MAE-94 Lab Assignment – 6A

Simulation

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P1: Crankshaft

(a) According to the video from SolidProfessor, we can see that the applied force on the crankshaft should be pointing upward, thus the correct applied force is shown below:

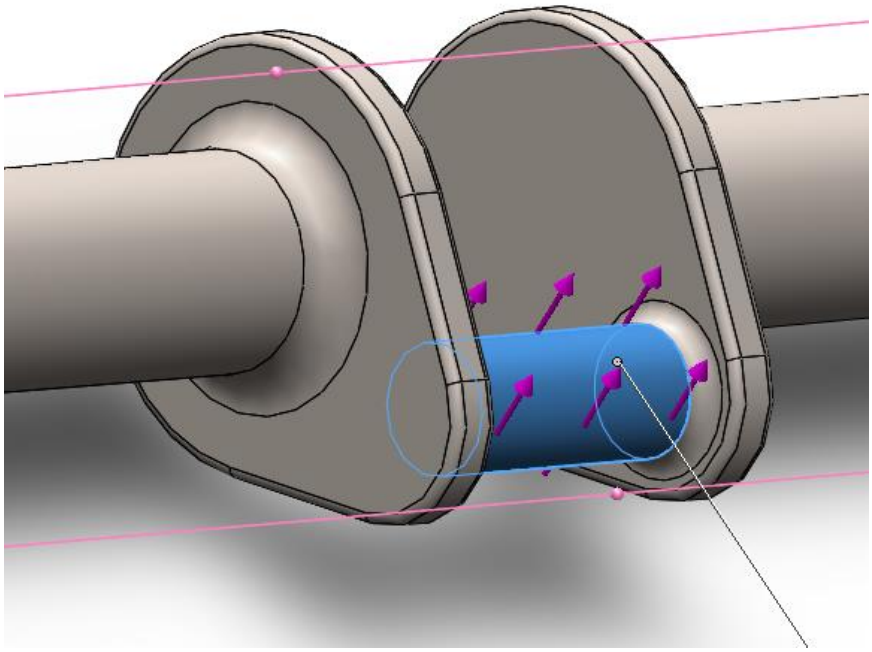

Figure 1. Correct Applied Force on the Crankshaft

(b) According to the simulation, the two handles and the cylindrical face in the middle are the areas that do not satisfy a FOS of 4, thus the two handles are thickened to have a 1 inch diameter and the cylindrical face are thickened to have a 0.8 inch diameter. Now the part satisfies a FOS of 4. The isometric view is shown below, also a figure of the modified crankshaft showing that it satisfies a FOS of 4 is also shown below.

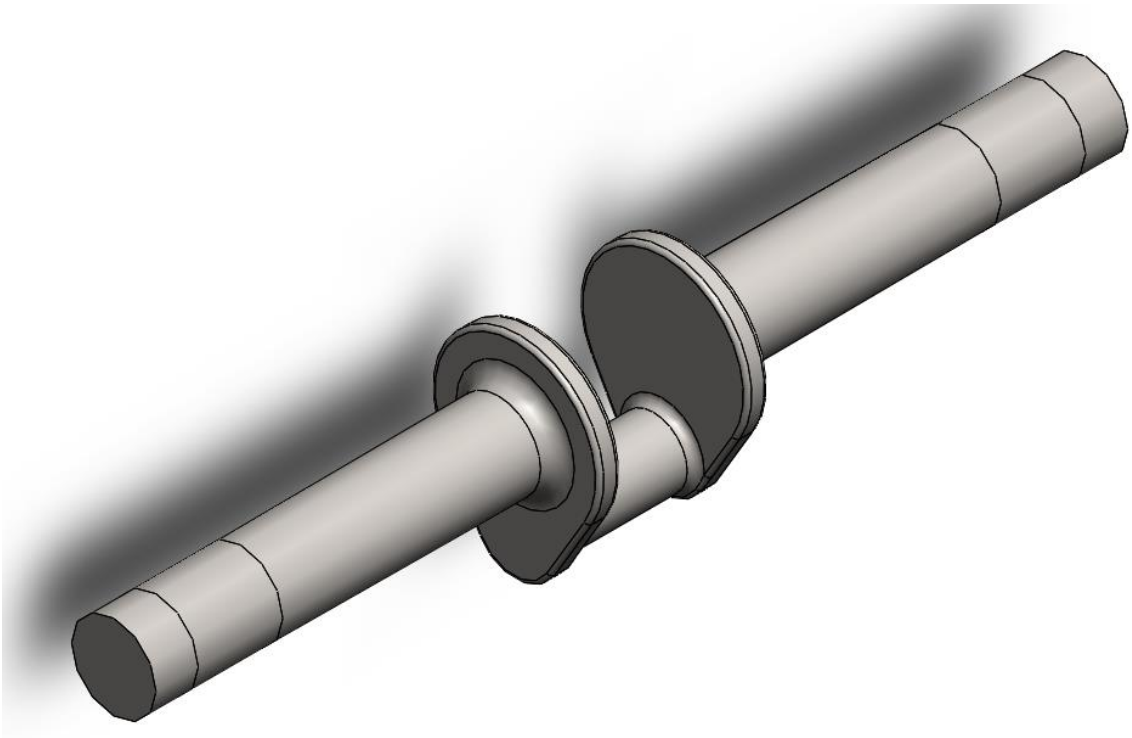

Figure 2. The isometric view of the modified crankshaft

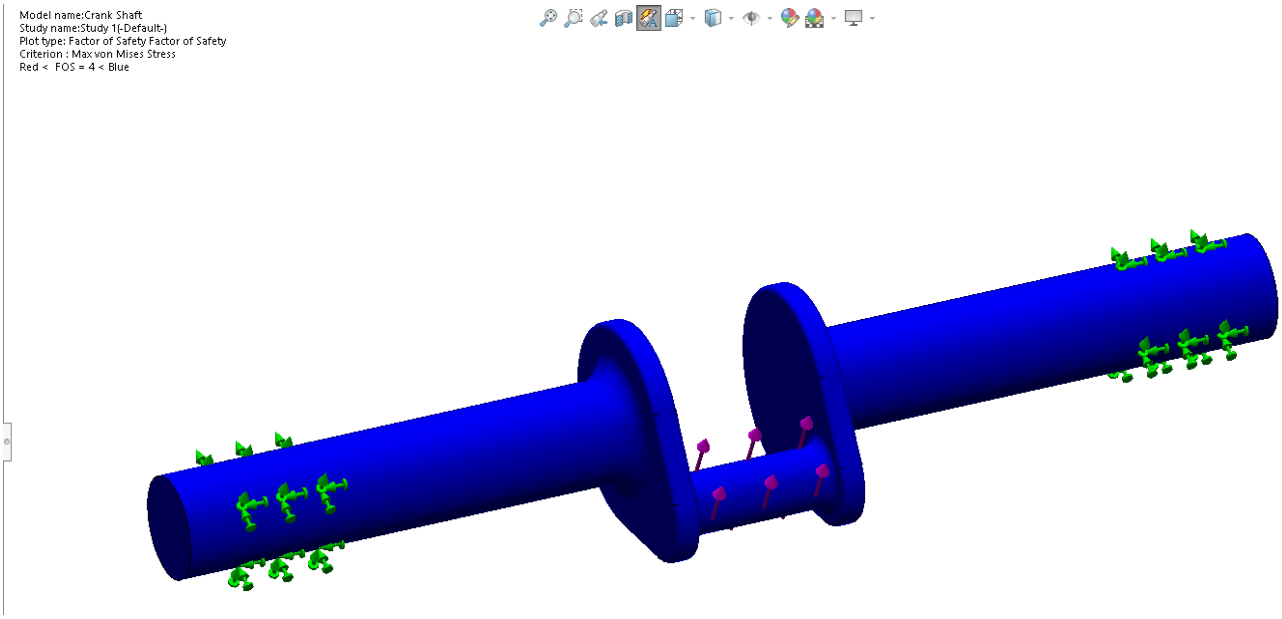

Figure 3. The modified crankshaft satisfies a FOS of 4

P2: Reducer Pipe

For the reducer pipe, we first only fix two of the bolts on each flange and apply a pressure of 2500 psi. The FOS = 3 plot is shown below.

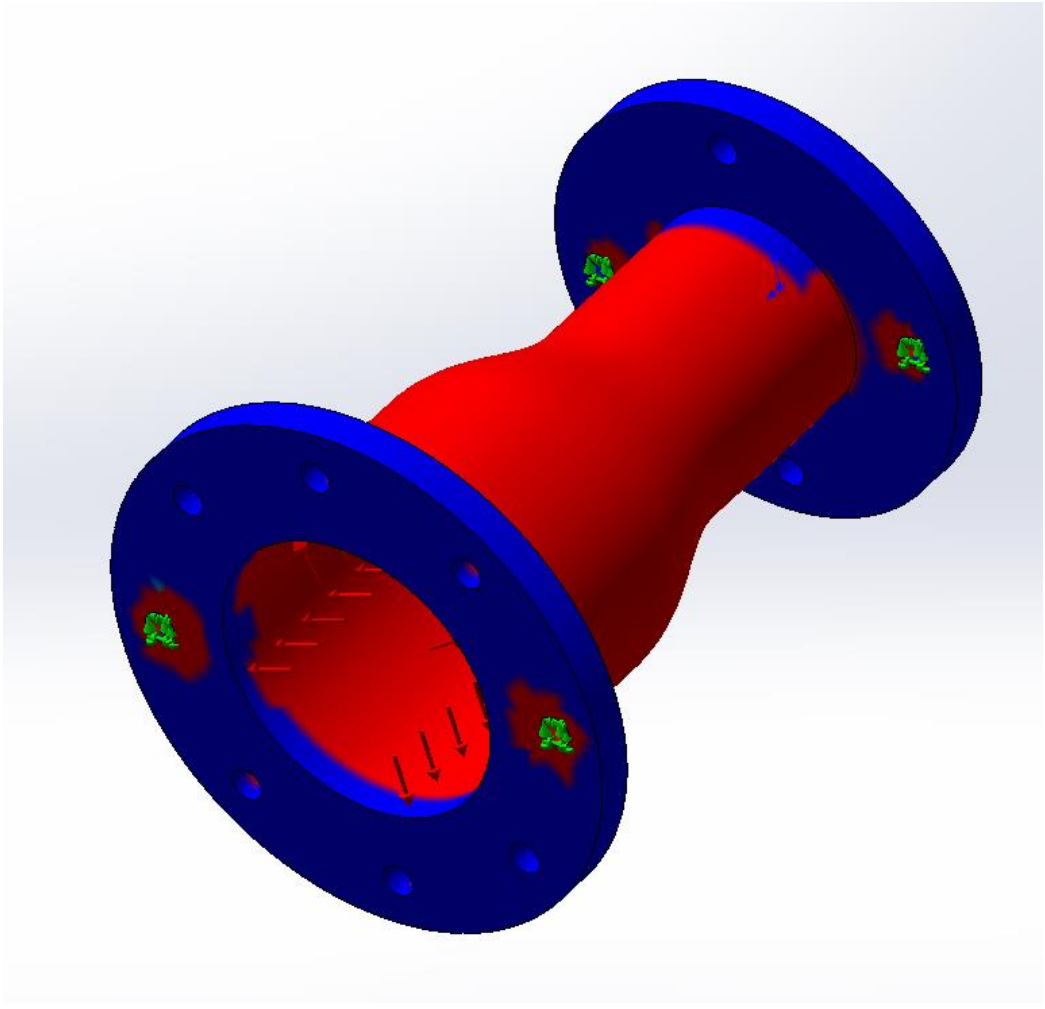

Figure 4. Unmodified reducer pipe with FOS of 3

Now, we want to modify the pipe reducer to achieve a FOS of 3 everywhere. From the plot above, we can see that the pipe itself and the fixed bolts are the areas that do not satisfy a FOS of 3, thus we can make modification accordingly. In summary, the pipe is thickened as well as the flange, and also 0.2-inch fillets are applied to each bolt. An isometric view of the modified reducer pipe as well as the sketch of the changes are shown below.

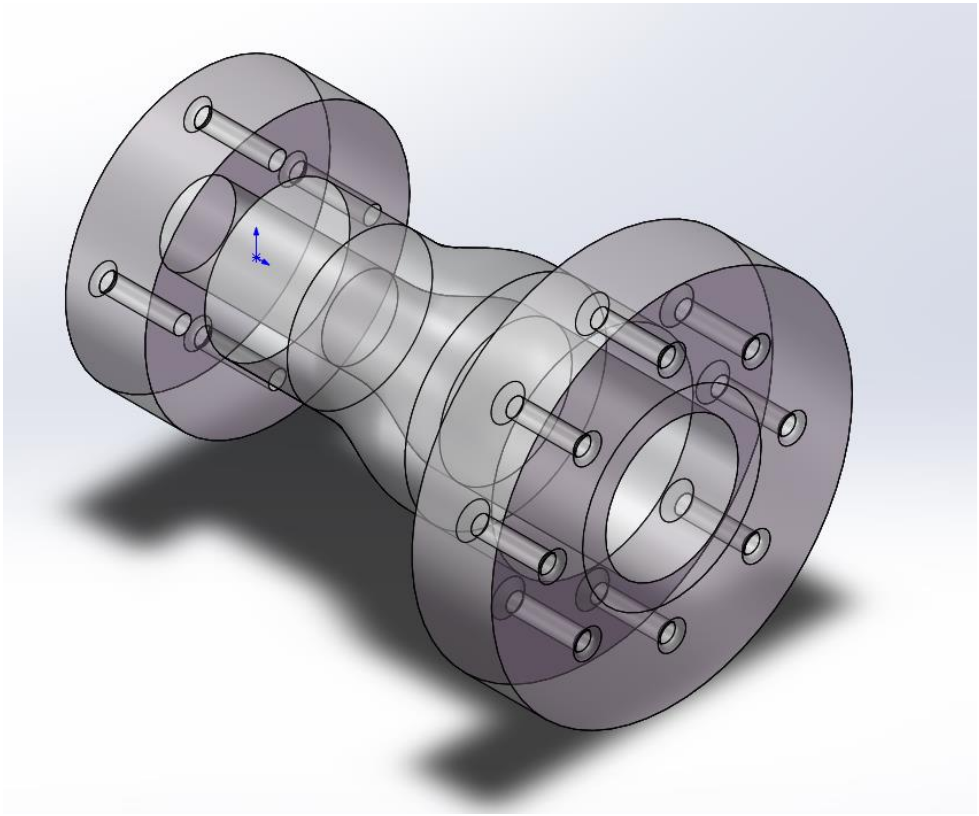

Figure 5. The isometric view of the modified reducer pipe

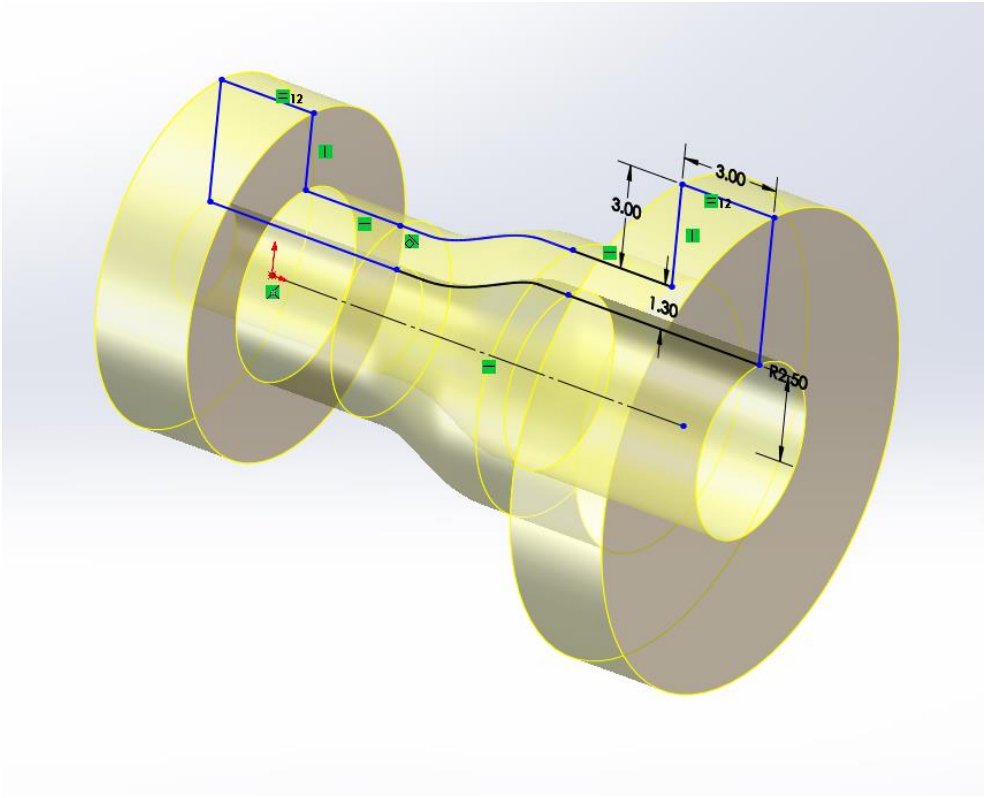

Figure 6. The sketch of the changes

And the FOS = 3 plot of the modified reducer pipe is shown below.

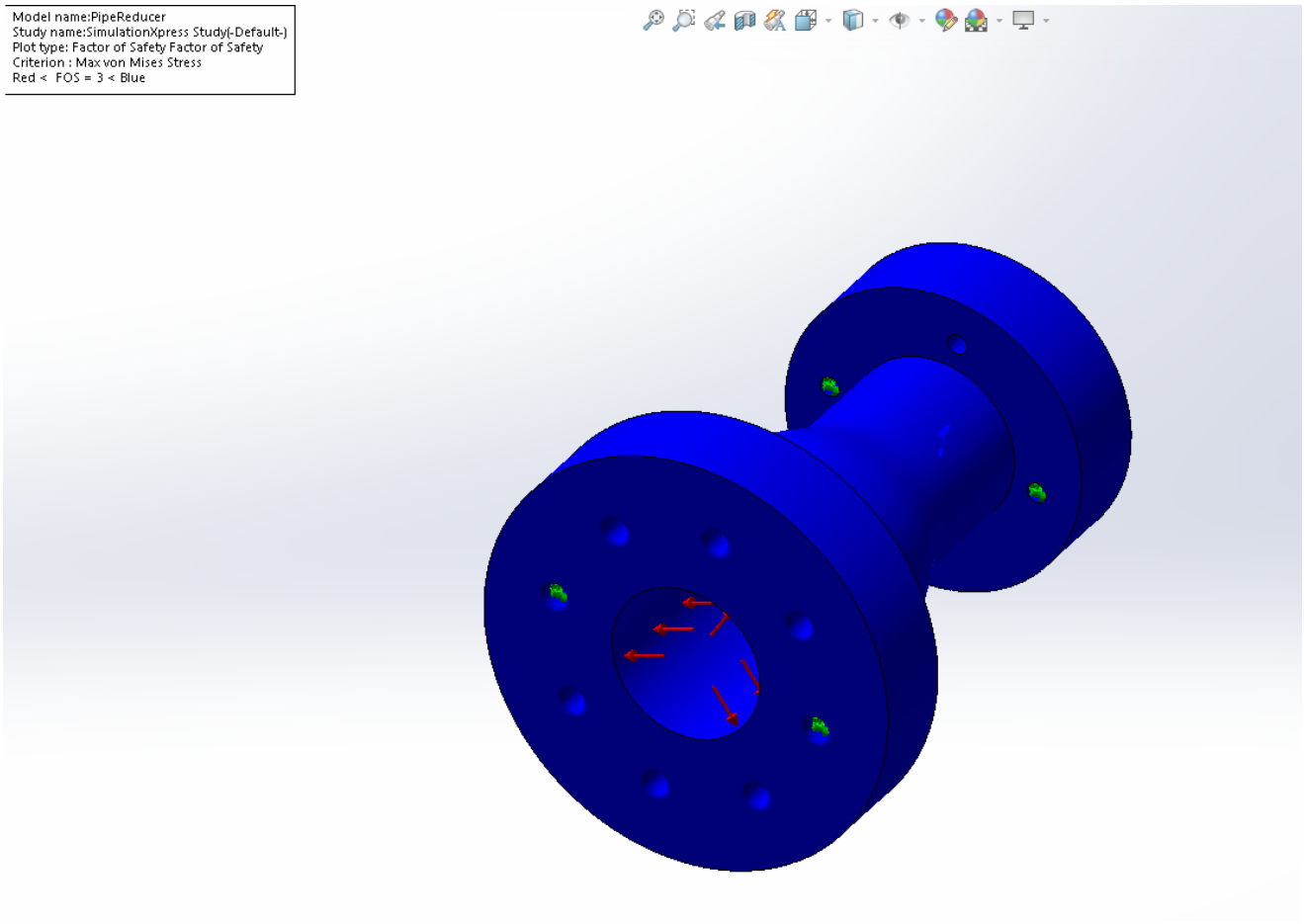

Figure 7. The modified reducer pipe satisfies a FOS of 3

P3: Static Analysis of a Sheet Metal Part

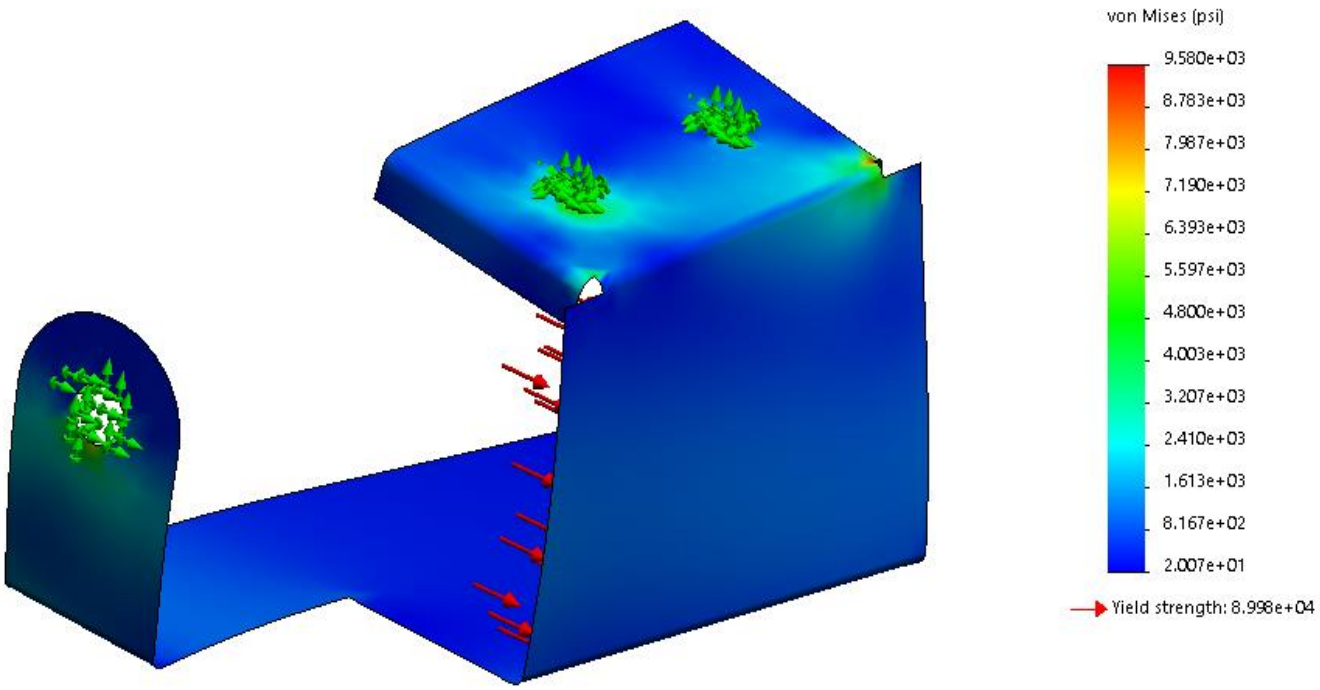

Figure 8. Bottom von Mises Stress of the sheet metal part

P4: Static Analysis with a Mixed Mesh

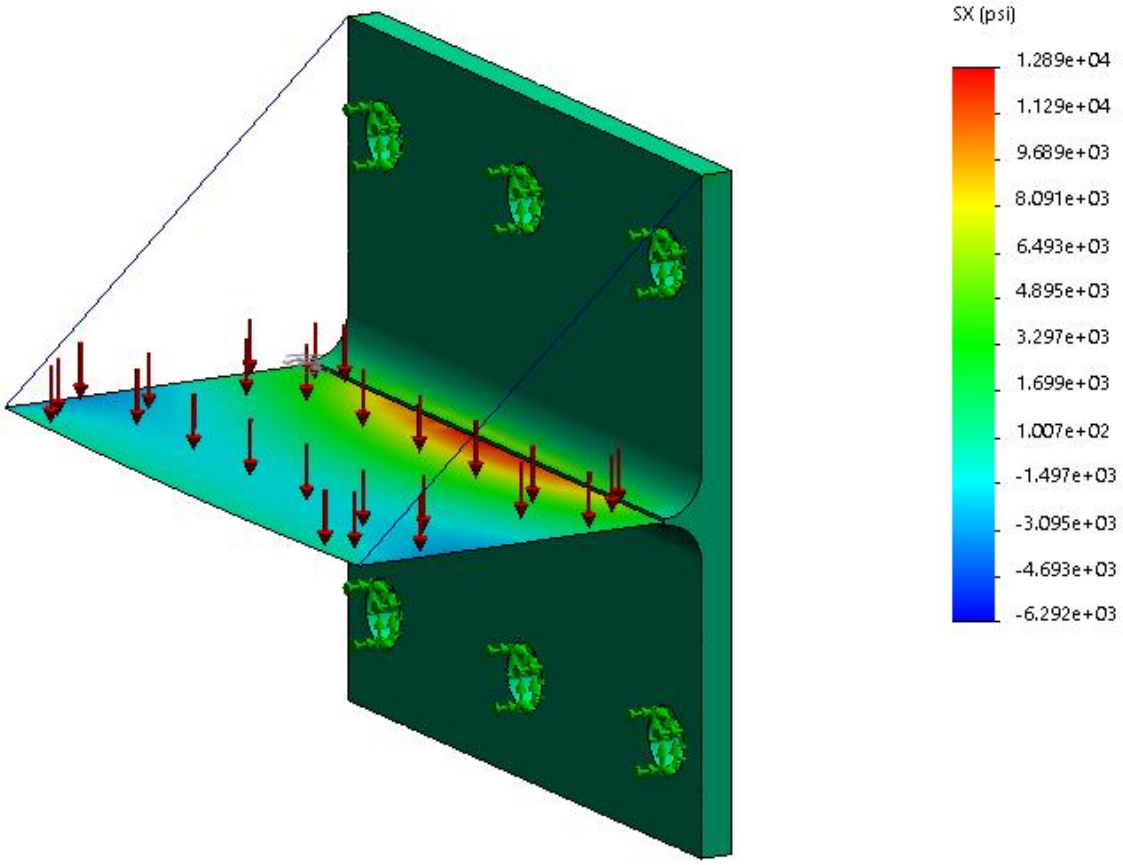

Figure 9. stress x-component (Sx) for the bottom face