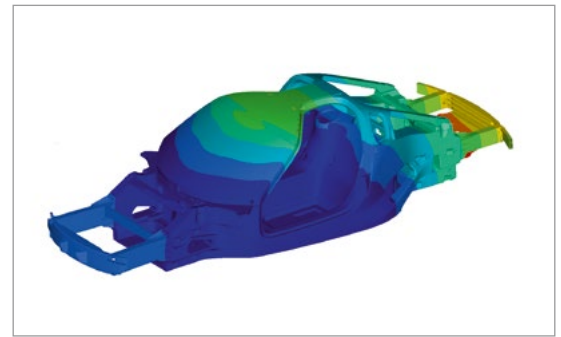


Enabling EV Excellence – Simulation Helps Rimac Improve Structural Design of Innovative Hypercar



About the customer

Rimac Automobili develops and manufactures key electrification systems for global automotive companies. CEO Mate Rimac founded the company in 2011 and has since accumulated an impressive list of clients ranging from automotive OEMs, tier one suppliers, and emerging players. In addition to providing innovative electric vehicle (EV) technology that meets environmental and safety regulations, Rimac has recently introduced a second generation of its own electric hypercar – Rimac C_Two. Headquartered on the outskirts of Zagreb, Croatia, the technology company employs more than 600 people.

When Daniele Giachi, director of vehicle engineering and C_Two chief engineer, joined the development department in 2016, he brought his outstanding expertise in vehicle architecture to the team. His extensive experience in the field of body structures from management, through computer aided engineering (CAE) structural analysis, testing, and engineering, is the reason he introduced Altair HyperWorks™ to Rimac as the main tool for vehicle development. Today he is directly responsible for definition of the body structure architecture, as well as the definition of complete CAE processes and methodology.

In Rimac's development departments, eight structural CAE engineers now work with HyperWorks. To support the structural design of the car, the team uses Altair HyperMesh™ and Altair HyperCrash™ for pre-processing. Altair Radioss™ is used to handle dynamic and quasistatic issues such as large structure deformations with high stresses and strains, which occur in typical crash or forming applications. Altair OptiStruct™ is employed for linear static and modal simulations and Altair HyperView™ is used for post-processing.



Industry

Automotive

Challenge

Structural design of the monocoque for the Rimac C_Two, representing the biggest single carbon fiber part in automotive industry so far.

Altair Solution

Simulation enables Rimac engineers to test and evaluate the behavior of different options allowing them to develop with confidence and innovate faster.

Benefits

- Time savings, material savings
- Less expensive prototypes
- Driving innovation through simulation (the possibility of testing several options, evaluating the behavior of each one, allowed the engineers to dare to go much further)

Their Challenge

One of the most important parameters in designing EV is weight. The lighter the vehicle, the more increase in vehicle range which can lead to a higher acceptance of EV. Following a lightweight approach in the development process of their concept hypercar C_Two, the Rimac engineers were tasked to design the monocoque as a single carbon fiber reinforced composite part with an unprecedented size.

The main challenge in the development of the monocoque was the material, a lightweight, carbon fiber reinforced epoxy resin composite. As composites are orthotropic and brittle materials, determining the correct properties and their inclusion in the finite element (FE) material card is more complex than for metals.

Our solution

To meet this enormous structural challenge, the engineers used HyperWorks. The goal was to have the closest correlation between real and virtual testing to minimize failure. The development process started with the part proposal and based on the results of the simulations run, the CAE team developed a concept with design engineers.

The model was then updated and tested again at each component level until the team saw perfect correlation between simulations and physical performance to achieve a design that performed as expected. The simulations performed by the vehicle engineering CAE design team involved 123 load cases. This was at component, system, and vehicle level, as well as linear, non-linear, static and dynamics simulations. The time frame for the whole development project was 5 months.

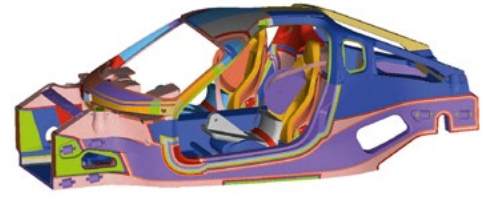
Results

Rimac was satisfied with the results of the physical tests, which correlated well with the previous FE simulations and enabled the team to come up with a monocoque design. Prototype builds of the final design were used in six crash tests, demonstrating the excellent simulation results. In addition to significant time and cost savings, simulation also drives innovation at Rimac because it pushed engineers to the next level when creating new products.

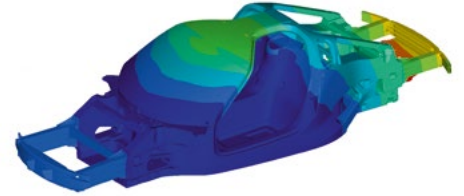
"The Altair solutions enable us to test and evaluate the behavior of different proposals which helps us develop with confidence and create new products in a short time. Simulation changed the way we develop our products and helps us stay competitive."

Gustavo Andrade
Vehicle engineering CAE manager at Rimac

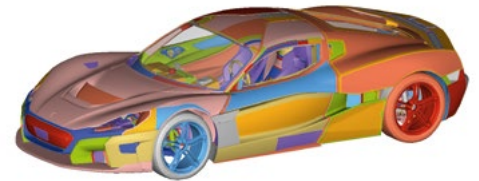
In addition to providing software licenses and specialist support, Altair introduced HyperWorks Unlimited virtual appliance (HWUL-VA), which is part of the Altair innovative cloud offer. While Rimac was skeptical in the beginning, it soon realized how it could benefit by unlimited access to this incredibly powerful infrastructure. HWUL-VA helped Rimac complete the project on time and gain an understanding of the number of resources they need for its new cluster. Convinced by the flexibility and high efficiency, Rimac will continue to draw from Altair PBS Works™ as its preferred high-performance computing (HPC) infrastructure.



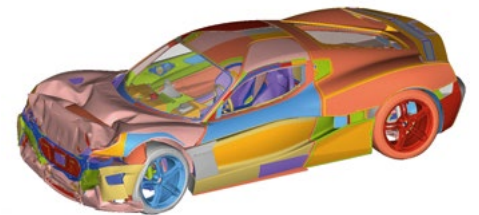
Set Up of the Simulation Model of the Rimac C-Two monocoque



Contour plot of a monocoque design



Simulation Model of the Rimac C-Two monocoque



Simulation model in a virtual crash situation

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