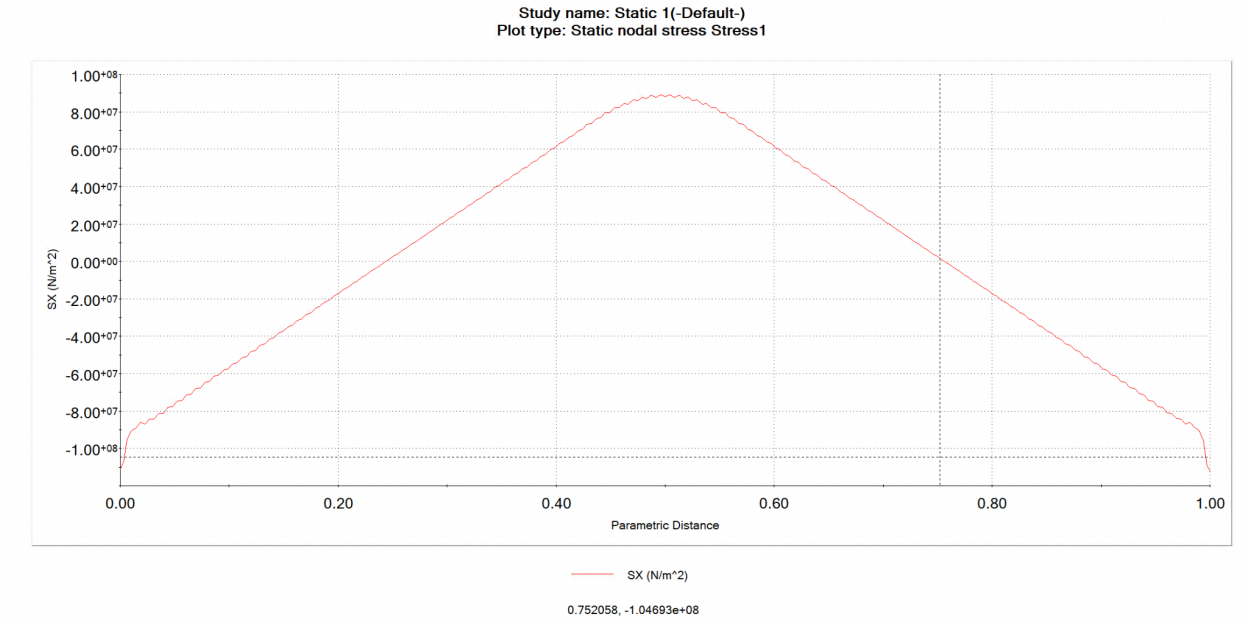
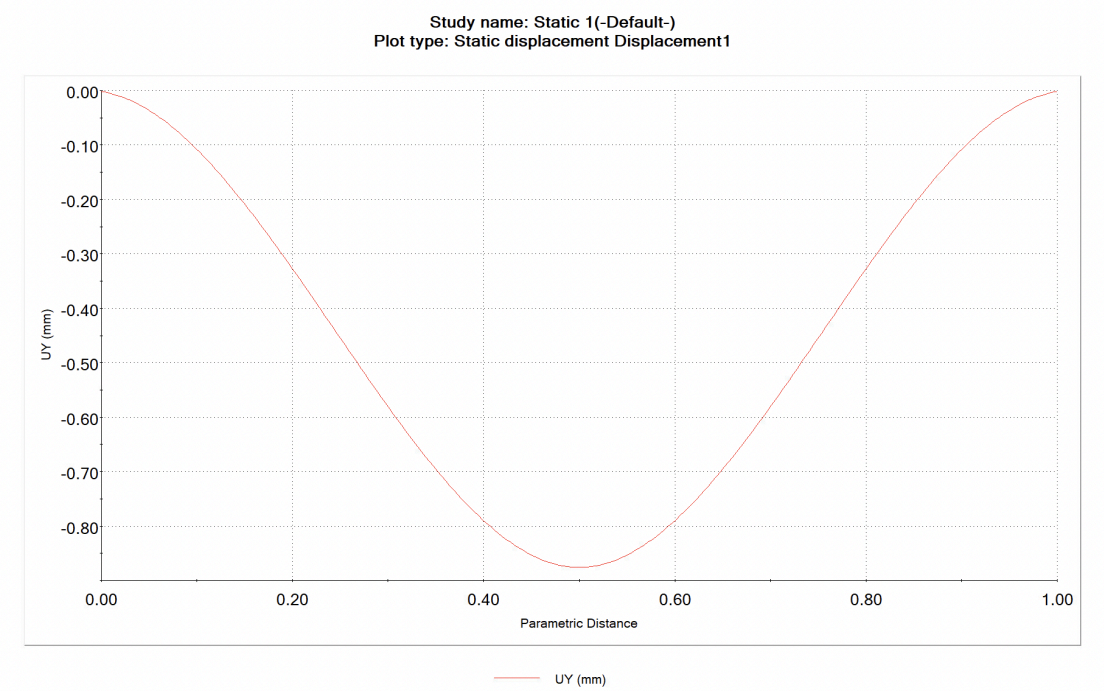
LAB: Modeling a Pull-Up Bar in FEA

Deliverable 1 - Plot of Normal Stress in the X Direction (SX): Full Bar
The graph above shows the relationship between normal stress in the parametric distance



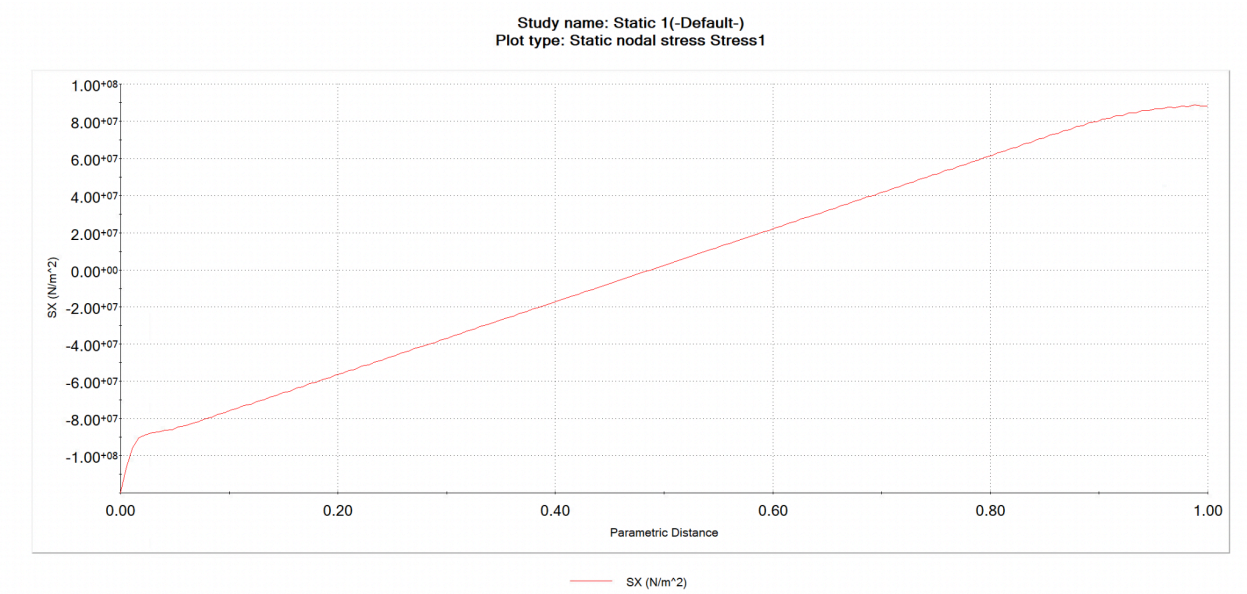
(x-axis) vs x-direction (y-axis) generated by a probe along the split line running along the entire bottom of the bar. The graph shows that in the middle of bar, at a parametric distance of approximately .49, the bar experiences a maximum tensile normal stress of 8.9e+7 N/m^2. This is important because it shows where the locus of stress is experienced along the bar when force is applied to the top middle. This part of the bar has to withstand the maximum impact of the load.

Deliverable 2 - Plot of Displacement in the Y Direction (UY): Full Bar



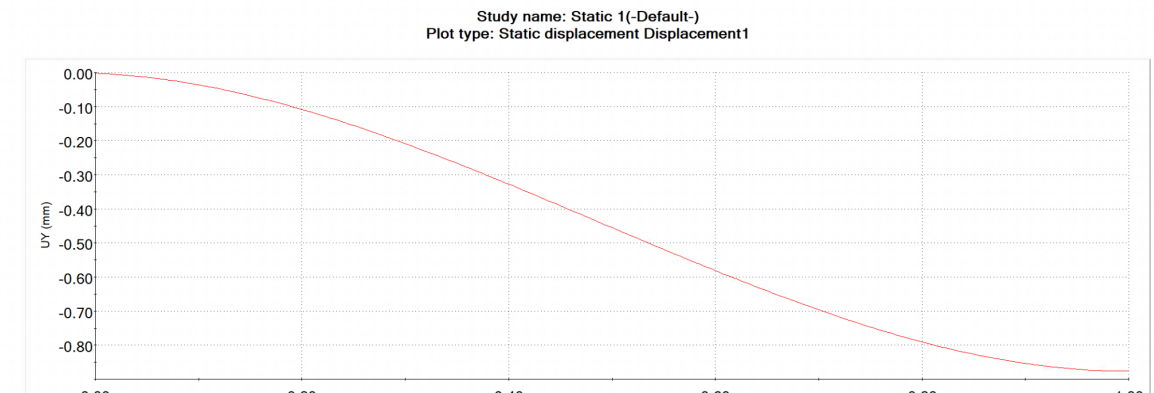
The graph above shows the relationship between parametric distance (x-axis) displacement in the y-direction (mm, y-axis) generated by a probe along the split line running along the entire bottom of the bar. The graph shows a peak displacement of .875 mm (magnitude) at a parametric distance of .5. This is important because it illustrates that there is the most deformation in the middle of the bar, indicating a positive moment.

Deliverable 3 - Plot of Normal Stress in the X Direction (SX): Half-Bar



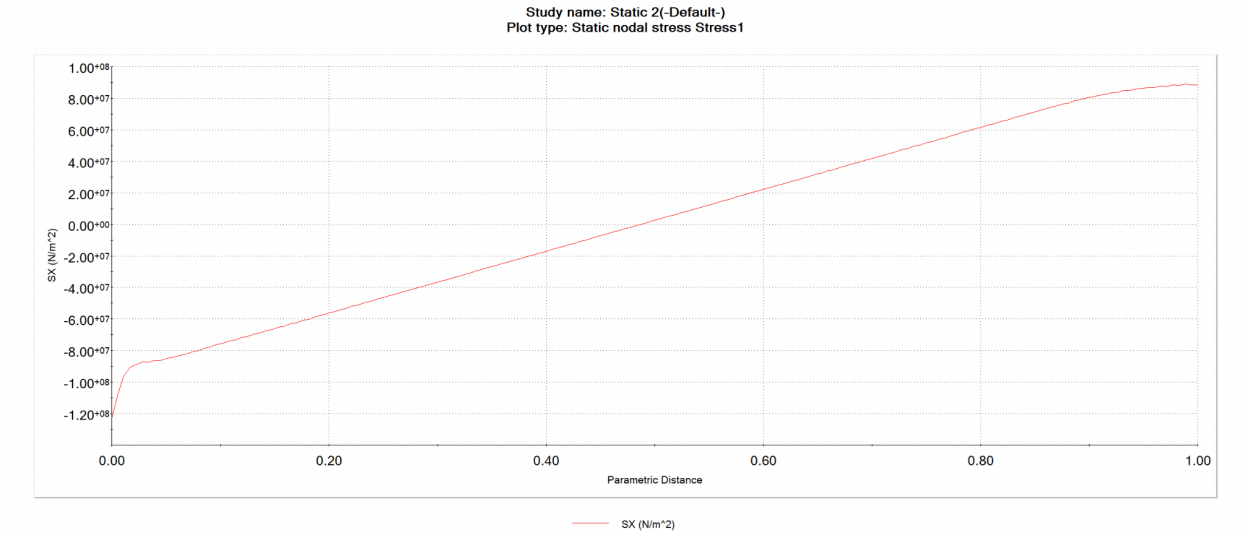
The graph above shows the relationship between normal stress in the parametric distance (x-axis) vs x-direction (y-axis) generated by a probe along the split line running along the entire bottom of the half bar. The graph shows that in the middle of bar, at a parametric distance of approximately .987, the bar experiences a maximum tensile normal stress of 8.9e+7 N/m^2. This value is the same as reported in deliverable 1, however at a parametric distance of double .49 because only half the bar is being analyzed. Again, these results demonstrate that at the middle of the bar (where the symmetry fixture is applied to specify), the bar has to withstand a maximum impact of the load.

Deliverable 4 - Plot of Displacement in the Y Direction (UY): Half-Bar



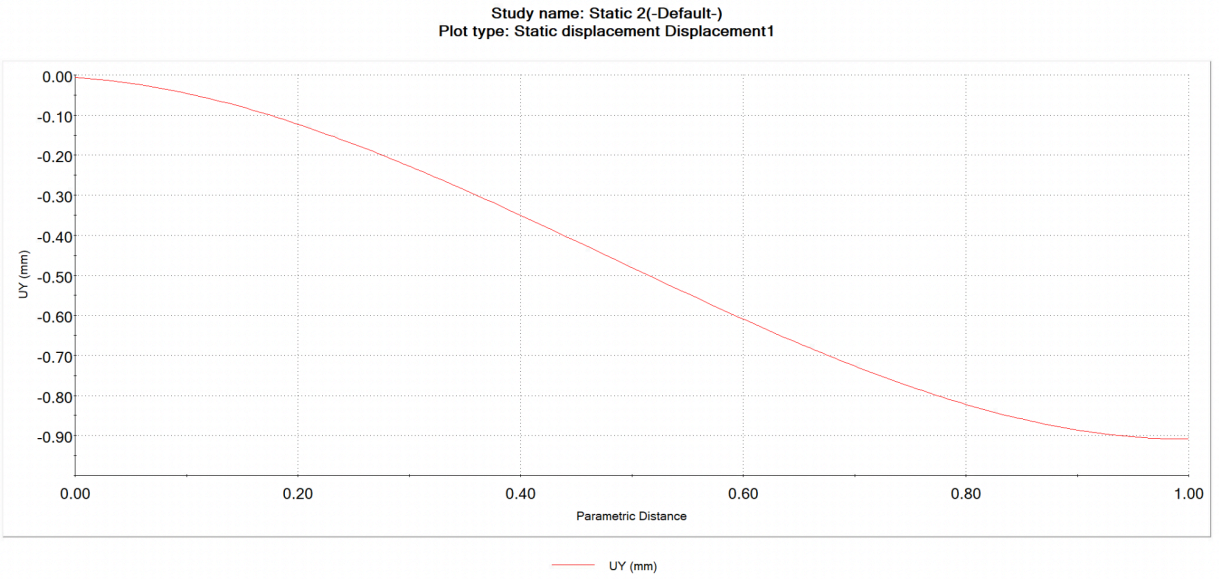
The graph above shows the relationship between parametric distance (x-axis) displacement in the y-direction (mm, y-axis) generated by a probe along the split line running along the entire bottom of the half bar. The graph shows a peak displacement of .8757 mm (magnitude) at a parametric distance of 1.00. Compared to deliverable 2, the peak displacement is approximately the same (with an additional significant figure), however occurs at a displacement approximately double of that in deliverable 2. These results make sense as half the bar was analyzed and again demonstrate that there is the most deformation where the load is applied.

Deliverable 5 - Plot of Normal Stress in the X Direction (SX): Half-Bar with Foundation Bolt



The graph above shows the relationship between normal stress in the parametric distance (x-axis) vs x-direction (y-axis) generated by a probe along the split line running along the entire bottom of the half bar. The graph shows that in the middle of bar, at a parametric distance of approximately .988898, the bar experiences a maximum tensile normal stress of 8.92751e+07 N/m^2. This value is the same as reported in deliverables 1 and 3, and has a similar parametric distance measure to deliverable 3, for the same reasons as explained in deliverable 3. The graph overall looks very similar to that in deliverable 3. Again, these results demonstrate that at the middle of the bar (where the symmetry fixture is applied to specify), the bar has to withstand a maximum impact of the load. The values calculated by this study may be more accurate to the theoretical values calculated by hand (at a .001 or smaller metric) because of the improved fixture and connection features in the FEA study.

Deliverable 6 - Plot of Displacement in the Y Direction (UY): Half-Bar with Foundation Bolt



The graph above shows the relationship between parametric distance (x-axis) displacement in the y-direction (mm, y-axis) generated by a probe along the split line running along the entire bottom of the half bar. The graph shows a peak displacement of .906743 mm (magnitude) at a parametric distance of .998458. The increase in displacement is significant and demonstrates an increase in the effect of the force when the FEA study is run with a foundation bolt.