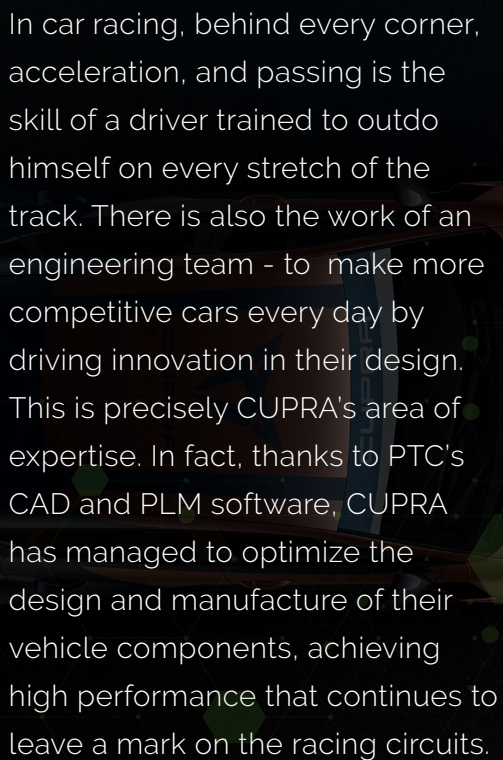


# CUPRA optimizes vehicle component design and manufacturing with PTC Creo



In car racing, behind every corner, acceleration, and passing is the skill of a driver trained to outdo himself on every stretch of the track. There is also the work of an engineering team - to make more competitive cars every day by driving innovation in their design. This is precisely CUPRA's area of expertise. In fact, thanks to PTC's CAD and PLM software, CUPRA has managed to optimize the design and manufacture of their vehicle components, achieving high performance that continues to leave a mark on the racing circuits.

## CUPRA, a sports and competition brand

CUPRA was born in 2018, a challenging and unconventional brand, based on the exciting style and the contemporary performance that inspires the world from Barcelona with innovative vehicles and experiences.

In 2021, CUPRA has taken part in 70 races scheduled for this season in TCR world, continental, and national series and championships. At the same time, the brand continues its electrification strategy through its participation in Extreme E and PURE ETCR. Indeed, the creation of CUPRA e-Racer, the world's first 100% electric passenger car, was the initial test of the brand's technological expertise. Its goal is to contribute to the future development of this racing car and to gain knowledge about high-performance electric motors that are later applied to street cars.

## From screen to reality

To make a car competitive on the track requires countless hours of effort and dedication. Part of that work has to do with the process of designing and creating vehicle components.

This task, in the case of CUPRA, had a turning point in 1998, when they began working with PTC parametric software, which at that time was called Pro/ENGINEER. In fact, before CUPRA implemented the software, the team could not design certain parts because of their inherent complexity. PTC's parametric software provided the capabilities CUPRA needed to evolve components much faster, as well as test their performance "Start using PTC parametric software was groundbreaking. In fact, it changed the way we design. We increased our efficiency and changes were easier to implement. It also reduced dramatically the parts development and lead times and increased their quality," explains Jaume

Tarroja, Head of Full Vehicle Design at CUPRA Racing.

## An exponential evolution with PTC Creo

At the beginning, only the basic features included in the software were used. Along with higher requirements, more modules were added in order to make work much more comfortable and faster when designing new components for their vehicles. "We used to design the components in 2D and then they were sent to be manufactured – with the consequent errors that could occur. Now we can view the car in 3D with all the components assembled. In fact, we can visualize the whole car on the computer screen. We can modify the car without changing its design and within a full stable environment. This has been a huge step forward for us," says Tarroja.



While the CUPRA team take full advantage of Creo software, four areas stand out:

- **Top-Down Design.** A top-down design provides a skeleton model to the engineers to define the general structure of the vehicles. Related to this, engineers can design and assemble their components with the additional benefit that, if a redesign or variation of the skeleton model takes place, these changes are automatically implemented across all components. Since the skeleton model includes a kinematic mechanism, engineers can quickly simulate the actual motion of the vehicle to determine any interference or collision between components. For CUPRA, this is a fundamental step that saves many errors and hours of design repetitions.

- **Finite element parts simulation.** This option allows engineers to simulate the stress on the components in a real-world situation. It provides a very precise view whether the design is right along with its possible weak points.
- **Sheet Metal.** It streamlines the creation of metal components. From the beginning, it has helped CUPRA to achieve lighter parts with a higher performance, better results, and economic savings.
- **Piping and Cabling.** Enables the layout of electrical wiring and cooling to be simulated. This has been a big step forward for CUPRA; previously a prototype was modeled and delivered to the supplier, who then replicated it. Now, thanks to PTC's software, CUPRA's engineers can simulate everything with the computer, including the wiring system and piping, so that when the part is manufactured, everything works well at the first attempt.

It is worth mentioning the parametric surface and freestyle feature, which for the CUPRA is used in component design. It allows curves and shapes of the developed parts to be molded freely. For this purpose, it uses subdivision molding feature that provide a higher surface control and finer details without changing the existing shape.

In addition to all these capabilities, the CUPRA roadmap includes new PTC Creo features that are due to increase CUPRA competitiveness. The new modules to be implemented include IA-controlled generative design, optimized design for additive manufacturing, and behavioral modelling. As Tarroja states, "in the mechanical components



environment, PTC Creo offers us unmatched stability and precision levels."

To complement this, CUPRA also supports PTC's Windchill software, a PLM solution. Windchill is an information management system that enables data and processes to be integrated in a cost-effective way during the whole component lifecycle from the initial idea, design, and manufacturing, up to the final maintenance of the product.

In the case of CUPRA, this application was implemented in 2014 and provided a huge step forward for its product management. With Windchill it is possible to modify a component or a full vehicle and know that a simple click will update the whole team with the latest version. This reduces errors and time.

## Two decades optimizing the components design and manufacturing process

After more than twenty years using PTC solutions, CUPRA is very satisfied with the result. As Tarroja states, "In the competitive world, you have to improve the car you made the previous year. There is a need for constant improvement with the aim of reducing manufacturing costs." And PTC solutions have played a key role in it. "We have always seen that PTC design tools have evolved along with the industry, which has increased our possibilities for improvement," he points out.

CUPRA also enjoys additional benefits. For example, CUPRA has increased its effectiveness in parts design. "We are able to create the component on the computer in 3D and perform all the stress



tests before manufacturing the part, so we can reduce design errors. Thus, when manufactured, the part works perfectly at the first attempt. In this way, the time to market of a new vehicle can be reduced by more than 20%," says Tarroja.

In parallel, CUPRA has been able to decrease the weight of components and optimize the design process. In fact, components normally have a weight optimization of around 10% without reducing their mechanical properties. This is achieved, in large part, thanks to finite element modules. Overall, this provides a cost reduction of the components of about 15%, thanks to the superior sheet-metal capabilities in Creo.

Finally, design and manufacturing time has also been reduced. A clear example is the development of the stub axle, a high-complexity part that connects all the elements on the front axle. Using PTC's Creo software tools, the CUPRA team has improved the component by reducing its weight and keeping its mechanical properties. In this way, as Tarroja explains, "Although the development time of a component changes depending on the part complexity and volume, with PTC Creo we can have the component ready to manufacture within two weeks."

In short, CUPRA can take world of racing forward with PTC Creo software.



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