Technion FSAE Racing

Steering System

Design of a new product - Course# 034353/4

Client: Nimrod Meller

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Abstract

Formula SAE is a student design competition organized by SAE International, gathering universities from all around the world, to compete against each other.
This is the first year the Technion is taking part in this competition. The project is divided between several teams, each with his own area of responsibility.
Each student team designs, builds and tests a prototype based on a series of rules, whose purpose is both ensuring on-track safety (the cars are driven by the students themselves) and promoting clever problem solving.

Main challenges

The main challenges that faced the team in this project were dictated by the FSAE regulations, that states:
1. Design and Build a reliable system that will ensure the safety of the driver.
2. transfer the rotational movement of the driver's steering to divert the wheels
3. Design and Build a system that will be accurate with maximum 7 degrees of freedom in the driver's wheel.
4. Integrate quick release mechanism in the system in order to make sure the driver can exit the vehicle in less than 5 seconds, without degrees of freedom.
5. Rack and Pinion system
6. Preventing the rack from buckling
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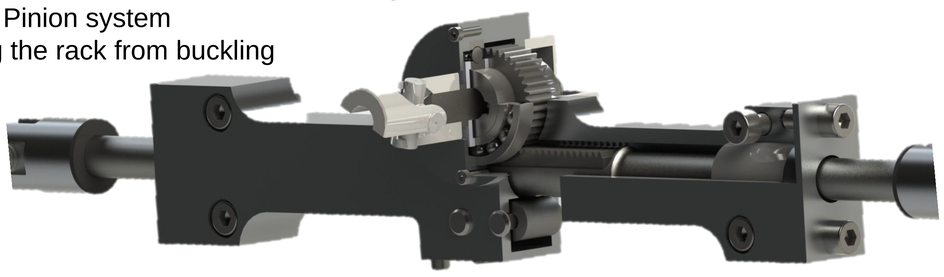
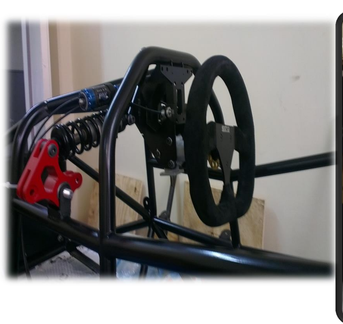
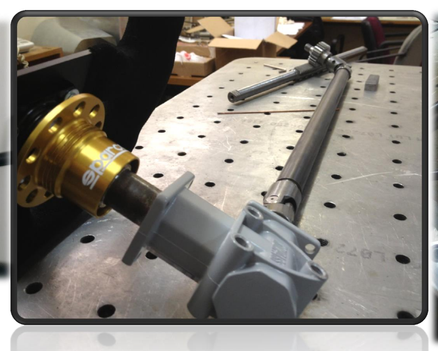


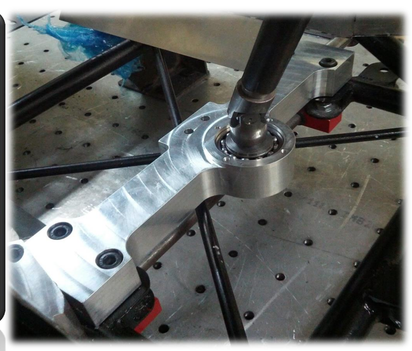
Product description and manufacturing

Wheel complex

In order To guarantee "zero freedom" while turning the wheel, the team decided to buy both the wheel and the quick release mechanism from Sparco. For the transformation of the moment from the wheel, an Ackerman steering system was designed (movement of the wheels is from behind the wheel axle). A bevel gearbox 1:1 is used, transferring the movement in a 90 degree angle. In order to join the two parts, some tiny modifications were made by the team.

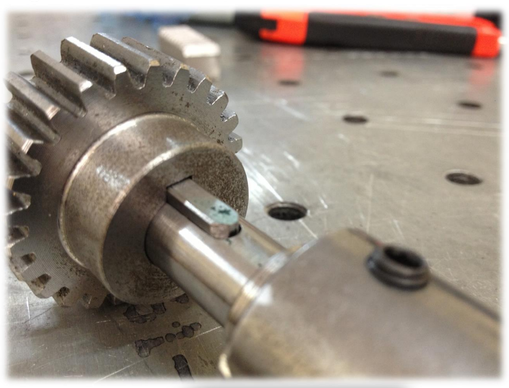


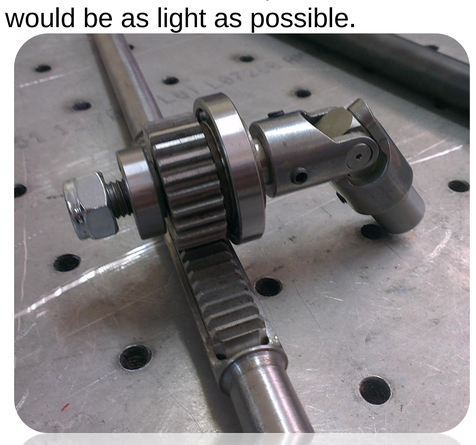


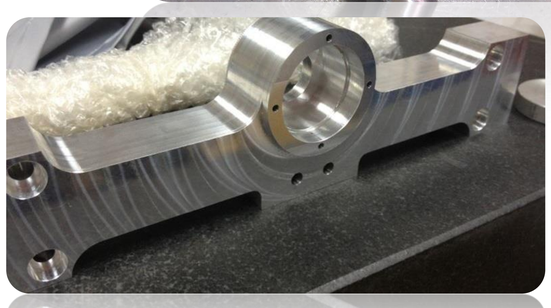


Rack and pinion complex

Most of the parts were made from AISI 4340 Steel, by the kind help of Jacob Hauser from the Technion workshop, while the outer shell that binds all the parts together, was made from Aluminum in a CNC machine. The idea was to make sure that critical parts could withstand large forces, while parts with no loads on them, would be as light as possible.





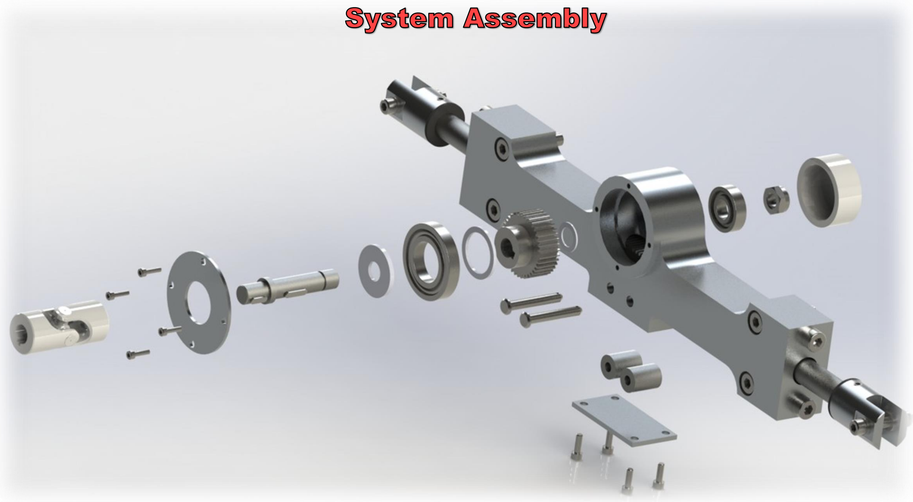


Connecting them together

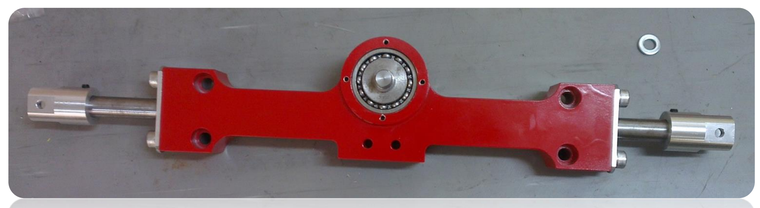
Between the two complexes, a hollow rod was used, which can withstand torsion and in order to adjust the angle between the two complexes, a universal joint was used allowing a 35 degree angle of movement from the vertical line of the gearbox.

System Parts

System Assembly

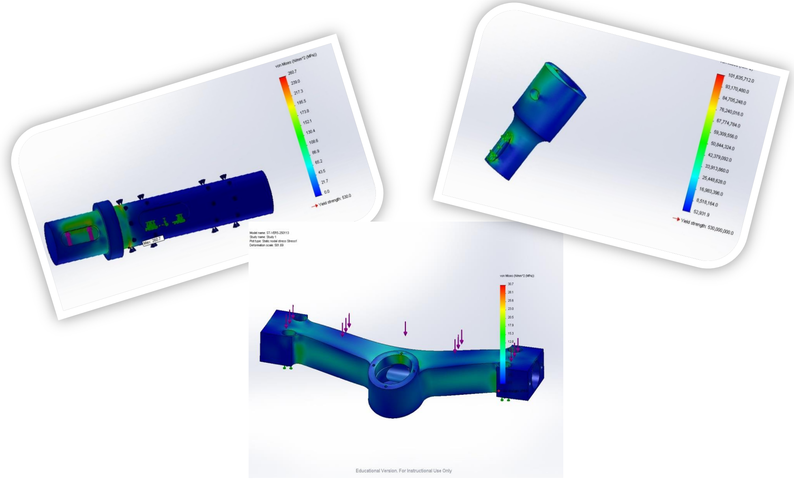


Assembled system



Analysis

The theoretical calculations were verified by the team, using SolidWorks Simulator while applying different forces and torques on the parts,
checking the applied Torsions and Bending



Acknowledgements

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