Shells Assignment

Hanna, John

Shell analysis is used to analyze 3 dimensional problems where objects have very small thickness. The elements are based on the plate theory but live in a 3 dimensional space. In this assignment, a concrete hyperbolic shell with thickness of 0.1 and under self weight is analyzed. The shell is clamped from all its sides. Linear Triangular RM elements are being used for the analysis.

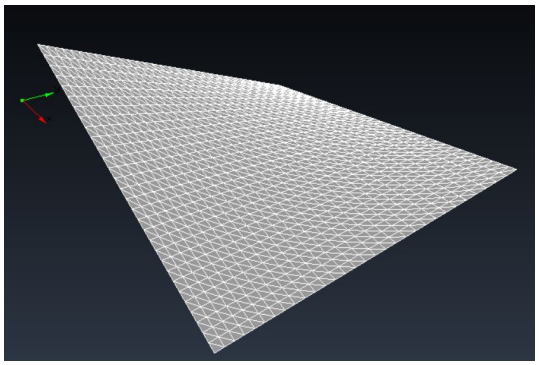

Figure 1: Original Shape

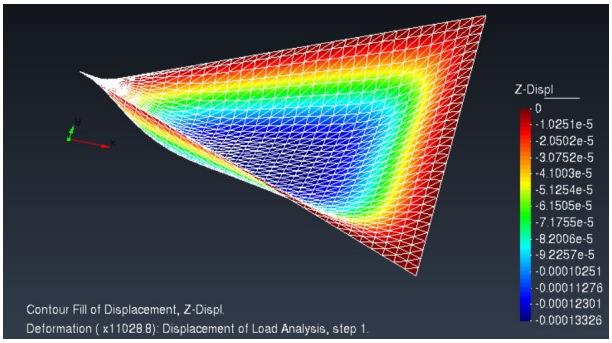

Figure 2: Deformed shape with z-displacement

The above figures shows the original shape and the deformed one with z-displacement. As expected, the maximum displacement is at the center of the shell and is reduced as we go towards the clamped sides where the displacement is zero.

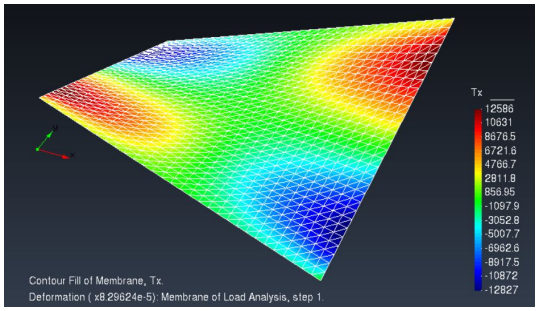

Figure 3: x-membrane

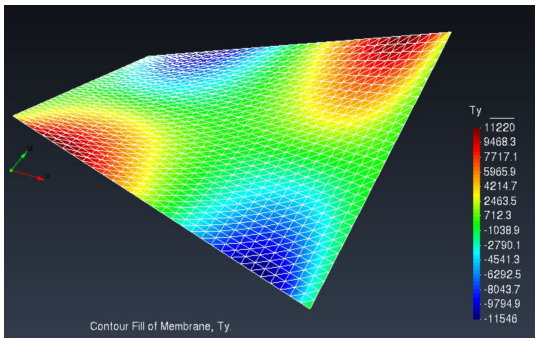

Figure 4: y-membrane

For the x-membrane, the positive and negative maximums occur on the sides parallel to the y-axis. While in the y-membrane, they occur along the sides parallel to the x-axis. The symmetry in the results are due to the geometry of the shell and the uniform self weight.

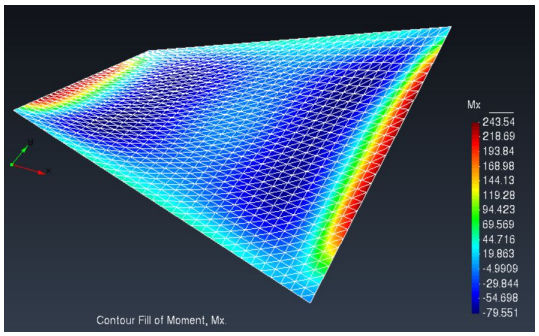

Figure 5: x-moment

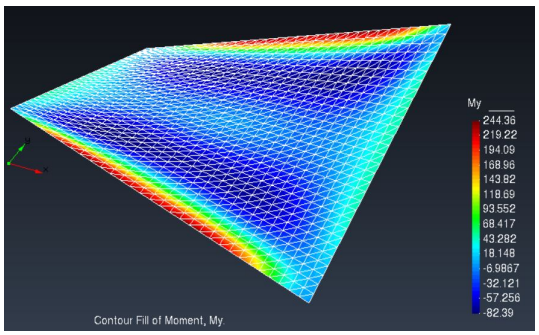

Figure 6: y-moment

The x-moment vary along the x-direction having a positive maximum at the end sides followed by negative maximums and in the middle another positive maximum is there by with lower magnitude than the ones at the ends. Similar variation occurs for y-moment but along the y-direction.

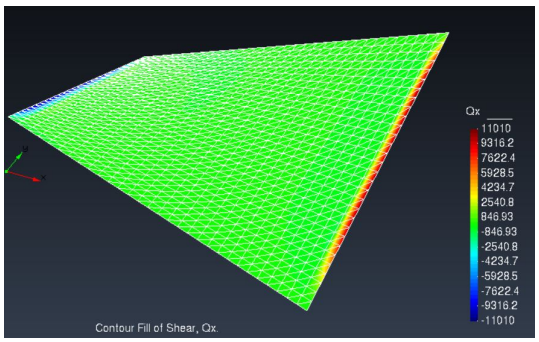

Figure 7: x-shear

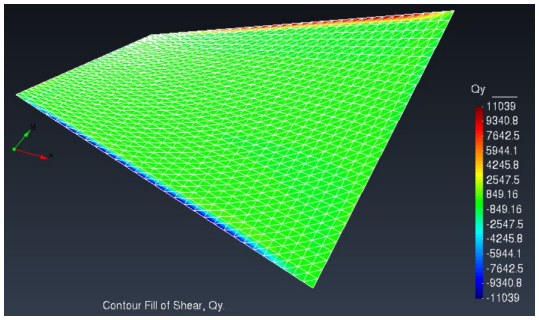

Figure 8: y-shear

As expected, the shear in the x-direction vary from a positive maximum in one side to a minimum on the other side and is zero along the mid surface parallel to the y-axis. Same behaviour is obtained for the shear in the y-direction due to the symmetry of the problem.