

# Gator Motorsports

Automotive/Formula Racing



Images courtesy of Gator Motorsports, Inc.

**SAE INTERNATIONAL'S FORMULA SAE** is an engineering design competition for undergraduate and graduate students. The competition provides participants with the opportunity to enhance their engineering design and project management skills by applying learned classroom theories in a challenging competition. The engineering design goal for teams is to develop and construct a single-seat race car for the non-professional weekend autocross racer with the best overall package of design, construction, performance and cost.

Gator Motorsports is the Formula SAE team based out of the University of Florida. At Gator Motorsports, the opportunity to design, manufacture, and build a Formula-style racecar is more than just an extracurricular pursuit, it is a passion. Each May, Gator Motorsports competes against 120 teams from all over the world in the Formula Society of Automotive Engineers (FSAE) design competition in Michigan. This competition assesses the team's ability to not only engineer and produce a reliable, high-performance vehicle, but also its ability to organize and manage a team to develop a feasible product for market. The program provides students with the technical, teamwork, and project management skills required to transition seamlessly into careers in industry.

Gator Motorsports has been extremely successful in recent years with a 9th place overall finish in 2016 and a 2nd place finish in 2015.

For the 2017 season, the team at Gator motorsports is redesigning some of the critical components of its vehicle including its pedal box, as well as suspension bell cranks.



## INDUSTRY

Automotive/Formula Racing

## CHALLENGE

Decrease the weight and increase the strength of Formula Racing car parts for better competition performance and faster design.

## SOLUTION

Concept generation and optimization utilizing solidThinking Inspire to redesign and increase performance of the vehicle's bell cranks and brake pedal.

## RESULTS

- Decrease in bell crank weight by 6.6%
- Decreased bell crank max stress by 1,000 psi
- Increased stiffness in both bell crank and brake pedal
- Increased factor of safety results for brake pedal
- Decreased design time

Byron Cheung is a third year mechanical engineering student at the University of Florida who is serving as the team's Control System Lead. In this role, Byron is responsible for the design of the pedal box, steering wheel, and ergonomics systems. Byron mentioned, "This year we were developing a new pedal box tray for the car so we had to redesign the brake pedal to fit. Some of my other colleagues had used solidThinking Inspire in the past, so I figured I would try it to see if we could improve the vehicle's performance. In addition to the brake pedal redesign, some of my colleagues also worked to redesign the cars new bell cranks."

## SOLIDTHINKING INSPIRE IN THE DESIGN PROCESS

The first parts that Gator Motorsports focused on for their latest vehicle were the bell cranks. Byron explained, "For this design, we focused on all of the connections and loads, as well as kinematics of the system. We first measured how far the suspension system could safely travel and then used our data logging system to find the maximum forces on the pull rod. From there, we applied the different forces to different locations on the bell crank in Inspire. Inspire then used these loads to generate the optimal structural design for the bell cranks."

The resulting optimization was then refined and put into production. The new design resulted in a 6.6% weight decrease over the prior year's bell crank, as well as a reduction in max stress by 1,000 psi, all while increasing the overall stiffness of the part that was produced with 6061-T6.

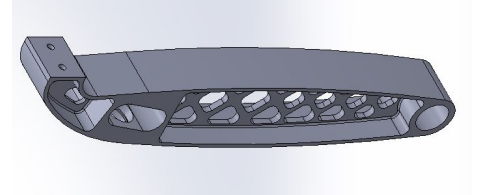
Due to a pedal box redesign, the next part that the team worked on with Inspire was the cars break pedal. Byron mentioned, "The process for designing the pedal in Inspire was great, after the team viewed a few online tutorials, we were comfortable enough with the program to apply loads and preform a full optimization of the pedal. In all, the whole redesign took less than two weeks from start to finish." The redesigned pedal resulted in a significant increase in factor of safety. The team is currently working on producing the part so it is ready for the team's first racing event in Brooklyn, Michigan early next year.

## WHAT'S NEXT?

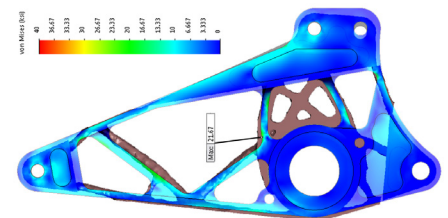
As the design phase for this year's vehicle wraps up, Byron mentioned that the successful usage of Inspire has encouraged the team to use it on multiple new parts in the future. "For next year, we have plans to try Inspire for aerodynamics of our end plates, as well as wing clevises. We have found it to be a very useful tool for the team to learn and use."



Brake pedal Optimization from solidThinking Inspire



Final brake pedal design based off of Inspire optimization



Inspire optimized bell crank overlaid with refined design analysis



Redesigned bell crank compared to old bell crank

## ABOUT GATOR MOTORSPORTS

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