CASE STUDY

Altair HyperWorks Helps Joe Gibbs Racing Optimize Race Car Handling Characteristics

Overview

Using OptiStruct from the Altair HyperWorks computer-aided engineering (CAE) suite of software tools, Joe Gibbs Racing was able to significantly redistribute vehicle mass and improve ride handling characteristics to design a more competitive race car.

Business Profile

Joe Gibbs Racing (JGR) is one of the premier organizations in NASCAR, currently fielding three NASCAR NEXTEL Cup Series teams, two NASCAR Busch Series teams and a driver development program. Its driver lineup consists of Tony Stewart, Denny Hamlin and J.J. Yeley in Nextel Cup; Hamlin, Stewart, Aric Almirola, Kevin Conway and Brad Coleman in Busch; and Marc Davis and Joey Logano in the NASCAR Busch East Series. Based in Huntersville, N.C., and owned by Joe Gibbs – a three-time Super Bowl-winning coach, a member of the Pro Football Hall of Fame and current coach of the Washington Redskins – JGR has competed in NASCAR since 1992, winning three Cup Series championships and over 70 NASCAR races, including three Brickyard 400s and the 1993 Daytona 500.

Challenge

Designing a car capable of winning a NASCAR racing championship is challenging because competition regulations set strict limits on the vehicle's dimensions and properties. For example, the car's weight must not be under a certain limit even though it could benefit from the lesser weight by allowing an increase in the performance characteristics. Joe Gibbs Racing is also up against limited timeframes for component redesigns which would be applied to a new car for an upcoming race.

Figure 1.
NASCAR vehicle suspension

OptiStruct comes up with designs we never would have thought of. So far, the software has taken more than nine pounds out of the front end of our cars, while reducing design time significantly.

Daniel Olson
Engineer
Joe Gibbs Racing

Solution

Although Altair OptiStruct is often used in industry to reduce structural mass, the goal at Joe Gibbs Racing was to redistribute component material to adhere to regulations that require minimum vehicle weight. Joe Gibbs Racing engineers applied Altair OptiStruct to redesign key suspension components and find the optimum material distribution for them. This mass redistribution allowed for optimal handling enhancements based on different track configurations. Figure 2 shows an optimized suspension sway bar arm. By reducing its mass by 37 percent through optimization, material can now be moved to other areas to improve the car's overall handling characteristics.

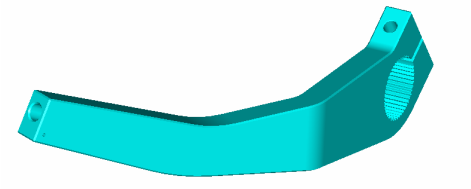

Figure 2a. Sway bar arm design space

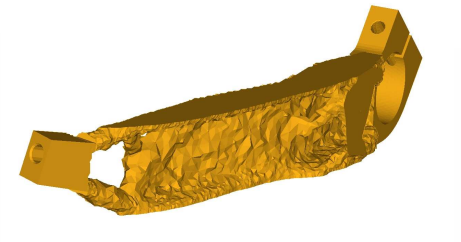

Figure 2b. OptiStruct proposal

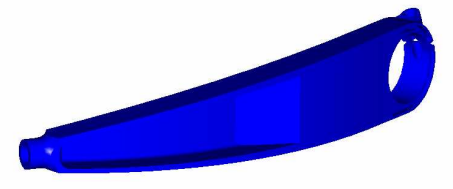

Figure 2c. Final design

Benefits

Optimization of various car components not only improved the handling characteristics of the vehicle but OptiStruct's concept design optimization approach also reduced design time by more than 30 percent on the overall structure.

By using OptiStruct, we are able to influence design cycle time significantly. OptiStruct also allowed us to validate our designs in a timely fashion, which is much needed for the fast-paced Nextel Cup racing circuit.

Nelson Cosgrove
Engineering Manager
Joe Gibbs Racing

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