SIEMENS

Fibersim

Renault F1 Team

Premier racing team reduces composite part development time by up to 30 percent with Fibersim

Industry

Automotive racing

Business challenges

Reduce product cycle time to meet demanding Formula One deadlines

Enhance precision of composite parts design and increase manufacturability

Streamline and improve composite part development processes

Gain knowledge and experience to fully leverage the value of Fibersim across parts in addition to the chassis

Keys to success

Reduce product development cycle time and enhanced part consistency by using Fibersim software in conjunction with Siemens PLM Software consulting services

Use Fibersim to efficiently develop a number of complex composite parts, including the gearbox

Siemens PLM Software professional services also enable 2009 Renault F1 Team to meet challenging deadlines

A race to get to the track

In Formula One, there is a race on the track and a race to get to the track. Most people are familiar with the race on the track, a colorful and thrilling two-hour test of driver and machine. But they are less familiar with the race to get to the track, a 16-week period in which F1 teams must completely redesign, manufacture, analyze and test their vehicles for the upcoming season. To ensure efficient resource usage and productivity during this period, the Lotus F1 Team (then racing as the Renault F1 Team) relied on established procedures.

That's especially the case with the software the team used to design and manufacture the car. The team had never before introduced new software into the production environment the first time the team used it.

But that changed in 2009. Based on the Renault F1 Team's success with previous versions of Fibersim™ portfolio of software for composites engineering, they were so confident that the solution from Siemens PLM Software would help them reduce the product development cycle time, enhance the precision of composite part designs and increase the manufacturability of parts, that the team put it into the production environment for building the R29 race car for the 2009 season. And the team did one other thing. They brought in a

The Renault F1 Team relied on Siemens PLM Software consulting services and the use of Fibersim software to optimize the development processes for composite parts on the R29 race car.

Results

Realized a savings of 20-30 percent on the time it took to design composite parts

Analyzed over a thousand plies of carbon fiber and found that Fibersim delivered 100 percent accurate data

"We found that taking a comprehensive view of Siemens PLM Software's systems and services – considering them as a complete solution – gave us the tools and knowledge to maximize our design-to-manufacturing process and significantly contributed to our ability to build the best possible race car."

"In every case, we found that using Fibersim saved us a day or two in the time it took to design these parts, which is impressive when you consider we had just implemented the new version of the software and were working with a new user interface."

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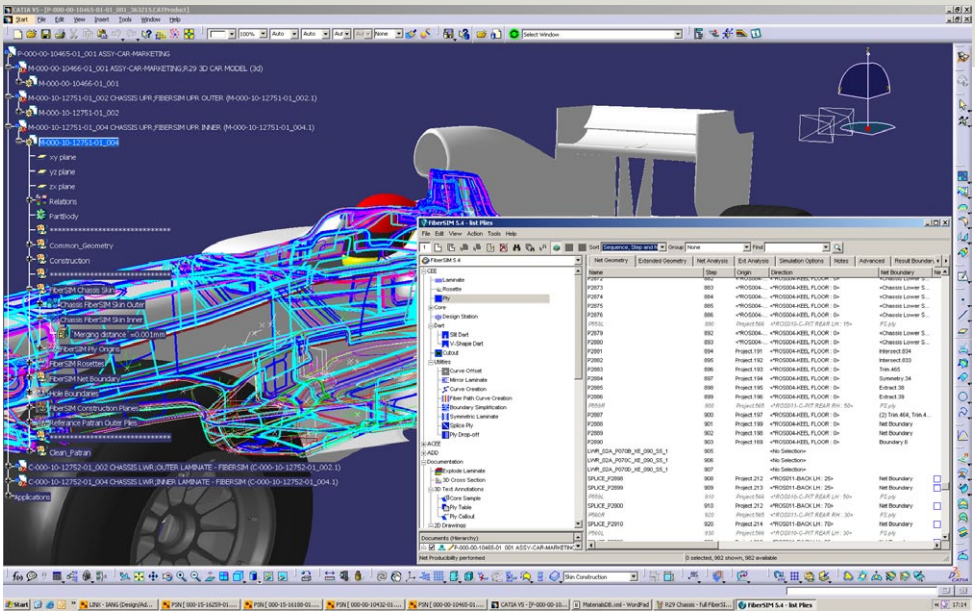
Senior CAE engineer
Lotus F1 Team (formerly Renault F1 Team)



Analysis ply boundaries were imported into the 3D CAD model of the R29 chassis using Fibersim. Prior to using Fibersim, designers received analysis data and had to reconstruct the boundaries by creating all the CAD geometry manually. The use of Fibersim eliminated that step, leading to a faster and more accurate analysis-to-design process.

Siemens PLM Software technical consultant to work with them for a month so that she could get an intimate understanding of what is involved in designing a Formula One car, which, in turn, would enable them to get the most out of Fibersim.

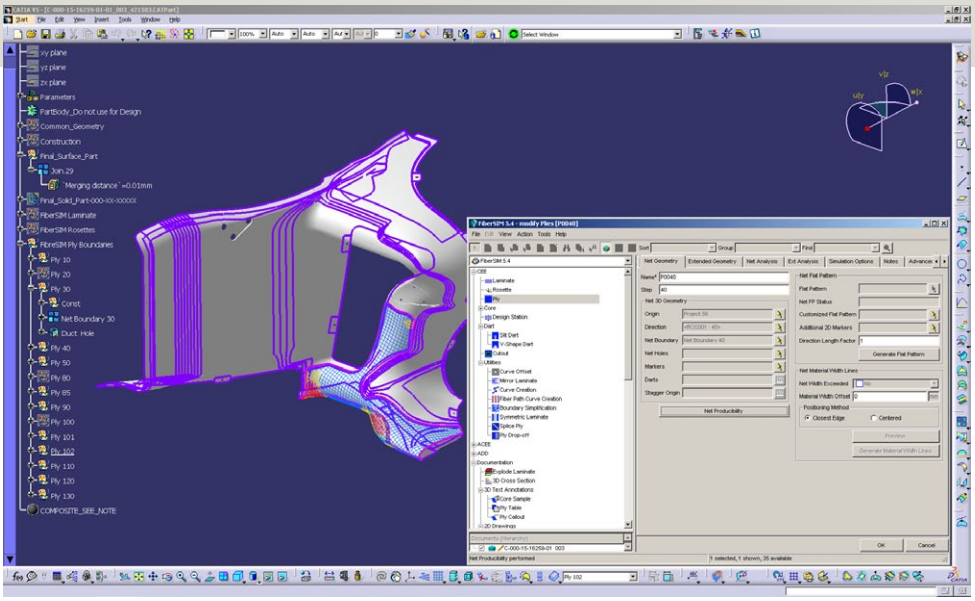
"Both decisions proved fortunate," says Ian Goddard, senior CAE engineer for the Lotus F1 Team (who formerly held the same position at Renault F1). "We found that taking a comprehensive view of Siemens PLM Software's systems and services – considering them as a complete solution – gave us the tools and knowledge to maximize our design to manufacturing process and significantly contributed to our ability to build the best possible race car."

Gearing up with Fibersim

The Renault F1 Team had used earlier versions of Fibersim to design and manufacture the composite chassis, but this time they used it from the very beginning of the design process through manufacturing on its new 3D computer-aided engineering (CAD) system used for production of the entire car, Catia® software. And the team designed a number of other composite parts using Fibersim that season, such as the gearbox, floor, side pods and wing main planes. "In every case, we found that using Fibersim saved us a day or two in the time it took to design these parts, which is impressive when you consider we had just implemented the new version of the software and were working with a new user interface," says Goddard.

"What's even more impressive is this represents a 20-30 percent savings of time in the design of these parts. That makes a big difference in the 16-week period, but it is even more critical during the racing season when a part needs to be produced and shipped in time for the next race."

Using Fibersim to design the gearbox was particularly challenging because this part has extremely complex curves and is made up of small plies – many just a few inches long that look very similar – so it is a big job to manage the plies. The gearbox consists of more than 700 plies of carbon fiber and also plays a structural role that is integral to the whole rear end of the car, and deals with extreme power transmission, suspension loads and rear wing aerodynamic loads.



For the first time, the Renault F1 Team used Fibersim to design a number of composite parts in addition to the chassis on the R29, such as the side pod shown here. Pictured is a Fibersim simulation of a single composite ply draped over the complex curvature of the part. Areas where there will be wrinkling and bridging issues that need to be corrected in the design phase prior to being manufactured are highlighted in red.

Once the 3D CAD model of the gearbox was complete, the team used Fibersim to enter ply specifications, such as material, sequence, start point and orientation of the ply layup. They then used Fibersim to simulate actual layup and check for weak points caused by fiber deviation over the gearbox curves, thus determining the optimal layup starting points and directions. The engineers then used Fibersim to create flat patterns from the completed 3D ply data, and exported ply layup patterns to an automated cutter and a laser projection machine that ensured accurate and rapid ply layup.

Because the team outsources some of the manufacturing, Fibersim's ability to capture design intent proved very important to ensuring that the person doing the layup clearly understood the design objectives. This maintains consistency in the design from car to car, a critical consideration for making the most precise performance evaluation.

Consulting services complete the solution

When the Renault F1 Team was thinking about how to approach the 2009 season and the development of R29, the team decided to bring in a Siemens PLM Software technical consultant and make her part of its design team so she could actually learn their processes and approach to designing the race car.

This proved to be extremely beneficial for both parties. For instance, when the team ran into a design scenario that they weren't sure how to deal with, the consultant was immediately able to apply her knowledge of Fibersim to assist. While talking to someone on the telephone in technical support is very helpful, it is impossible for that person to have the same depth of understanding of a particular issue as a person who is working with the team in person. And Siemens PLM Software benefited from gaining specialized knowledge of the F1 race car development process, which it could use to shape future enhancements to their software and service offerings.

"We found that by having a technical consultant on site, we were able to gain a lot of knowledge about Fibersim. It moved us away from just using the most basic functions and enabled us to get the most out of the software. It was also valuable to be able to have a dialogue with someone who was so knowledgeable about Fibersim and understood what we were doing. As a result, we were able to get a much deeper understanding of the software and together we optimized our composites development processes."

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Solutions/Services

Fibersim
siemens.com/plm/fibersim

Customer's primary business

Lotus F1 Team (Formerly Renault F1 Team) is 100 percent owned by Genii Capital. Together with the backing of Group Lotus, the team embodies Enstone's proud motorsport heritage and Genii Capital's vibrant vision for the sport's future, driven forward by a singular goal: victory in the FIA Formula One World Championship.
www.lotusf1team.com

Customer location

Enstone
England

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Precision pays off

F1 teams willingly spend tens of thousands of dollars to save mere ounces to enhance performance, so the Renault F1 Team was more than a little impressed when they took a chassis from the R29 and found that the design data generated using Fibersim for more than a thousand plies was 100 percent accurate.

Achieving that kind of precision is absolutely critical to continuously improving the car. Perhaps equally as impressive is how the partnership between Siemens PLM Software and the Lotus F1 Team has grown over the past seven seasons.

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