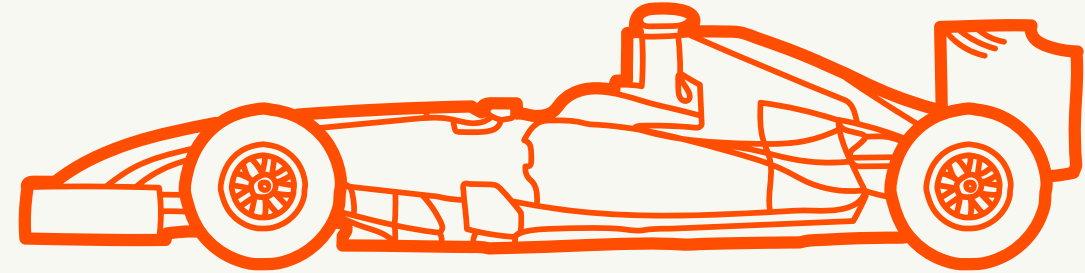


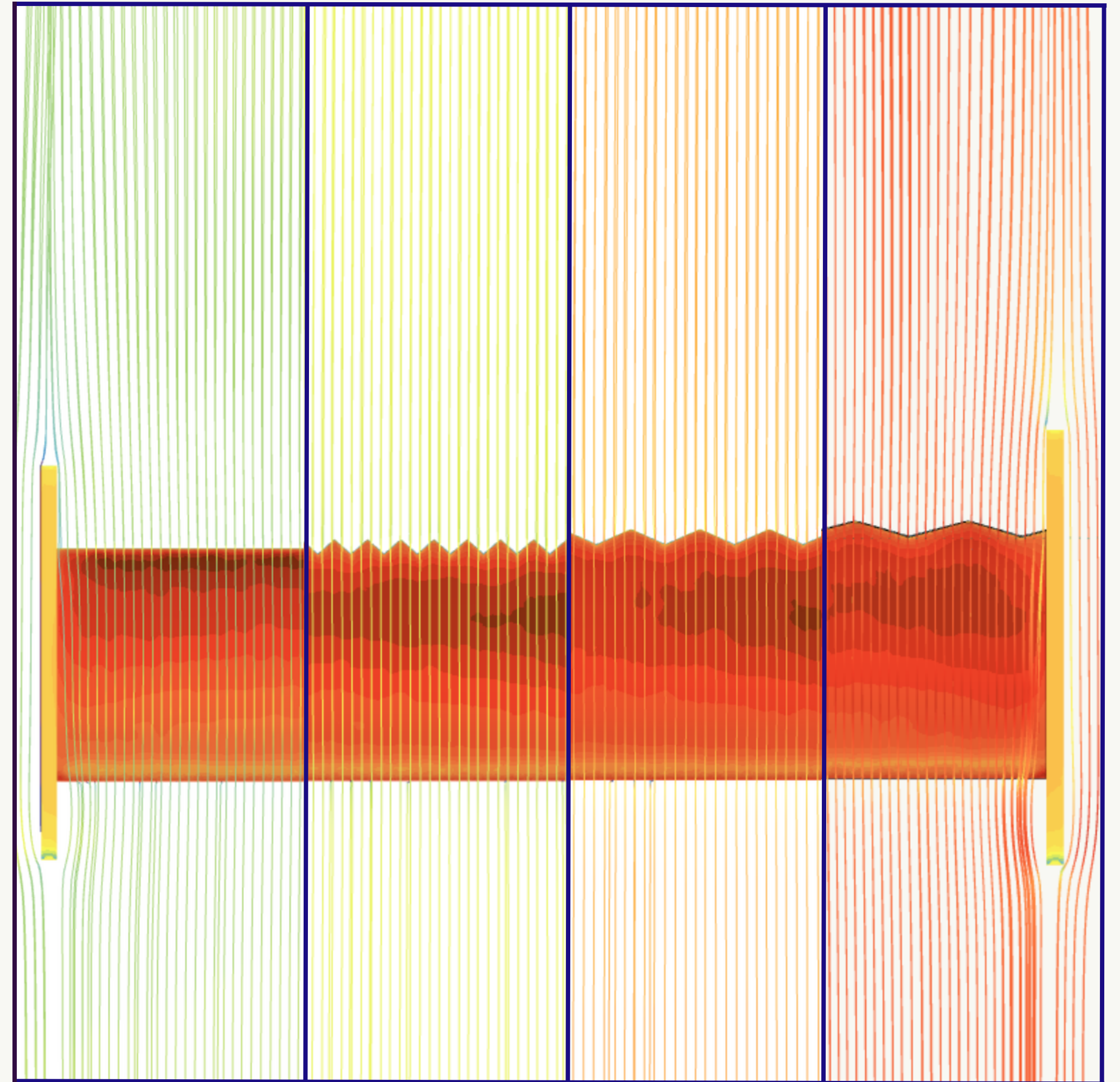
EFFECTS OF SERRATIONS ON A WING

AUTHOR

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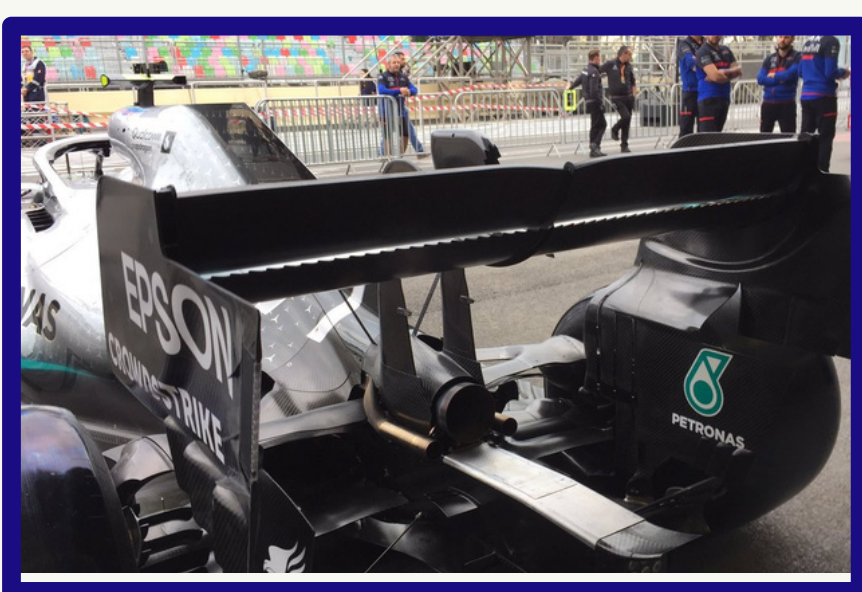
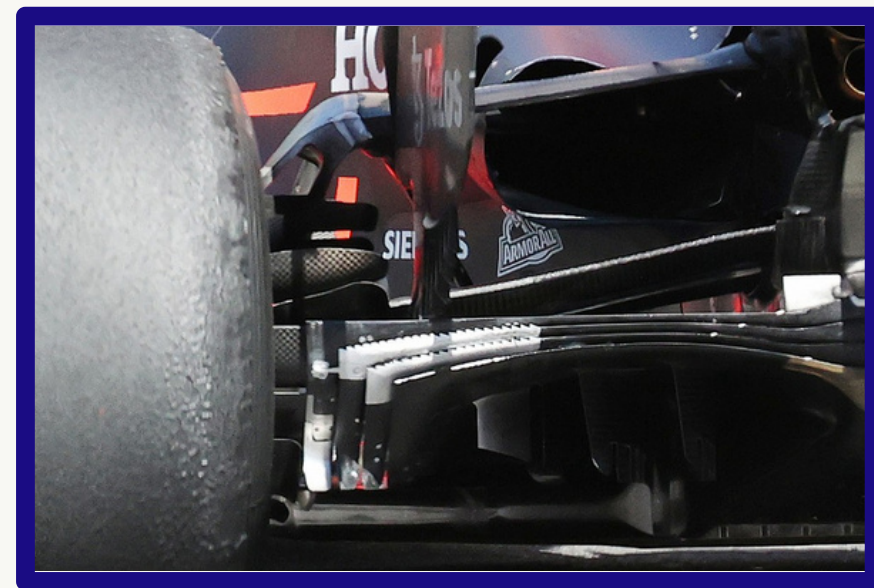


STREAMLINES FOR WING VARIANTS



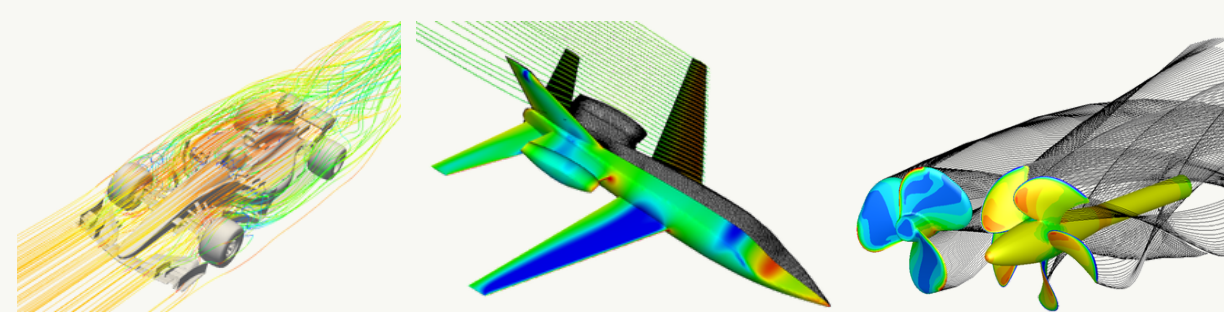
INTRODUCTION

Formula 1 is the pinnacle of aerodynamics. Every part is optimised and refined until it can yield the ideal performance. Some teams run cars with serrations along the edge of the wings. While most details in F1 are thoroughly researched, this characteristic does not have enough knowledge that has been made public. This project aims to fill that gap.



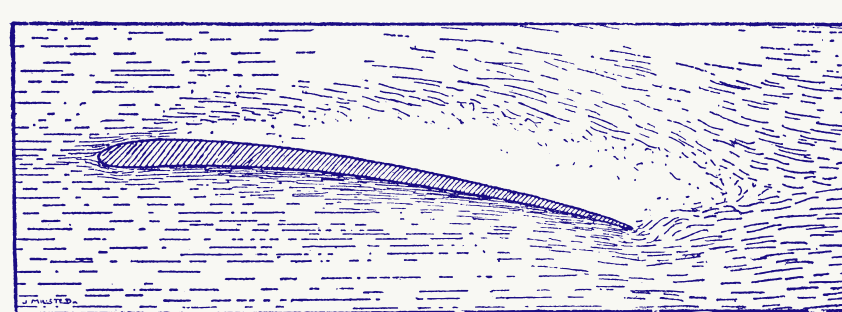
OBJECTIVE

This research explores a unique part of motorsport aerodynamics that can develop through testing in a wind tunnel or on-track. This CFD Investigation aimed to examine the effect of serrations on the performance of a wing with an NREL S826 airfoil. How this feature affects lift-drag characteristics, pressure coefficients, lambda-2 and q-criterion are observed.



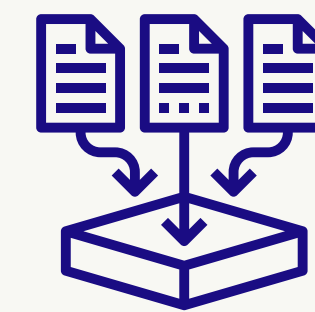
METHODOLOGY

Four variants of the wing geometry are developed. The serration spacings are based on real-world implementations of this concept, in particular, the Mercedes W10 (Azerbaijan GP, 2019) which has serrations spaced 20 mm apart. This is used as a baseline for further variants. The airfoil used was NREL S826 for its high maximum lift coefficient and low drag coefficient.



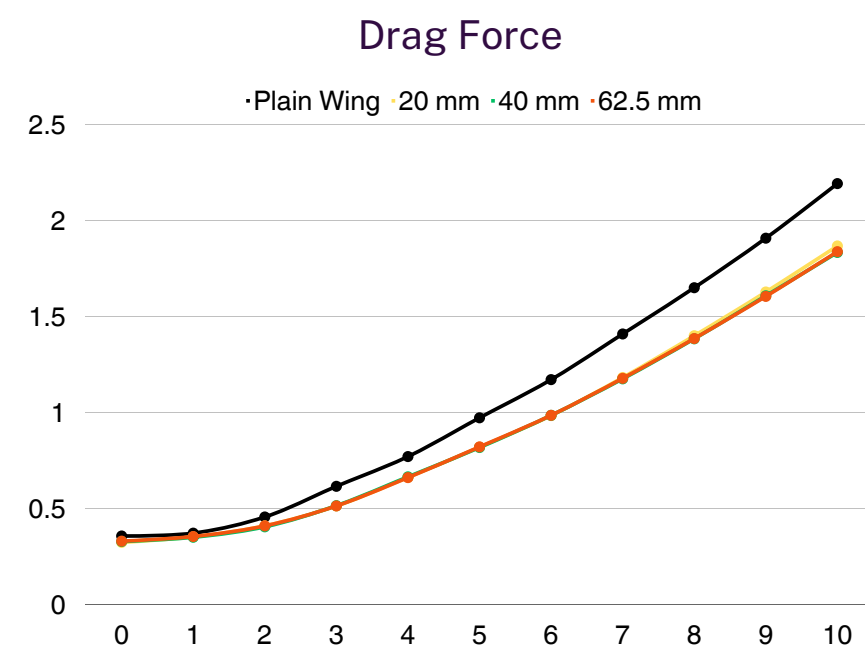
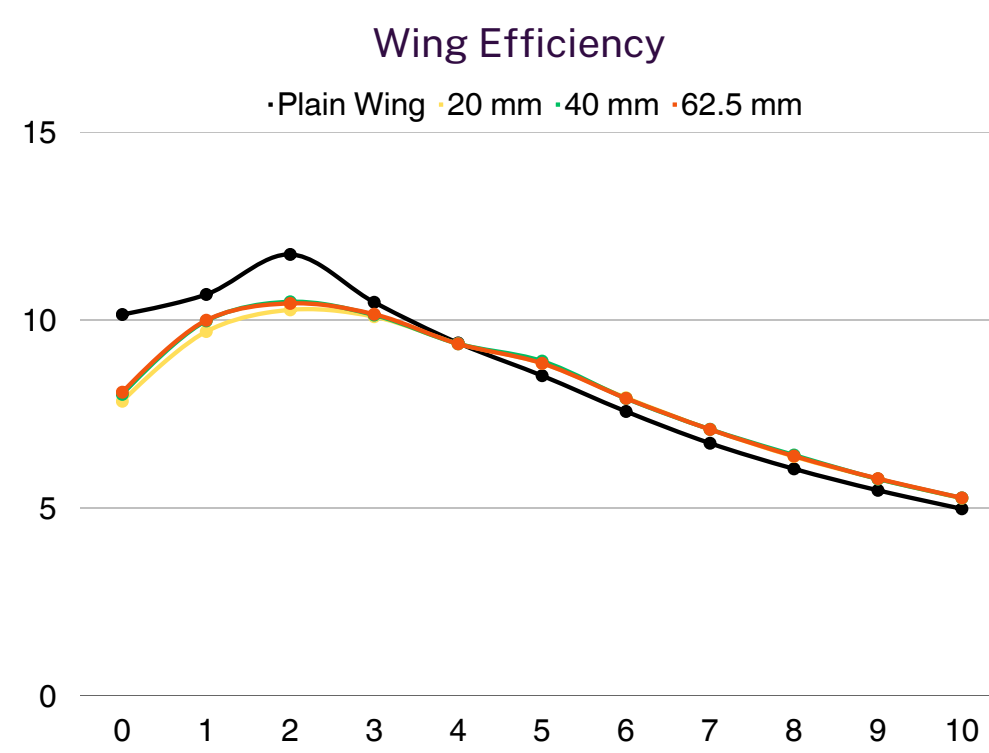
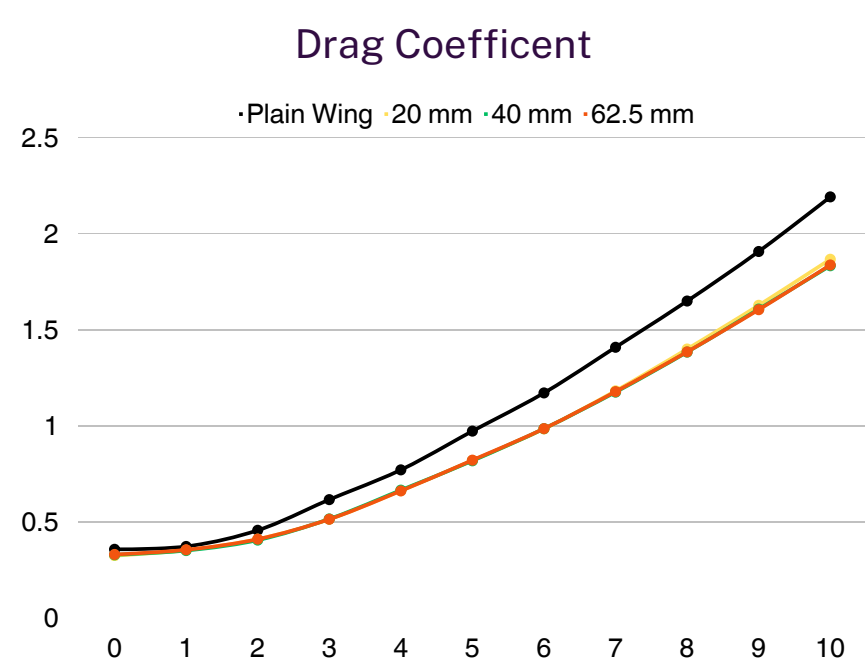
RESULTS

A significant reduction in drag force is achieved simply by introducing serrations to the airfoil. At higher angles of attack, the effectiveness of the serrated wings substantially improves over the plain airfoil. An unintended consequence of the addition of serrations is the reduction of the frontal area of the body.



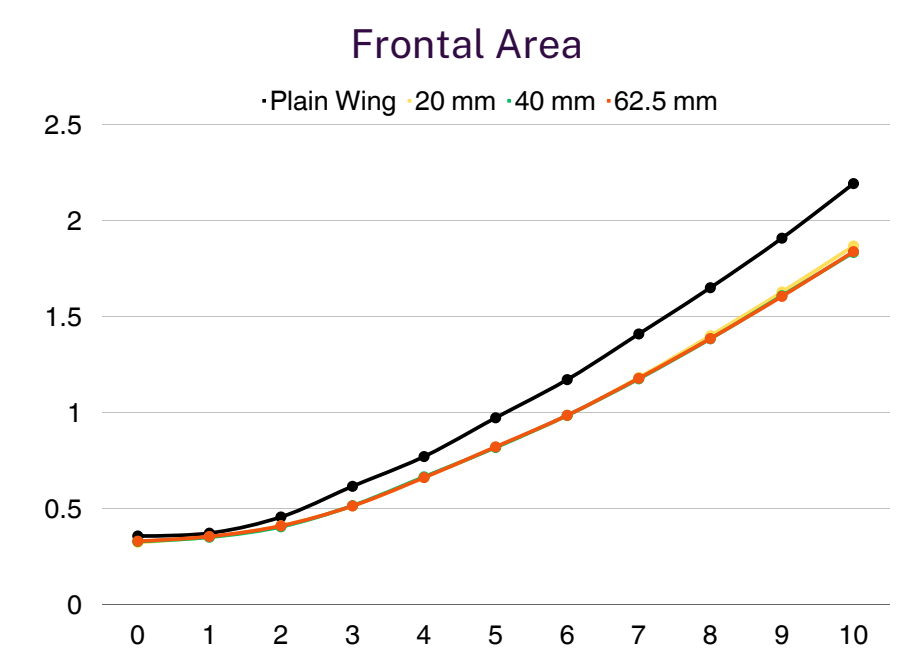
ANALYSIS

It is observed that a greater distance between serrations produces a higher efficiency. Each variant produces less drag, up to 20% when compared to the baseline wing. The 62.5mm Serration Wing is the optimal design in this scenario and for the range of angles presented. Overall, an efficiency increase of 5.5% was achieved, which is a significant amount in the field of F1 Aerodynamics, where every millisecond is disputed.



Improvements of Each Variant

Variant	Frontal Area	Drag	CL/CD
20 mm wing	5.536%	19.442%	5.299%
40 mm wing	5.578%	20.932%	5.499%
62.5 mm wing	5.741%	20.896%	5.506%



CONCLUSION

This new feature can now be applied in other areas of the automotive world. Just as hybrid systems and high-performance computing have trickled down from motorsports to the everyday world, so has advanced aerodynamics. A reduction in drag directly impacts the fuel consumption of the vehicle and with these findings, the concept of serrations can be directly applied here. Serrations are a low-cost, lightweight solution which can be applied to any road car, similar to other notable advancements like shark fins, diffuser fins and splitters.

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