



Automotive aerodynamics

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Introduction

The optimization of transport aerodynamics has become an important field of study. Aerodynamics is the study of airflow around and through a vehicle. The science behind automotive aerodynamics is not only limited to external aerodynamics and its pressure distribution, but its elements such as engine cooling, internal ventilation, air conditioning, aerodynamic noise reduction, dirt deposition, high-speed stability, and many more.

Cars can be divided into regular/normal cars and racing cars, which results in the aerodynamics system to be slightly different. A racing car has a more powerful engine compared to normal cars and fuel efficiency and engines are best in terms of transmission, clutch, handling and etc. On the other hand, many normal cars don't have to experience these speeds as much, thus the usage of aerodynamics instead, with an increase of normal production such as comfort, practice as a daily ride, and fuel efficiency.

Background

Aerodynamics can be explained as a dynamic airflow going through a car. Where the pressure distribution s classifies as *lift* and *drag*. Its drag forces are compromised by 3 forces.

- Frontal pressure
- Rear vacuum
- Boundary layer

According to Bernoulli “An increase in the speed of a fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid’s potential energy” (Bernoulli, 1783, p. 780-781), therefore, the laws of thermodynamics 1st law are very similar yet it is the expression of Bernoulli's principle. In an equation form 1st law of thermodynamics can be seen as;

$$\Delta U = Q - W$$

ΔU (the change in internal energy of U in the system)

Q (the net heat transferred in the system)

W (The net work done by the system)

Discussion

A normal car is very simple compared to a racing car. A race car is suitable and designed for a very specific purpose. Its body type varies depending on the model such as rally, time-attack, and hybrid. However, the overall picture of a racing car contains;

- Wings and spoilers
- Aerodynamic
- Carbon fibre hoods
- Non-functional hood scoops
- Large wheels
- Lowered suspension
- Bumper canard fitting to the front bumper



(Drive tribe, 2020)

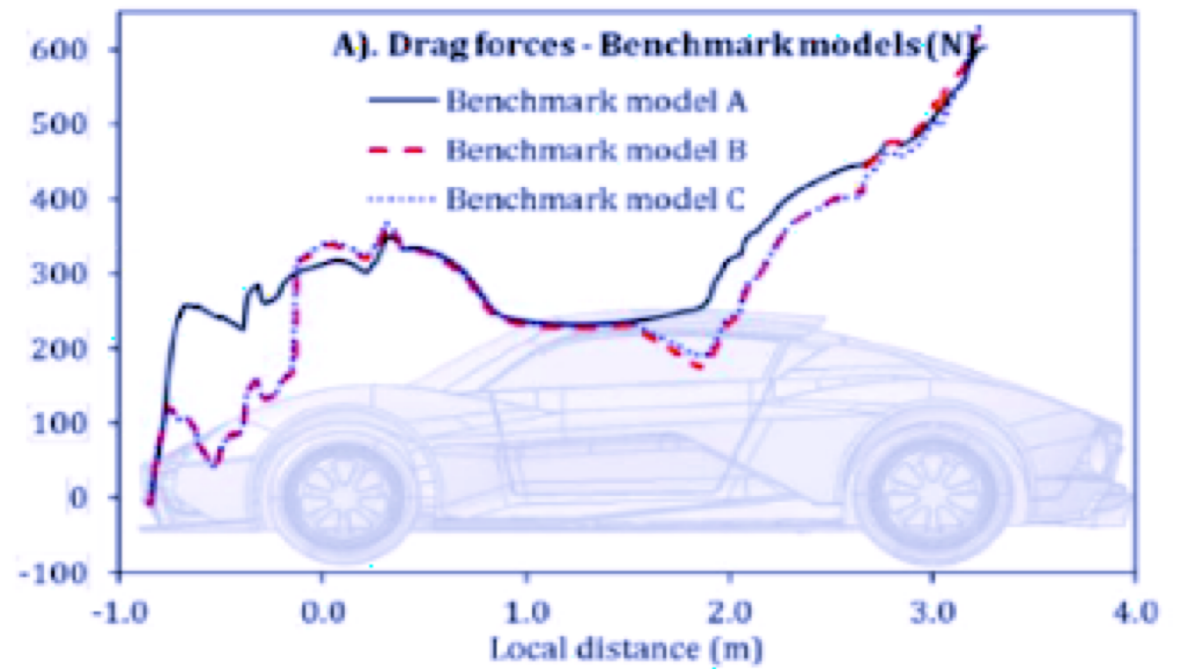
(A world time attack challenge, 2018)



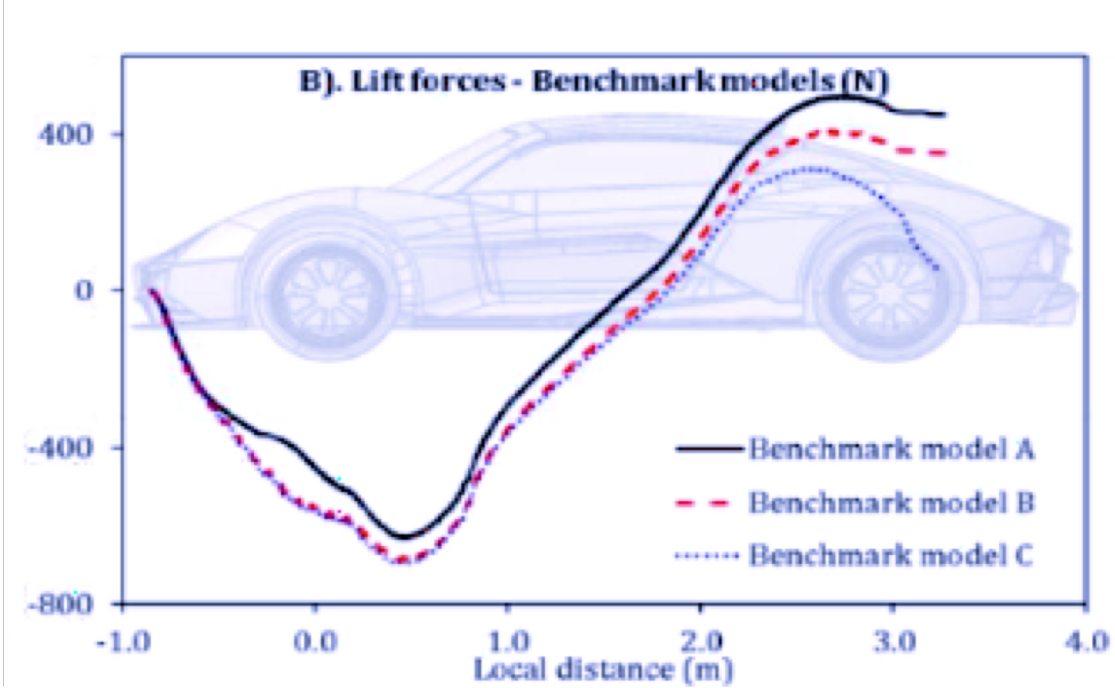
(Secret-free: Aston Martin Valkyrie exposes cockpit design, almost final exterior cues, 2017)

Along with many effects aerodynamics has been a great contribution to the new societal racing events. Many of which include the important factors of the aerodynamic system has provided is the preventing of undesired lift forces creating the driver and the car to a great crash.

The most efficient shape of a car is generally known as a Cd figure (coefficient of drag). This in many cases helps the car to lower excess fuel efficiency further creating more horsepower and speed for a race car. On the other hand, speed isn’t much needed for normal cars whilst as it more set for comfort and daily rides.



(Dickison, Ghaleeh, Milady, Subbakrishna, Wen, Qubeissi 2019, p.583-601)



(Dickison, Ghaleeh, Milady, Subbakrishna, Wen, Qubeissi 2019, p.583-601)

As shown from the two graphs, the usage of aerodynamics as in Drag forces and Lift forces has a higher effect in overall usage. Thus, becoming a great usage for racing cars.

Conclusion

Aerodynamics as a concept isn’t as much of a use in normal cars rather the usage in sports cars varies in many different forms. A normal car lays on the onus of the comfortability and a race car on speed. A normal car will always have a considerable coefficient of drag force, the less drag the better. Whilst, a racing car is solely focused on the efficiency of fuel increasing more speed during a race. In the future, the usage of aerodynamics can affect many types of transport.

References

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