CONQUERING ROUGH TERRAIN

The Baja SAE competition challenged students from Brazil to develop a vehicle that can maneuver over very rough terrain.

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One of the most highly recognized collegiate engineering competitions is the Baja SAE, a worldwide off-road design competition. Engineering students are challenged to design and manufacture all-terrain vehicles based on a defined set of regulations. Teams compete with other universities from around the world to overcome grueling off-road dynamic obstacles during a four-hour endurance race. Universidade Federal de Santa Catarina's team — Equipe UFSC Baja SAE — from Brazil is one of the leaders in the circuit and has competed for over 18 years in regional, national and international competitions. The team focuses on topics outside the scope of material normally covered in engineering classes. This provides an opportunity to solve engineering challenges and improve engineering and design skills that will better prepare them for their professional lives — while getting a taste of the motorsport competition environment.

Equipe UFSC qualified in 2013 to compete at the international level in the Baja SAE World Challenge. The ultra-competitiveness of this event demands more than workshop time to develop improved vehicle components. Competing against some of the world's brightest up-and-coming engineers, UFSC turned to ANSYS Workbench to optimize different components of the vehicle. After initial studies, three systems were selected to be improved: chassis, suspension links and wheel mounts.

The team focused mostly on the trailing arm suspension link, an integral part of the Puma and Jaguar endurance vehicles that UFSC uses. In one competition, the suspension arm fractured from stress applied on the part. To correct this issue, the team used ANSYS DesignModeler to import a solid model of the trailing arm suspension link into ANSYS Mechanical, which helped to simplify the model and reduce processing time while maintaining accuracy. Displacement restrictions, forces, pressures, accelerations and other conditions were considered during simulation to rapidly optimize the design. After running static structural, linear buckling and modal simulations, the team realized that the suspension link had regions of high stress near the steel plates. To ensure that a fracture would not occur in the new design, students simulated the vertical deformation of the arm to confirm that maximum deformation was less than 3 mm — a value that would prevent the fracture that occurred in the previous vehicle.

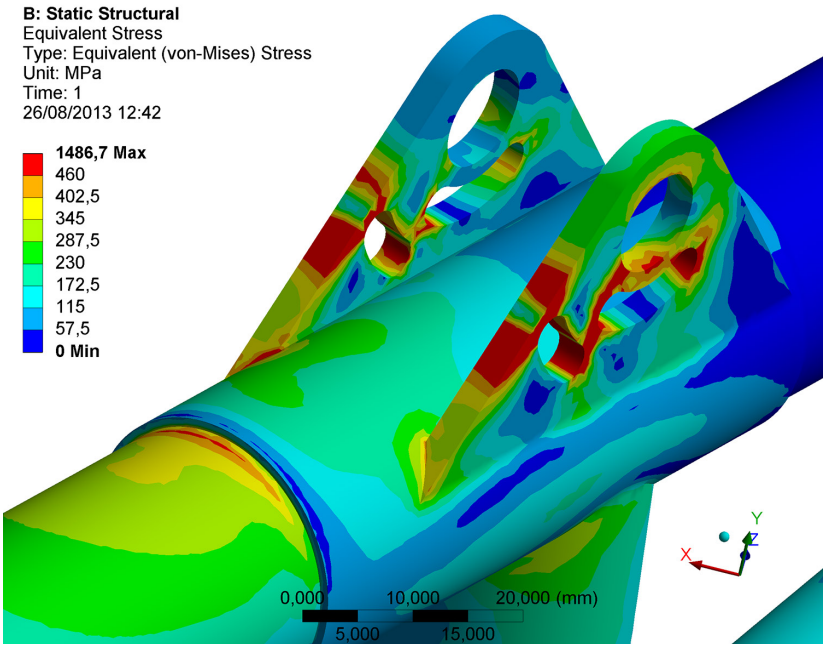
UFSC Jaguar showing trailing arm suspension linkage on bottom right

Simulation provided the team with insight into the most critical components of the vehicle.

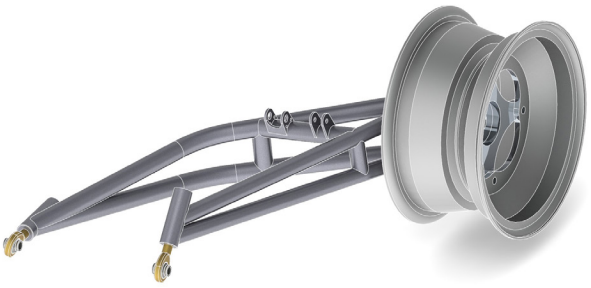
After studying the simulation results and improving vehicle components, UFSC selected a more reliable design than the previous vehicles with a lighter, more solidly constructed frame and components. Simulation also provided the team with insight into which critical vehicle components could be improved and monitored in future designs.

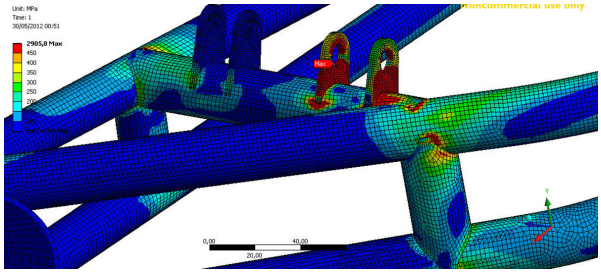
In the 2013 Baja SAE World Challenge in New York, Equipe UFSC finished 20th overall, securing top-20 rankings in five categories, including fifth in overall design. Simulation helps the students to rapidly develop improvements to the vehicles and will assist the UFSC Baja team to remain competitive on an international level for years to come.

Learning and Making Engineering Fun
Every year, students around the world use simulation in engineering competitions that are not only fun but prepare them for future careers.

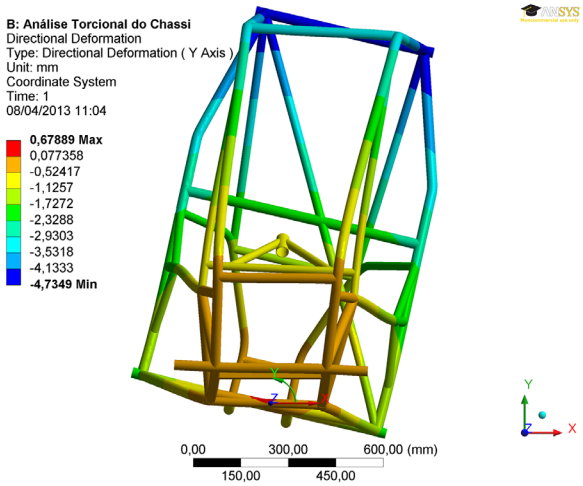


Shocks support stress simulated with ANSYS Mechanical within ANSYS Workbench

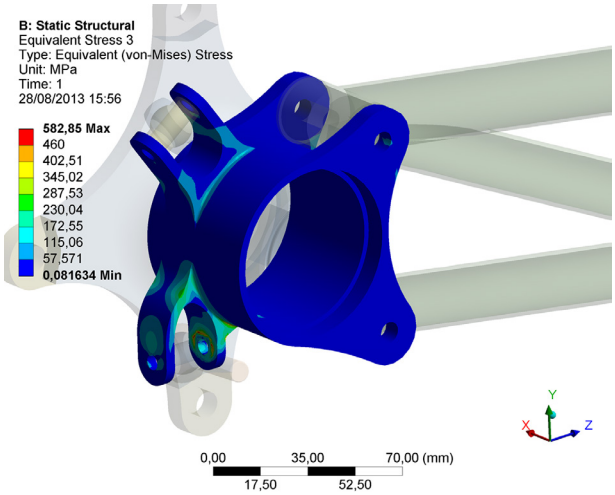




To prevent fracture of the trailing arm suspension link for the Baja vehicle, the team performed static structural, linear buckling and modal simulations. After finding regions of high stress near the steel plates, students simulated the deformation to ensure that fracture would not occur.



Torsional deformation of chassis



Simulation of wheel mount