FORMULA TECHNION 2016

Chassis, Brakes & Ergonomics Team

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Client: Prof Reuven Katz

Abstract

- The **Chassis** was designed with innovative geometry to enable the necessary weight reduction. Using CAD modeling software and FEA the team designed a light chassis with improved stiffness for torsion. Later using the CAD model the team designed and manufactured the Jig assembly with the objective of manufacturing the Chassis with high precision. The design took into account integration factors and focused on volume and weight reduction in addition to lowering of the center of mass. Furthermore, fabrication of the chassis and brackets was done at the team's workshop ,allowing us to fine tune the chassis design during the production process, making it easier to achieve good compatibility to the other components of the car.
- By using the standard FSAE **Impact Attenuator** and using a lighter bulkhead plate, we were able to reduce 1.2 kg from the component's weight.

Project Objective and Requirements

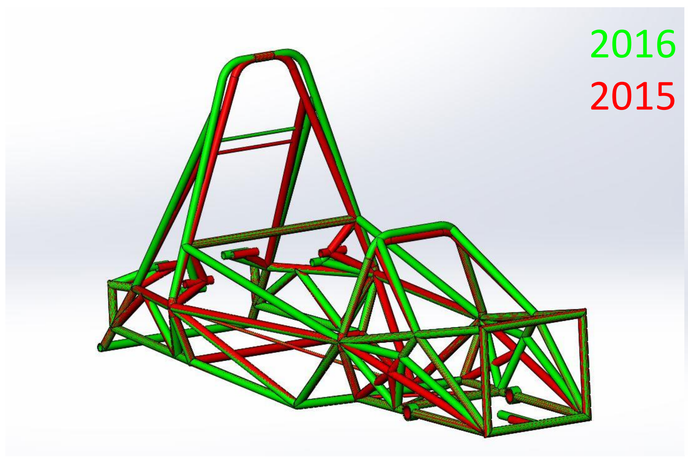
- Improvement of the torsion rigidity of the chassis to 900 $[\frac{Nm}{deg}]$ while not exceeding a chassis weight limit of 35 kg.
- Chassis compatibility with the FSAE structural regulations.
- Chassis design that will be able to accommodate all vehicle subassemblies while minimizing the car's volume.

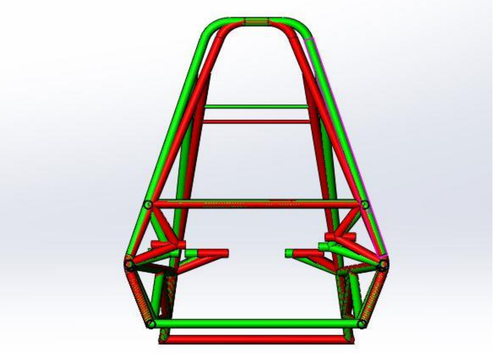
Product Description

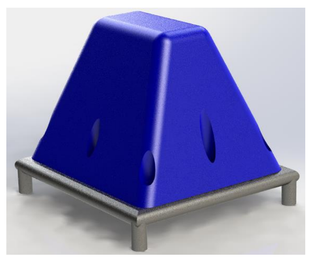
- **The 2016 Chassis**

Using CAD modeling software and considering integration needs this years team designed and manufactured a lightweight and stiff chassis at great precision. The chassis stiffness for torsion was improved by 50%.

The chosen material was 4130 chromoly steel chosen for its good strength to weight ratio.

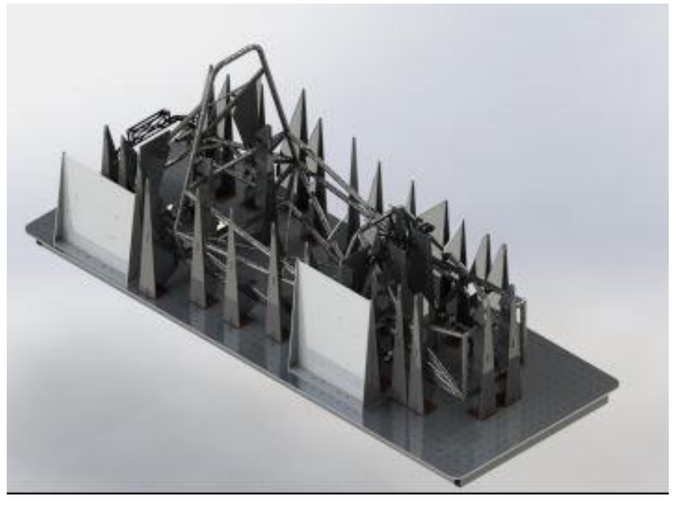






- By using the standard FSAE **impact attenuator** we were able to reduce 1.2 kg which allowed us to dramatically improve the rigidity of the chassis for torsion while not increasing the weight of the final product.

- Using **laser cutting** technology for the tubing of the chassis provided us perfect fittings even in complex junctions. This tight fittings were among the main contributors for the high accuracy in the manufacturing.

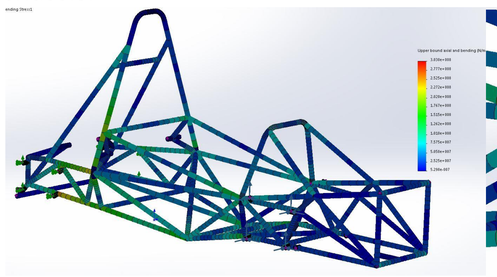


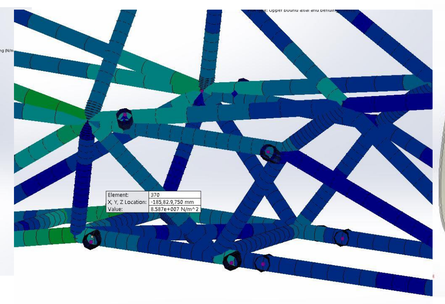
- In order to construct the chassis with minimal deviation, **a jig table** was designed using CAD software and the jigs were laser cut. This year we put emphasis on designing a jig for the engine. This was made to be bolted to an actual engine block, allowing us to accurately weld the engine mounts into place.

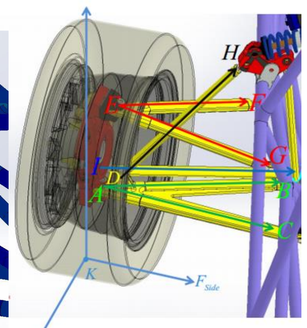
Analysis

- **Chassis analysis**

The analysis on the chassis was conducted with FEA software. The team got input data from the Suspension team about the magnitude and directions of forces at the suspension brackets at different load cases. These load cases included braking + turning and accelerating + turning. The forces in these load cases were put into the FEA model to get a Factor of safety and maximum deflection. Using these inputs, structural members and nodes were moved in order to stiffen the chassis.

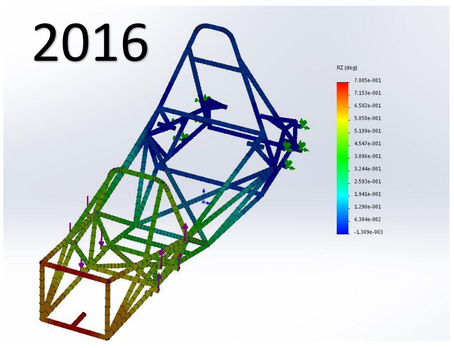


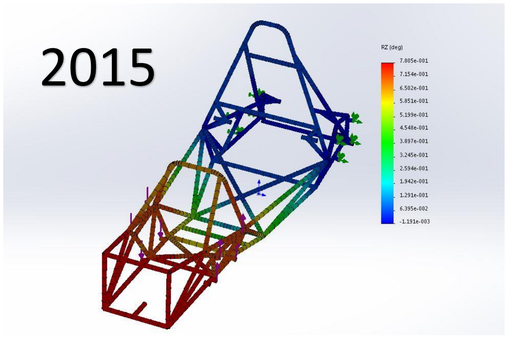




- **Torsion Rigidity analysis:**

Several variations of strengthening geometry were tested using FEA. The chosen concept was selected after taking into consideration the driver ergonomics as well as compatibility to other systems. We archived a 50% improvement to the torsion rigidity.

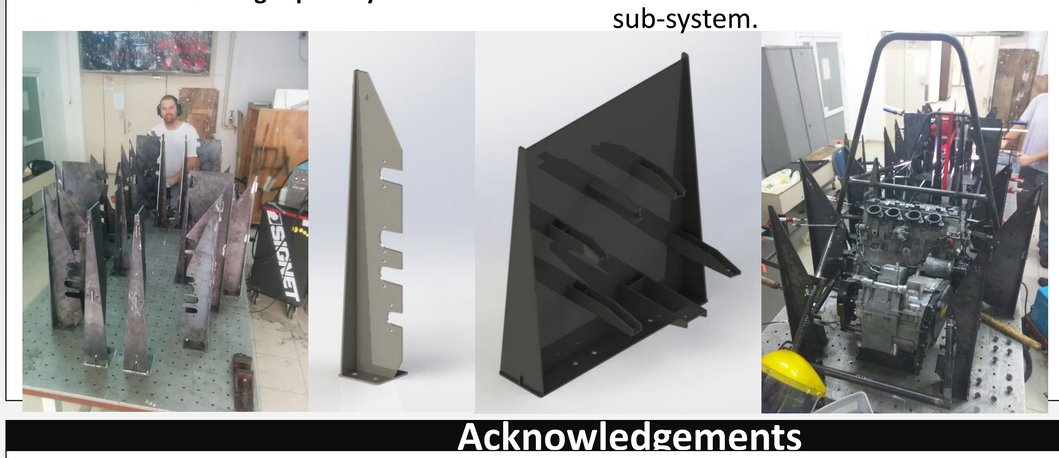




Final Products

Jig table
chassis manufacturing assembly
Mass manufacturing capability

- Proper component integration is a critical part of the design process. After we reviewed last year's car, this year's goals for integration included several modifications for dynamic benefic, such as positioning the engine in such a way that the differential will be located in the center of the rear axle. In addition, maintaining a centralized center of mass regardless of this change. Additional goals were construction and maintenance oriented, and included improved access to all components. This was achieved by changing the location of the engine, widening of the chassis in critical places and profound brain storm about the location of each component and sub-system.



Acknowledgements

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