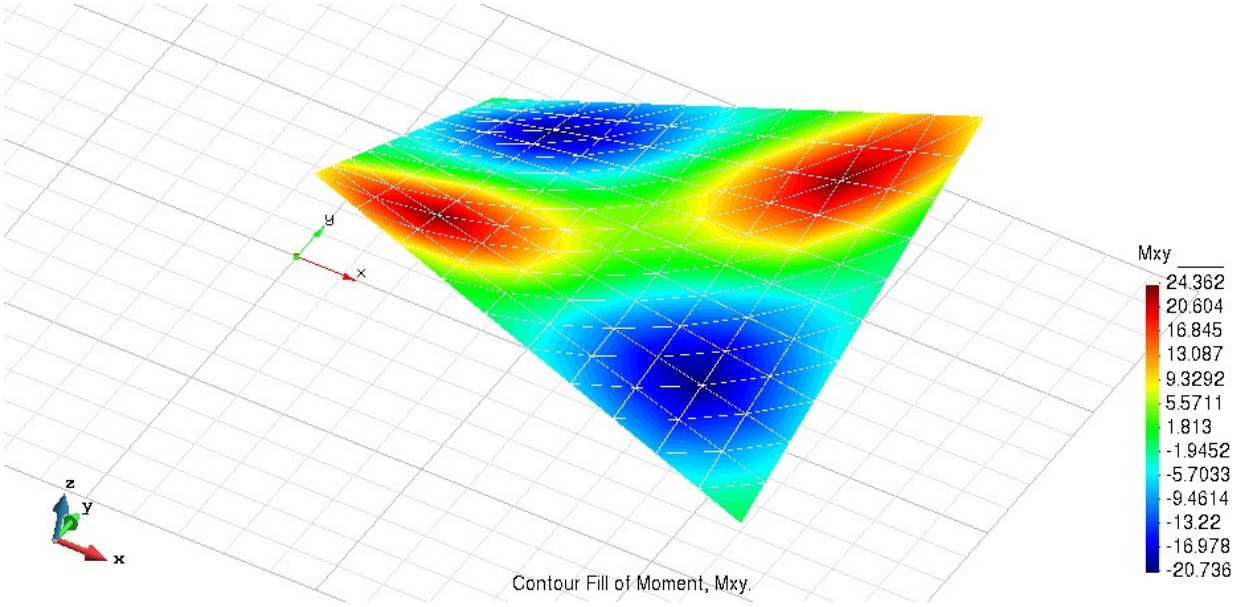


Figure-10 Moment M_{xy} in X-Y plan

It can be seen that moment M_x & M_y have higher values at boundaries because of the fact that weight is acting at centre and moment arm have maximum value when point is at the edge of shell. And it is directional dependent, means in M_x have higher value in x direction and same for M_y. While M_{xy} has more value at the edges in both directions than the response in the middle.

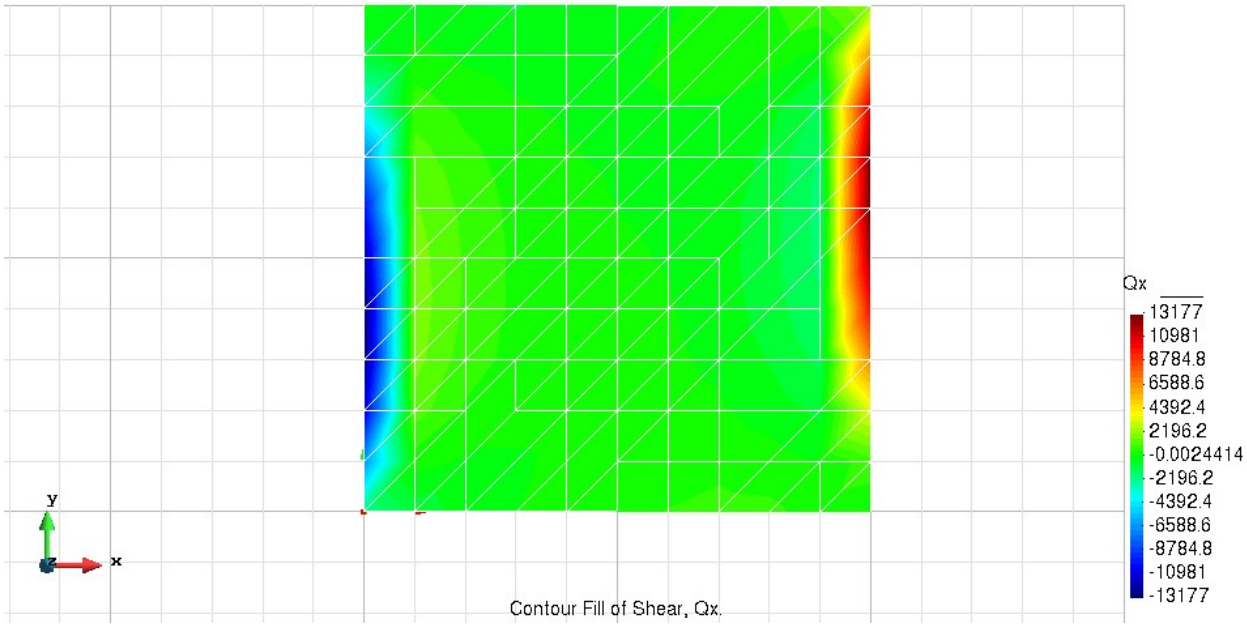


Figure-12 Shear Stress Q_x in X direction

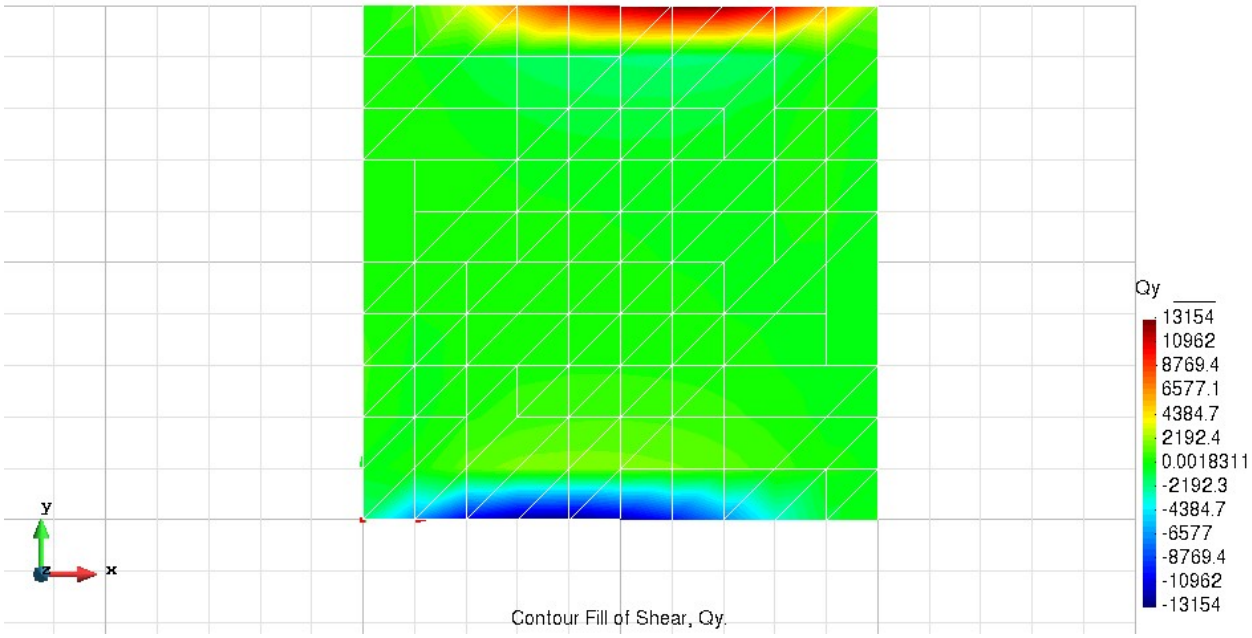


Figure-12 Shear Stress Q_y in Y direction

It can be observed that Qx shear stress have maximum (almost same to each other) value at the opposite corners in x direction and same is the case with Qy. This is due to geometry of the shell, the weight is acting in the centre and shear stresses act like symmetry about central axis.

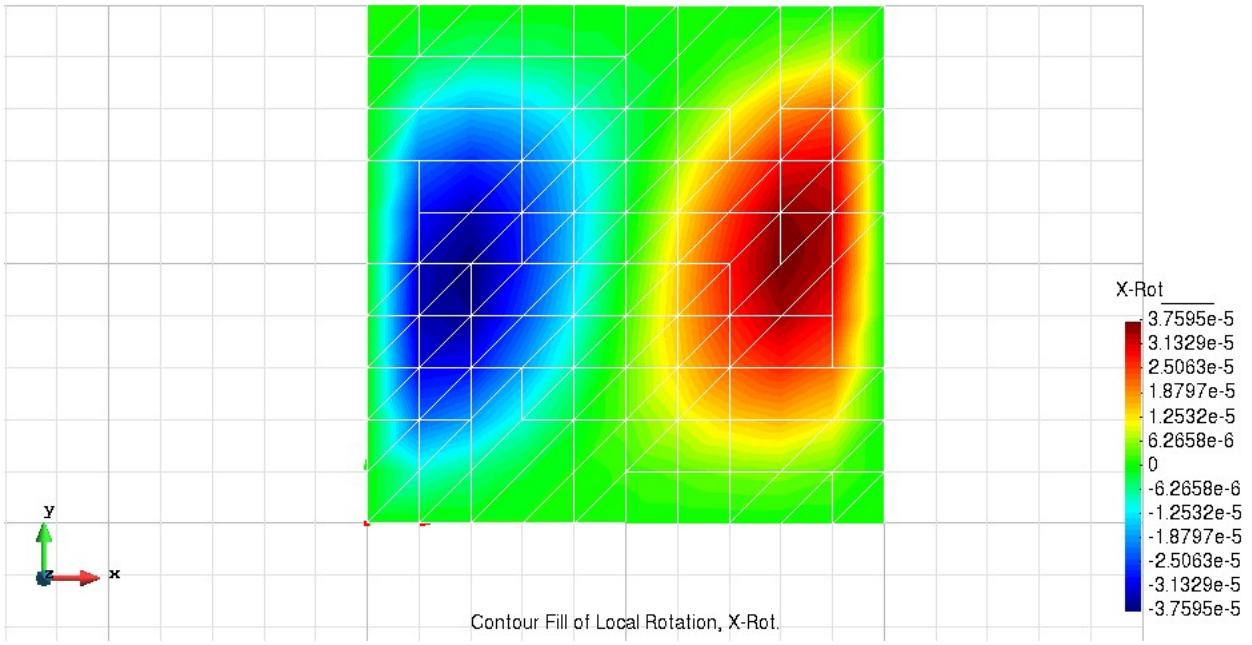


Figure-13 Local rotation about X axis

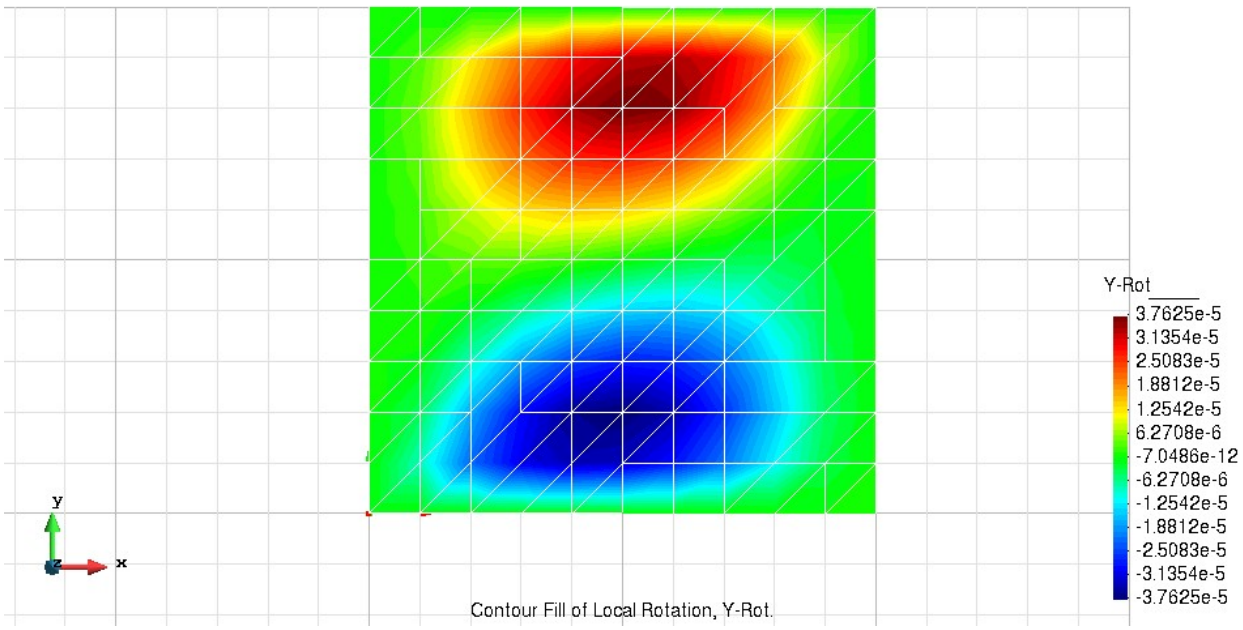


Figure-14 Local rotation about Y axis

It is quite oblivious to see that middle area and edges have almost zero rotation in both directions while the region between the centre and edge of other axis have local rotation and it is symmetric about central axis this is again due to geometry of the problem.