FORMULA TECHNION 2015

Aerodynamics Team

Product Design Course,
Team leader: **Alon Dahan**
Anna Sokolovskaya Eliezer Azoulai Nikolai Birger

Client: Evgeny Guy

Advisor: Prof. Steven Frankel

Abstract

The **FormulaSAE** challenges university students to design and manufacture a marketable vehicle for racing. The Technion Team consists of several subgroups who, together, designed and built this vehicle.
The **Aerodynamics Team** of the Technion Formula conducted comprehensive research of the undertray and wings of the car for preliminary modeling. Original design, manufacturability, maintenance and system integration were essential elements of the design.

Project Objective and Requirements

The **Technion Formula Team's** objective is to design, manufacture, market and race a vehicle according to the Formula SAE guidelines.

The **Team** objective is to design and manufacture an aerodynamic package consisting of an undertray and front and back wings:

The **Aerodynamics Team** had two primary objectives:

- The creation of maximum down force to improve cornering performance.
- Maintaining aerodynamic stability for good handling.

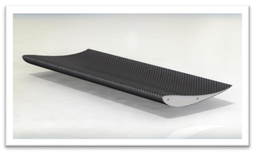
Product Description

Basic requirements

Two types of requirements determine the basic form and dimensions of the wings and undertray: Requirements set by the FSAE Regulations 2015, and others set by the FSAE Technion Team and advisors.
Some typical requirements:

FSAE Regulations:

- Sharp edges on the forward facing bodywork or other protruding components are prohibited.
- All wing edges including wings, end plates, Gurney flaps, wicker bills and undertray that could contact a pedestrian must have a minimum radius of 1.5 mm



Technion FSAE Team's Requirements:

- High levels of total Downforce (> 100 Kgf @ 80 km/h).
- Total weight of the undertray and wings should be lower than last year.

To create a product answering all the requirements the following steps were taken:

- Consulting with specialists in following fields: aerodynamics and design of cars; composite materials; tool production; etc.
- Experiments to determine material strength and strain.

Analysis and Production

Flow and Strength Analysis

During the design process, CFD analysis was performed to determine the aerodynamic properties. Simplified FEA strength analysis were performed, and the final material configuration was chosen with the aid of professional engineers from the industry.

CFD flow Analysis for the wings and undertray was used (see Figure 1) to optimize geometry and integration.

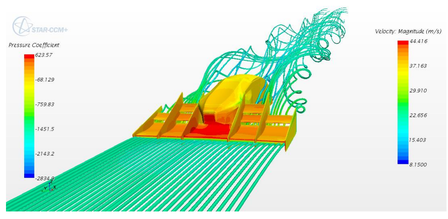


Figure 1: CFD results, multi element front wing-nose assembly

Tools and body manufacture

The wings and undertray were manufactured from carbon-fiber. The manufacturing process involved the following steps: 3D modeling of the tools for the final product; machining and joining molds made from Polystyrene and MDF, shaping with a CNC machine (see Figure 3); finishing and polishing the molds; lay up of the carbon fibers (see Figure 4); vacuum bagging of the final parts(see Figure 5).

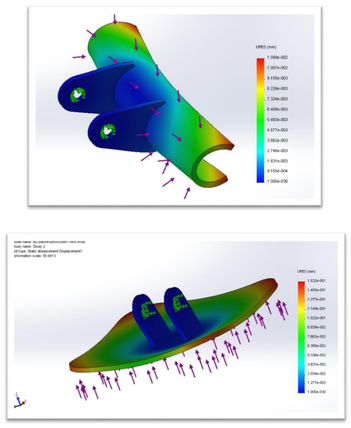
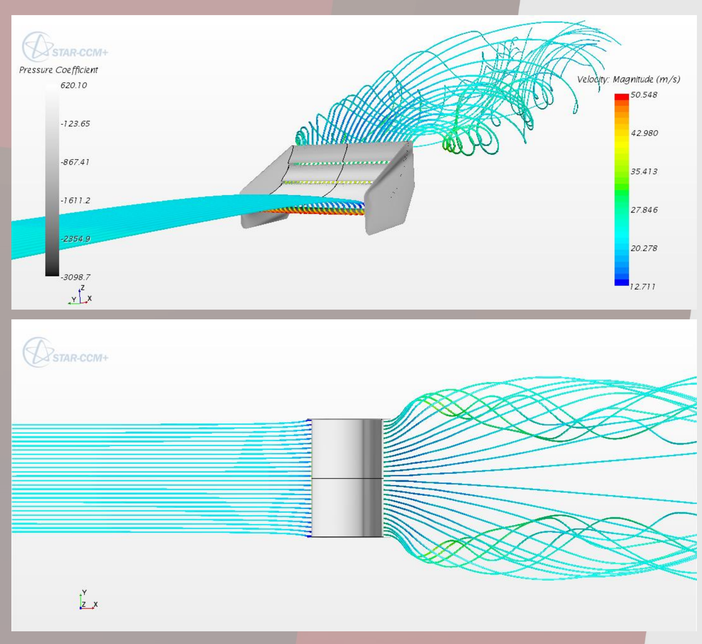


Figure 2: Strength analysis of the back and front wing insert.

Manufacturing Process

Machining & joining mold parts made of polystyrene

tooling | Vacuum bagging | carbon parts



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