



UTFR Runs CFD Simulations in the Cloud to Optimize Formula SAE Car Design

Objective

To make use of HPC resources to optimize the aerodynamic design of this year's formula race car.

Approach

Using Siemens' Star-CCM+, which is a software application already available to users on the ACTnowHPC cloud, the team ran CFD simulations to tweak the design of important parts such as the front wing package.

Cloud Matters

ACTnowHPC gave the team access to high end cpus and a high core counts that were not previously available to them. ACTnowHPC runs on bare metal hardware, not virtualized machines, in order to reduce run times and optimize results.



In early 2018, the team of students partnered with Advanced Clustering to make use of the company's on-demand cloud, ACTnowHPC. Using Siemens' Star-CCM+ to run computational fluid dynamics

simulations, the team developed numerous iterations of the front wing's end plates.

Front wings are critical to formula car design because this area has a significant effect on the aerodynamics of a car. Why? Because it precedes the rest of the car and directs the airflow back toward the rest of the vehicle.

"What we have done is transfer our simulations into the cloud," said Jonathan Lee, senior aerodynamics member of the University of Toronto Formula SAE Racing Team. "Previously we were limited by our personal computers, so we had to learn how to set up our simulations in such a way that we could make full use of the high performance computing resources that Advanced Clustering's cloud had to offer."

Case Study

University of Toronto Formula Racing

“Our efficiency has spiked massively. For example, for our front wing design, we have been able to increase our estimated downforce by 25%. That is a very promising start.”

- *Jonathan Lee, senior aerodynamics member*

The team was new to HPC cloud usage but onboarding was simple thanks to the support of Advanced Clustering's engineers, Lee said.

Challenges

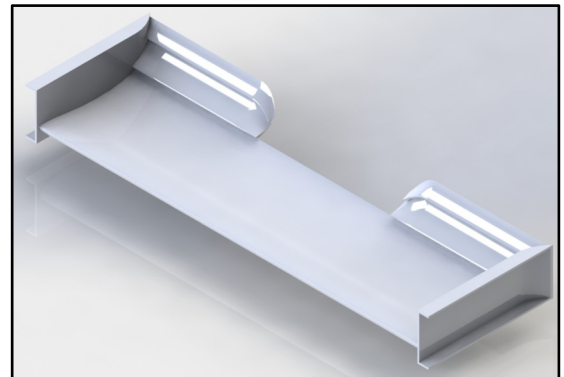
Our biggest challenge was expanding the overall scope of our simulations. We had to research how to use all of the available resources in order to expand the parallel computing power, using more nodes together so that we can run more accurate full car simulations rather than partial or half car or 2D simulations.

ACTnowHPC gave us access to high end cpus and high core counts. The team previously was limited to running CFD simulations on their personal computers, which is very limiting given the nature of CFD. You need high end resources in order to effectively run CFD simulations.

The team spends a year producing each new car and is now developing the vehicle known as UT19. The design work is nearly complete, and the team will spend the winter building the car, which will make its debut for the first competition May 8-12, 2019 at the Michigan International Speedway.

Benefits

“Our main benefit in using ACTNowHPC is being able to run more accurate simulations



The final design of the theoretical end plate, which has been the basis of most of the simulations being run by the team.

thanks to the powerful cluster that it provides,” Lee said. “I am able to run simulations without impeding other tasks. Running simulations in the past on our personal computers made it impossible to run other tasks while it was running. Our efficiency has spiked massively. For example, for our front wing design, we have been able to increase our estimated downforce by 25%. That is a very promising start.”