



Ansys + FEM, Nagoya University's Formula Team

“When developing a student formula car, time and funds are limited. Ansys simulation software enabled us to use time and resources efficiently, achieving our development goals in a short time.”

— **Heishiro Fukuoka**
Aero Development Leader / FEM

/ How Nagoya University's Formula Team Efficiently Develops Formula Machines

At its core, Formula Student is a design competition that provides students around the globe with an opportunity to design, build, and test a Formula-style racing car. Nagoya University's Formula team FEM participates in Formula SAE Japan (FSAEJ), a branch of this competition founded in 2003.

Not only does FEM want to win this competition — a goal they have accomplished previously — but they are also aiming to design the first electric vehicle (EV) to achieve overall victory.

/ Challenges

As a student team, FEM has limited time and funds to contribute to the FSAEJ competition, making efficiency imperative. At the same time, the team can not sacrifice accuracy because they need to perform detailed structural and aerodynamic analyses of composite materials to gain results that they can reproduce in a real vehicle. As a result, FEM turned to Ansys simulation software to perform multibody dynamics (MBD) analyses.

/ Technology Used

- Ansys Composite PrepPost (ACP) in Ansys Mechanical™ structural finite element analysis (FEA) software
- Ansys Fluent® fluid simulation software

/ Engineering Solutions

FEM applied simulation analysis to their work to better visualize and optimize their designs. They relied on Ansys software for its:

- **Visualization capabilities.** Ansys simulations offered the ability to view detailed stress distributions, pressure distributions, and flow at any location.
- **Mesh settings.** With Ansys software, FEM could make detailed mesh settings and link these to quantitative indicators (such as y^+) for confirmation.

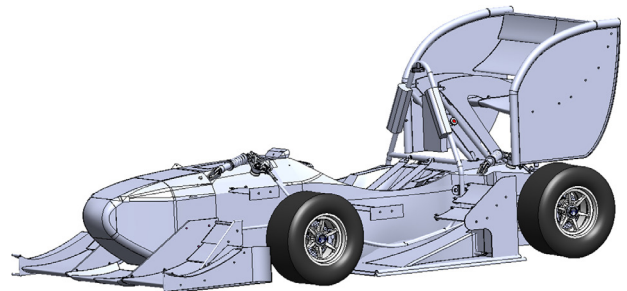
/ Benefits

With Ansys simulation software, FEM was able to overcome the major obstacles they faced when designing their Formula vehicle.

- By using simulation, the student team was able to progress more efficiently. For example, the detailed visualizations generated by Ansys software were ideal for immediate reflection when designing their Formula Student machine, in which time was of the essence.
- With Ansys simulation, FEM was able perform an aerodynamics analysis of a full-machine model, which would have been challenging to do without simulation.



Nagoya University's Formula team FEM and the vehicle they developed



An Ansys simulation of FEM's Formula-style racing car

/ Group Description

The Nagoya University Formula team's name, FEM, refers to both "Formula entertainment manufacturer," which means that they will continue to produce interesting Formula cars, and "free entry many minds," which indicates that many students can carry out their activities freely.

FEM has been competing in FSAEJ using EVs since 2017. They are the only competitor in Japan using a carbon monocoque four-wheel in-wheel motor-driven machine. Last year, FEM won the EV class championship.

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