Revolutionizing Race Car Aerodynamics with Supercomputing and 3D Printing

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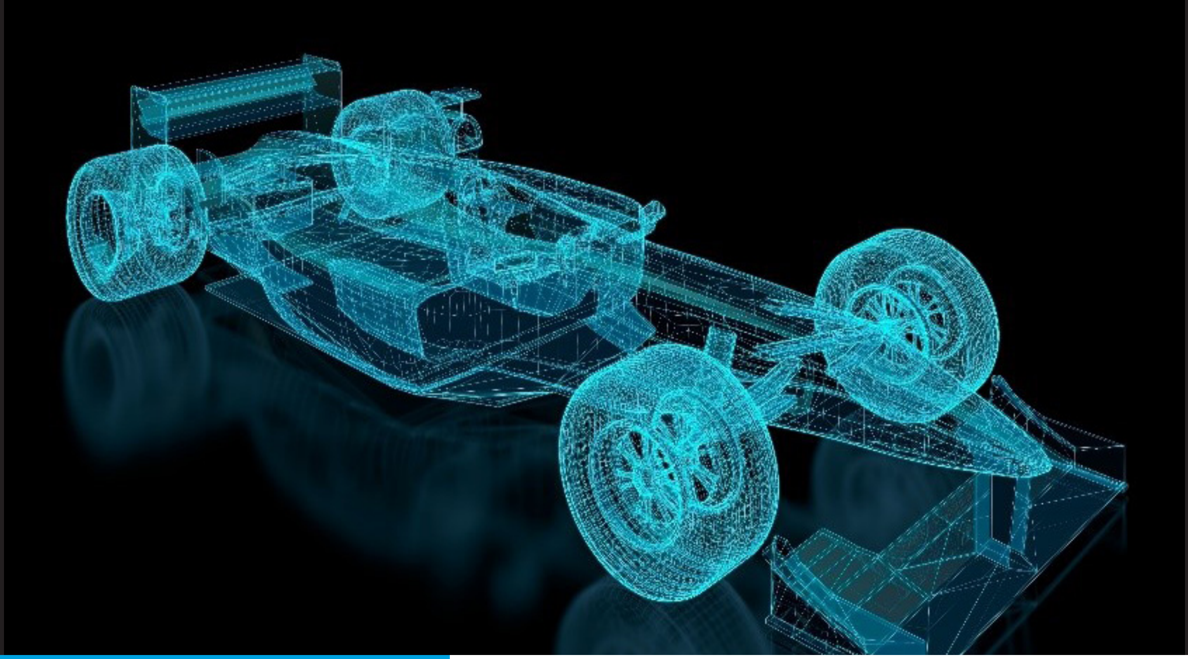
This is an excellent example of the capabilities we can achieve by combining supercomputing and 3D printing at KAUST.

Professor Matteo Parsani

King Abdullah University of Science and Technology (KAUST)

Case Study



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The data is very large and complex, and I wanted to see what's happening on the wing. By coloring the flow patterns on the wing, we could clearly visualize some of the key flow features. It is a very elegant example of Schlieren photography.

Professor Matteo Parsani

King Abdullah University of Science and Technology (KAUST)

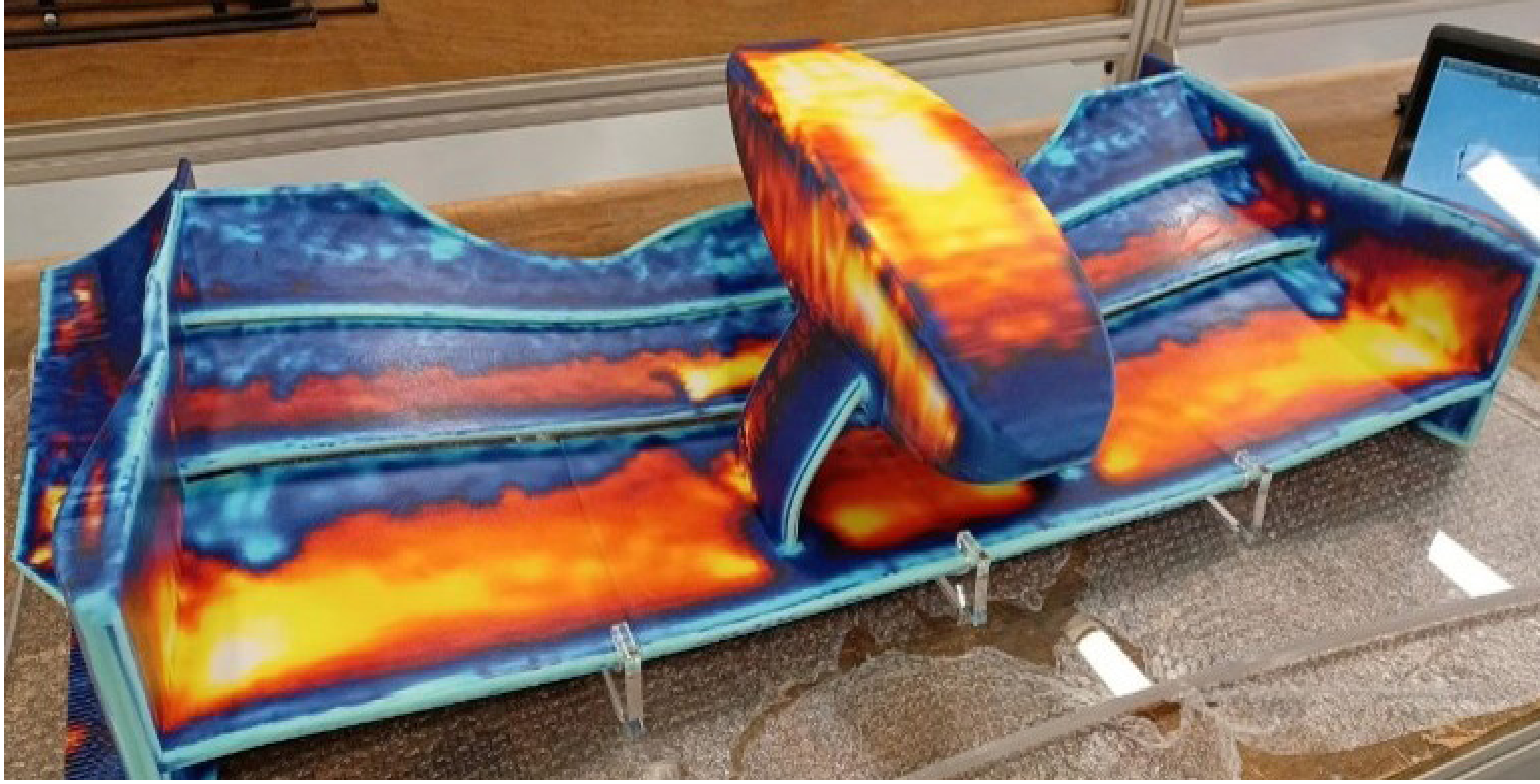
The Power of Aerodynamics in Formula One Racing

Supercomputing and 3D printing have revolutionized the world of race car driving by capturing the intricacies of aerodynamics. In Formula One racing, the manipulation of airflow around the car is one the most important factors in performance. A 1% gain in aerodynamics performance can mean the difference between first place and a forgotten finish, which is why teams employ hundreds of people and spend millions of dollars perfecting this manipulation.

Bringing Color and Clarity to the Aerodynamic World

To transform the vast data into tangible insights, the PCL harnessed the Stratasys PolyJet™ J-Series 3D printer. This cutting-edge printer, which is capable of producing full-color gradients and a wide range of materials in a single process, allowed engineers to achieve unparalleled realism without the need for post-processing. By intricately coloring the flow patterns on the wing, the team was able to vividly visualize key flow features, thus acting as an elegant example of Schlieren photography.

By intersecting supercomputing, 3D printing, and aerodynamics, this case study demonstrates the immense potential of technology in propelling Formula One racing to new heights of performance and innovation.



A photo of the 3D color printed McLaren 17D Formula One front wing endplate. The colors visualize the complex flow a fraction of a millimeter away from the surface of the wing.

Mastering the Art of Front Wing Endplate Design

Professor Matteo Parsani and his team of scientists and engineers at King Abdullah University of Science and Technology (KAUST) are conducting groundbreaking research on the front wing endplate in Formula One racing. Their work involves high-performance computing simulations from the Advance Algorithm and Numerical Simulations Lab (AANSLab) and 3D printing capabilities of the Prototyping and Product Development Core Lab (PCL). The primary focus is on optimizing the front wing's design to enhance downforce, leading to improved grip and faster cornering speeds, acceleration, and braking for faster lap times. To understand Formula One car aerodynamics, Parsani used the Shaheen XC40 supercomputer at KAUST to analyze airflow around the endplate and worked with the PCL to interpret the simulation outputs.

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