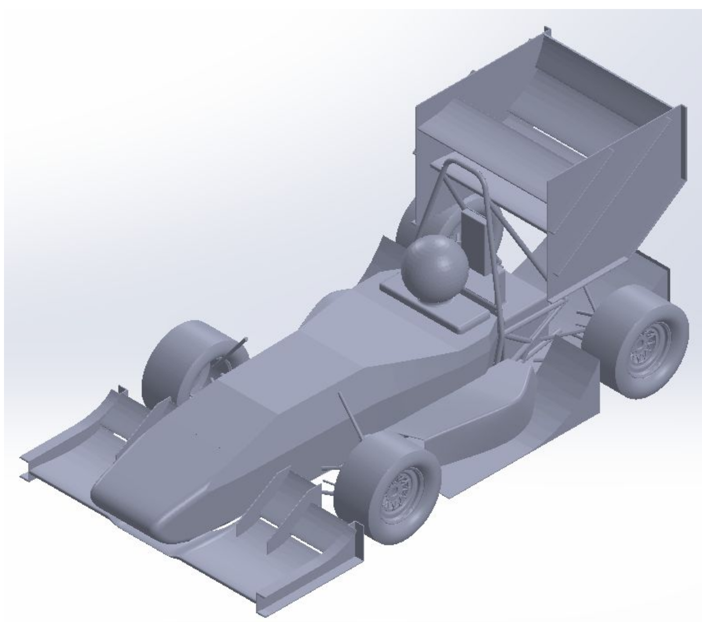
Design and analysis of an Aerodynamic package for a FSAE style race-car

Abstract: This report aims at designing and optimizing the aerodynamic package for a FSAE style racecar, based on the forces that are generated and its effects on cooling of the vehicle. Formula student teams compete to build the most optimum and reliable race-car governed by strict rules. Aerodynamic package proves to be one of the major components for such a vehicle as it provides the car with dynamic stability while also improving the lap times to gain advantage. Cooling is also considered while designing the aerodynamic package for the FSAe car.

Problem Statement: Aerodynamic forces include the lift, downforce, drag and thrust. To reduce the drag and lift of a open wheel race-car various features are added. These also provide with downforce which if distributed correctly contributes towards the stability of the vehicle in roll, pitch and yaw. The oversteer and understeer characteristics can be altered by changing the downforce bias of the vehicle. Cooling is another major aspect for a race-car. The fluid flow over the vehicle is a very complex phenomena and is governed by Navier-Stokes equation and turbulence models. The velocity and pressure contours along with the streamlines and wall shear data are the ways to optimise the performance of these vehicles.



Initial Conditions: Various considerations need to be made for the study

Initial velocity = 56 km/h

Pressure = 0 Pa

Density = 1.196 kg/m^3

Turbulence Model = k-w SST model

Wheel Speed = 70 rad/s

Kinematic Viscosity = 1.529 x 10^-5