FEA Analysis of AUC 510

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1. Assumptions

Here is the list of assumptions that applied in the analysis

- Material: Aluminum 6063 T6
- Fixed ends of the both profiles
- Profile length $2540mm(100inch)$
- Pressure on the flat side of the beam
- Applied pressure $100N/m^2(2Psf)$
- The material performs as linear elastic

Two types of design were analyzed in this case. Configuration A shown as Fig 1, an aluminum profile with thicker side wall compared with normal profile. Configuration B shown as Fig 2, an aluminum profile has thicker end wall compared with normal profile.

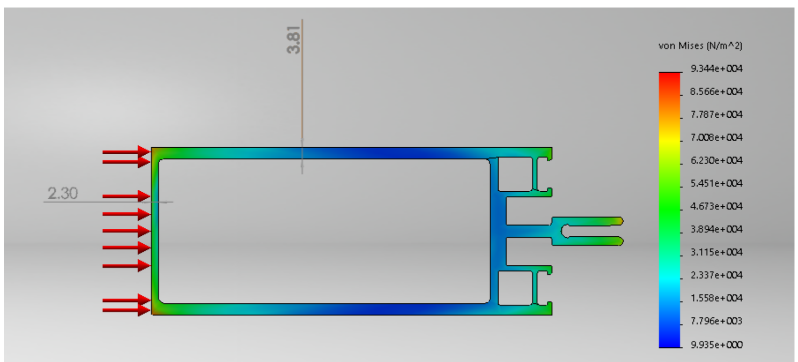

Figure 1. Configuration A: Static for thicker side wall profile

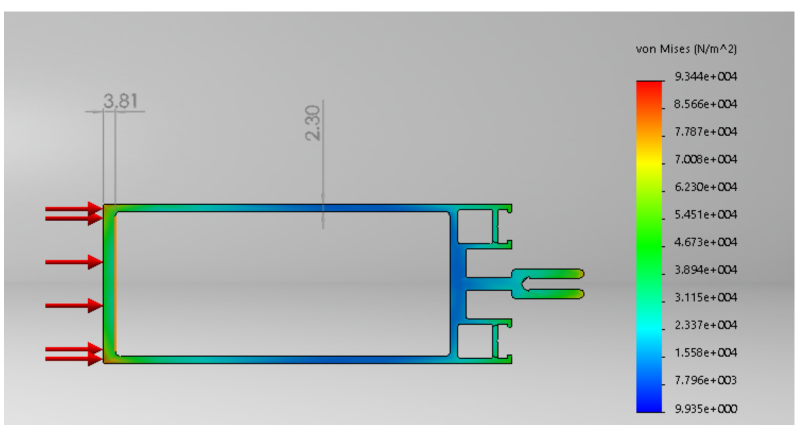

Figure 2. Configuration B: Static for thicker end wall profile

2. Result

2.1. Stress

The stress analysis shown how much pressure the profile would sustain under the condition shown as Fig 1 and Fig 2. The left profile is the thicker end wall profile shown in Fig 2. The right profile is the thicker side wall profile shown in Fig 1 the maximum stress occured at the left end corner of the profile. To make the profile stay fixed in both ends, the connection must be strong enough to support all force generated by the uniform pressure. The maximum stress value is $9.344 \times 10^4 N/m^2$

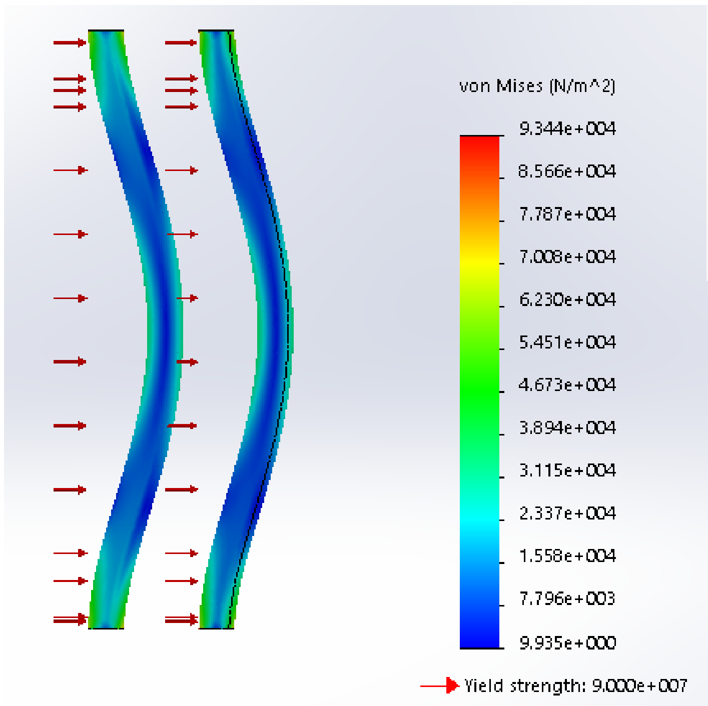

Figure 3. VonMises Stress along the profile bars, left is the thicker end wall

2.2. Displacement

The Displacement shown how far the profile is away from its original position. The purpose of having thicker wall is preventing displacement of the profile. Therefore, the smaller maximum displacement is, the better performance of profile.

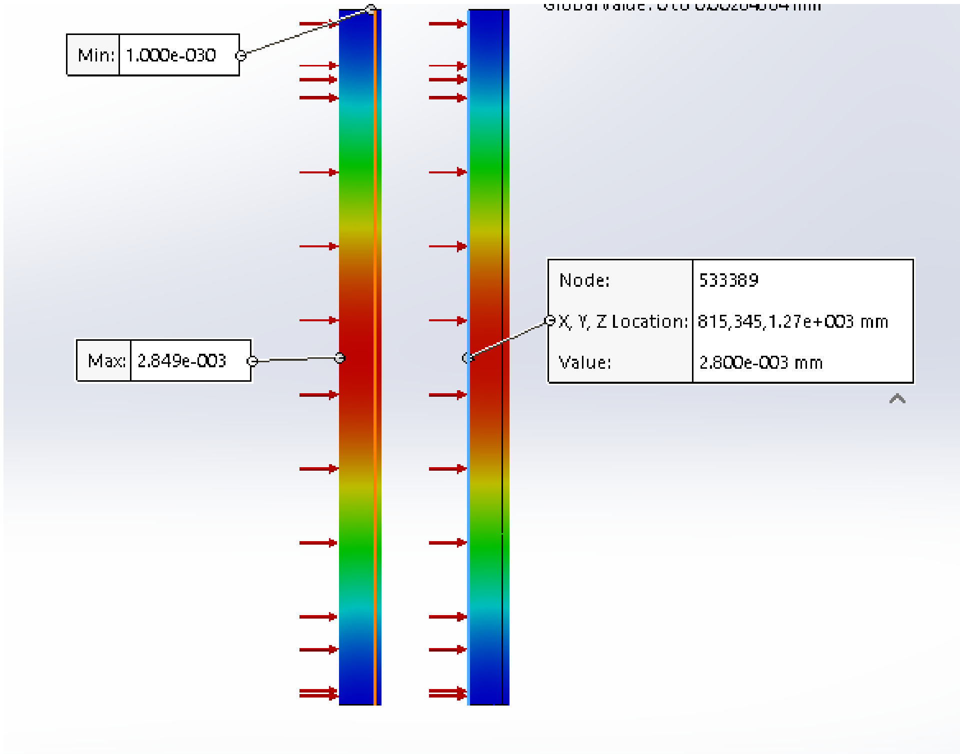

Figure 4. Displacement along the profile bars, left is the thicker end wall

Based on Fig 4, the maximum displacement happened in the left bar, the one with thicker end wall, the value of maximum displacement is $2.849 \times 10^3 mm$. Which indicate that the thicker side wall bar as shown in Fig 1 has better performance.

The difference on maximum displacement between those two bars is $0.05 \times 10^{-3} mm$, which means the right bar moves 1.78% less than the left bar. If considering the aluminum behaves linear elastic, increasing the pressure to 10000 N/m^2 will result in a maximum displacement of $2.849 \times 10^{-1} mm$ for left bar and $2.800 \times 10^{-1} mm$. The difference percentage remain the same as 1.78%.

2.3. Comparison with basic design

Configuration A is known to have a better performance to Configuration B. Then we also want to know how good are them compared with the basic design. In other words, how good those configurations compared with a design that having a thin side wall and thin end wall. The further simulation was done with one additional basic configuration.

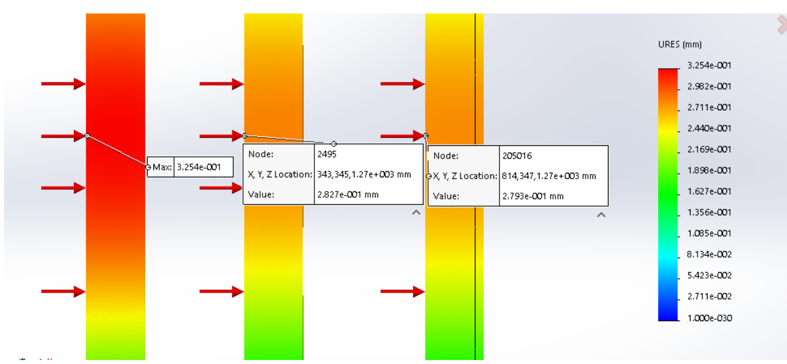

Figure 5.

The basic design has maximum displacement as $3.254 \times 10^{-1} mm$. Configuration A has improved 13.95% performance. Configuration B has improved 12.45% performance.

3. Conclusion

Both configurations are much better than the basic design. The performance of Configuration A is slightly better than Configuration B. However, it will also increase the material cost more since there are two side walls and they are longer than the end wall. Considering the material cost, A thicker end wall design would be a more reasonable choice when aiming at increasing the performance under uniform pressure from the end-wall side.