University of Texas - Arlington

Drivers...Start Your *Simulation*? University of Texas – Arlington uses Altair SimLab™ and Altair Optistruct™ to design an adjustable pedal box for their Formula SAE racecar

Overview

Formula SAE is a collegiate design series run by Society of Automotive Engineers (SAE), which challenges students to design, build and compete with an open wheel style car across various events. The competition pitches various teams across different static events focusing on the teams engineering design decisions, cost planning, marketing strategies and vehicle inspections. The teams also have to compete under various dynamic events like acceleration, skid-pad, autocross and the endurance run where even the fuel economy is checked. University of Texas – Arlington (UTA) Racing FSAE team was founded in 1976 and has been consistently competing at various competitions across the United States, as well as the United Kingdom, Japan and Australia. UTA racing has been using Altair Engineering's tools to validate and improve designs of various components of their racecar. In this case it's the pedal box the team developed for their 2019 car.

The team used Altair SimLab for preprocessing, Optistruct for solving and HyperView for post processing of the result. Using SimLab, the team was able to reduce the setup time for the assembly simulation by more than half and helped them iterate multiple designs in a short amount of time.

Team History and Structure

For more than 37 years, the team has built more than 30 cars while securing podium finishes in the United States, United Kingdom, Australia and Japan. The current car, F-19 features a 4130 chromoly steel spaceframe and suspension components, carbon fiber rims and aero package along with un-sprung aero, combustion powertrain and data acquisition systems. The F-19 team was divided in to nine subsystems (aerodynamics, chassis, suspension, drivetrain, engine, ergonomics, composites, data acquisition and electrical) which were led by a chief engineer who was responsible for systems integration and major design goals. All the team members including the chief engineer were led our team captain and

UNIVERSITY OF TEXAS ARLINGTON

Industry
Education

Challenge
Redesign the pedal box assembly to make it stiffer, lighter and easier to manufacture.

Altair Solution
To redesign the pedal box out of aluminum components instead of carbon fiber bits. This would make it easier to manufacture and modify if necessary.

Benefits
- Improve the stiffness-to-weight ratio
- Speed up design time and achieve accelerated build cycle deadlines to improve the car by testing for ample amounts of time
- Helped the engineers involved to develop their knowledge regarding computer aided engineering (CAE)

worked closely with our team manager (finance and marketing director) and our faculty advisor Dr. Robert Woods.
UTA Racing is affiliated to the Mechanical and Aerospace (MAE) department of The University of Texas at Arlington. For more information about the team, please visit: www.utaracing.com

Challenge

One challenge the team had for this year was to redesign the pedal box assembly to make it stiffer, lighter and easier to manufacture, in order to meet the design goal set for the 2019 vehicle. The previous pedal box assembly had a carbon fiber and foam core body with aluminum pedals and mountings. In 2018, the team had trouble with the body flexing and needed reinforcement, which unfortunately made the body heavier than originally designed. Additionally, the time spent on design and simulation was long.

Solution

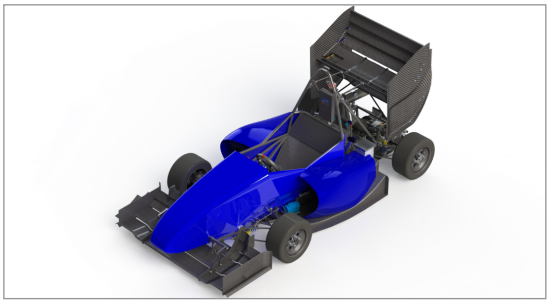
The solution was to redesign the pedal box out of aluminum components instead of carbon fiber bits. This would make it easier to manufacture and modify if necessary. Using Altair's SimLab for the simulation study, the meshing delivered a quicker and well-structured output. The model was solved in HyperMesh using Optistruct. After various designs were evaluated and selected, the team then manufactured all components involved in the same way.
The pedal box was designed to be adjustable for various drivers and especially to meet the FSAE rules for 95th percentile male and 5th percentile female diver templates.

Results

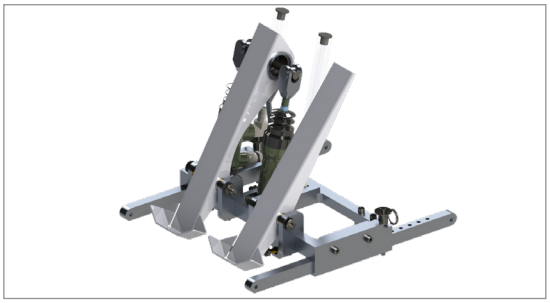
Using SimLab for setting up the simulations study, the team was able to reduce simulation time by more than 30 percent, which helped evaluate more design iterations in a short timeframe. The final parts designed were 20 percent lighter and met all the pre-set performance goals. The assembly was also easier to manufacture and better on the "Cost Report" event, as compared to the carbon one.
The constant support from Altair Engineering helped the team achieve 3rd place overall, 2nd in engineering design and 3rd in the autocross event at FSAE Lincoln 2019.
In summary, Altair Engineering products helped UTA Racing achieve:

- Improve the stiffness-to-weight ratio
- Speed up design time and achieve accelerated build cycle deadlines to improve the car by testing for ample amounts of time
- Helped the engineers involved to develop their knowledge regarding computer aided engineering (CAE)

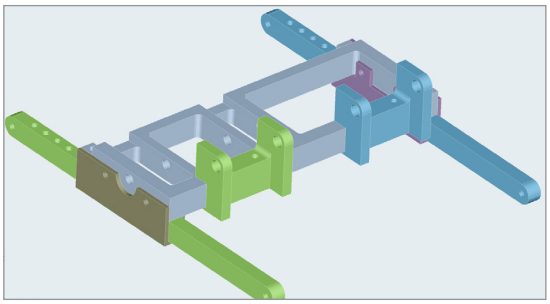
To know more about Altair University sponsorship, visit altairuniversity.com/sponsorship.
We would like to thank Altair Engineering for their unwavering commitment and support, as well as helping us achieve the great results we had this season.



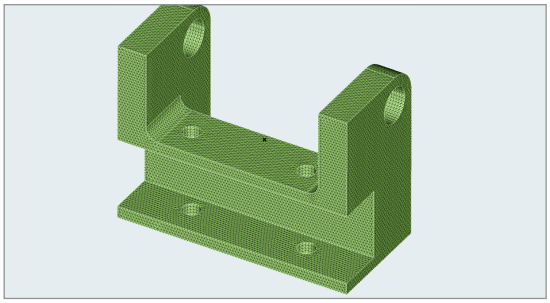
F-19 assembly render



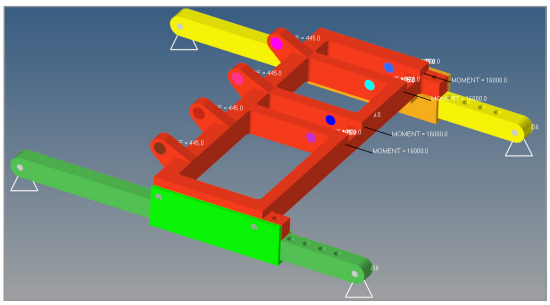
Pedal Box Assembly



Mesh Preview in SimLab



Mesh quality example



Simulation setup