Kantonsschule Im Lee

Front Wing Aerodynamics of a Formula One Model Car

Theoretical Study and Wind Tunnel Testing

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Fig. 1

Goals:

The goal of this project was to understand what effect the front wing of a model car has on its performance. More precisely, the effect it has on the amount of downforce produced by the car when trying out different kinds of front wings, each with specific defining features. For this, five different front wings were designed inspired by Formula One cars and they were tested in a wind tunnel setting.

Methods:

To achieve this goal a model car was built and designed in such a way, that the front wings could be easily exchanged. I designed five different front wings (see figure 2) using CAD software and then 3D printed them. The model car was then tested in a wind tunnel, with each configuration being tested seperately to measure the different amounts of downforce produced by each front wing. The ZHAW Winterthur kindly offered me time in their wind tunnel to test my model. The results from these tests were then analysed.

Results:

As can directly be seen in figure 3, every front wing produced a certain amount of downforce, wing 4 being the one with the highest one. If one only looks at the amount of downforce produced by the chassis, a negative downforce was measured. This means that without any aerodynamic components meant to produce downforce, the car actually produces a very slight lift force. In contrast to this all the front wings created a considerable amount of downforce.

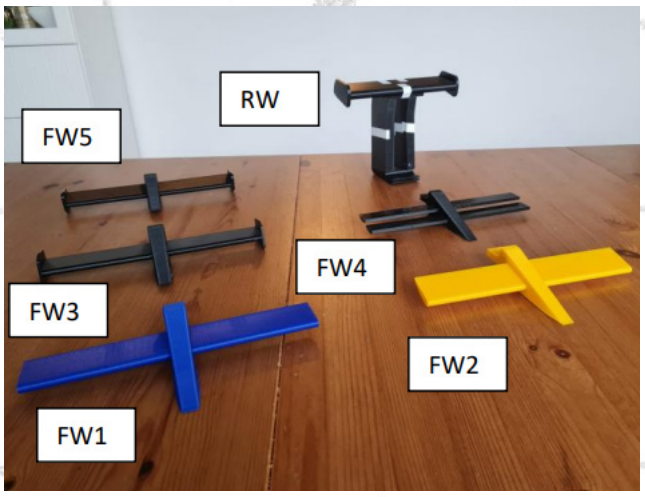

Fig. 2

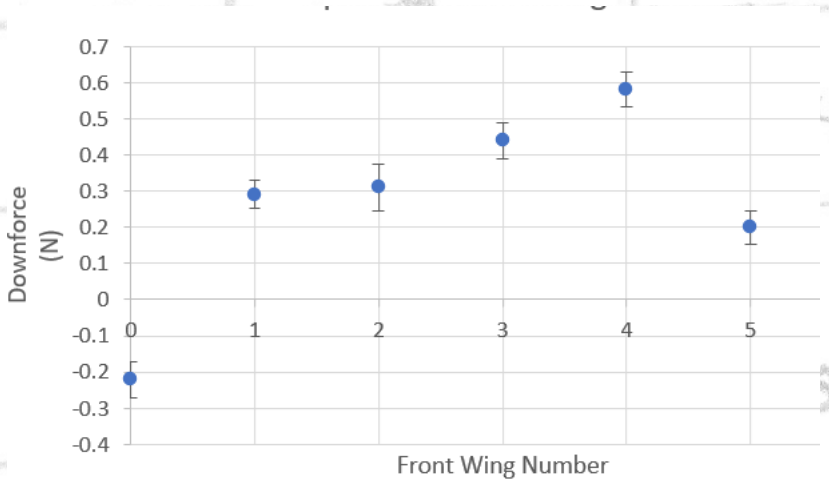

Fig. 3

Figure 1 : The finished model, with a front wing and rear wing attached, in the wind tunnel.
Figure 2 : All the wings.
Figure 3 : Graph comparing different front wings. The capped lines vertically going through each data point is standard deviation.