

Pratt & Miller Engineering

Automotive Racing Vehicles

United States of America

www.prattmiller.com

ANSYS®

Mechanical Solution

Overview

Pratt & Miller Engineering is one of the world's premier firms for designing and fabricating racecars and providing trackside expertise and services. The company provides a full range of services from concept development through detailed design, manufacturing and racing team support. Customers include clients such as General Motors, Ford, tier 1 automotive suppliers, and companies in the aerospace and defense industries. The company relies heavily on simulation technology integrated into its product development program to increase vehicle speed while compressing design cycles and meeting the maintenance needs and life expectancy of the components. Analysis is critical in maximizing vehicle performance within the boundaries of strict racing guidelines regulating variables such as car length, width, height, and dimensions of aerodynamic devices. Pratt & Miller has achieved considerable success in prestigious world-class competition including the Daytona 24 Hours, the 24 Hours of Le Mans, the 12 Hours of Sebring and Road Atlanta's Petit Le Mans. Their Corvette racing program has achieved major wins in these series, and the debut year for Team Cadillac in 2004 produced three wins and a close battle for the Speed World Challenge GT series.

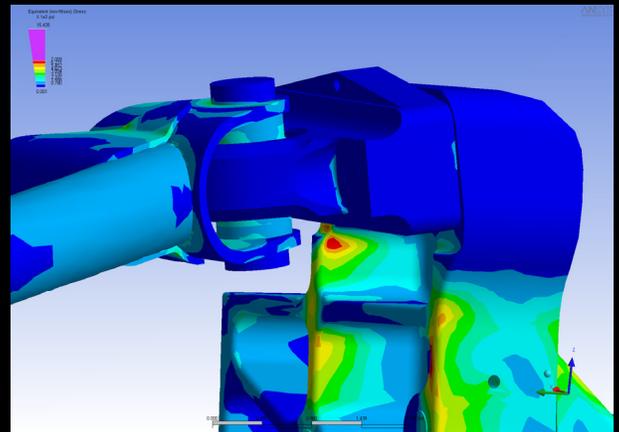
Testimonial

"ANSYS technology is a key part of our success in using simulation-driven design throughout the process of developing winning racecars and continually improving vehicle performance. Fast turnaround of development projects is essential in the racing business to minimize vehicle downtime and implement improvements as soon as possible, often in a matter of hours. Features such as automatic contact element generation enable us to study suspensions, powertrains and other complex assemblies quickly and accurately. Our experience with ANSYS software has instilled a higher level of confidence in our design and analysis methodologies to remain at the forefront of the pack at the race track."

Gary Latham
Design Group Manager
Pratt & Miller Engineering



Pratt & Miller engineers use ANSYS tools in the development and continual redesign of parts for their newest racecar, the Cadillac CTS-V.



ANSYS DesignSpace study of an automotive front suspension shows high-stress area as a red hot-spot where the upright fails on impact.

Challenge

One of the challenges in racecar design is developing components that will minimize the time and cost effects of crashes. In many cases, some parts are designed to fail for the protection of other more critical and expensive components. Fast turnaround of these projects is essential. This was the case in analyzing a crash-damaged expensive upright on a front suspension of a Cadillac CTS-V racecar. Engineers had to quickly redesign the assembly so a lower-cost and more easily replaceable upper control arm would buckle and fail instead of the upright. Physical prototype testing would have been too time consuming and costly. And because of the number of interconnected parts, modeling and analyzing the complete assembly proved to be difficult using a conventional FEA package.

Solution

Pratt & Miller accurately simulated impact conditions on the CTS-V suspension assembly with ANSYS DesignSpace. Automatic contact element generation enabled engineers to model the complete assembly, including interconnected parts and the pivoting motion of the spindle and ball joints. Analysis revealed a high stress area precisely where the upright failed upon impact. Iterating between DesignSpace and the UGS CAD system, engineers quickly evaluated several alternatives to shift the stress to the upper control arm. As a result of the analysis, changes were made to the design including pockets, vertical ribs, cut profiles and fillets that added less than three ounces of weight. Reducing the thickness of the control arm resulted in the required buckling characteristic along with a slight weight reduction.

Benefits

Automatic contact element generation is cited by Pratt & Miller as a significant advantage in using DesignSpace for their analysis. The software automatically detects contacting parts and creates the appropriate mesh for a variety of contact conditions including weldments of parts and movement between components. Other analysis packages require users to spend considerable time manually defining these contacts and local boundary conditions. The ability to bring CAD geometry for assembly models directly into DesignSpace without manual manipulation or conversion was also beneficial, especially in performing multiple design and analysis iterations. Using these features, Pratt & Miller engineers redesigned the front suspension parts in time for the next race series of the Cadillac CTS-V and describe the new assembly as more robust and cost effective.