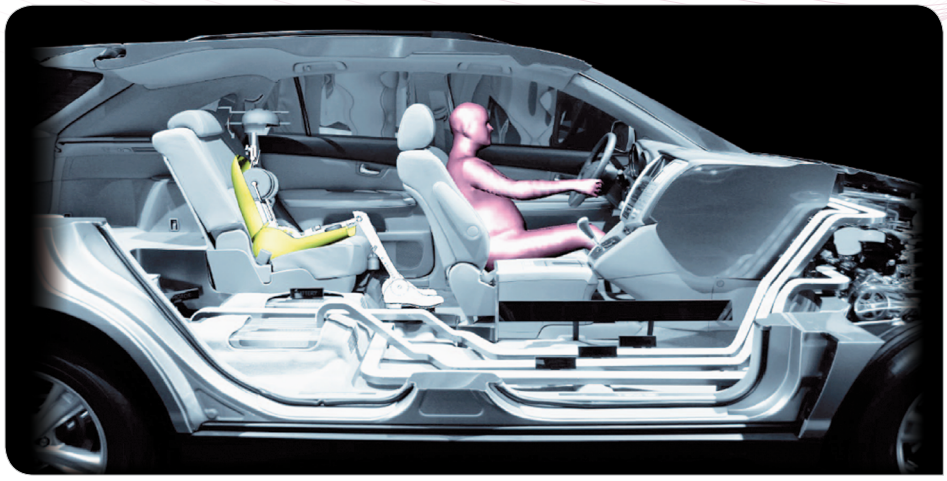
Design a comfortable, safe and light seat using ESI's Virtual Seat Prototyping



In the past decades, seat development was mainly based on physical prototypes, which were evaluated and optimized in an iterative process. Today, this procedure is less and less compatible with the demands for higher cost efficiency, innovative solutions for weight reduction, the use of recyclable materials and the increase of seat comfort and occupant safety. Therefore automotive OEMs such as FORD, GM, HYUNDAI MOTOR COMPANY, HONDA and RENAULT increasingly use ESI's Virtual Seat Prototyping for new seat designs.

Will this light seat be comfortable?

IImagine an innovative seat that is 20 percent thinner than conventional seats, or that uses a recyclable foam material. How do you check or prove that this seat is at least as comfortable as a more conventional one?

Looking for a new seat design

Seat design is continuously evolving. Automotive OEMs require a constant differentiation in their seat design and customers – who spend an increasing amount of time in their car, systematically expect improved comfort. Yet while more and more features are being incorporated inside a seat, the seat itself is expected to be thinner (to free more cabin space) and lighter (to contribute to the vehicle's global weight reduction). Consequently new seat designs require innovative solutions, and represent a real challenge for automotive OEMs seat and components suppliers.

Will this new seat ensure to the occupant the right posture?

From the car design, an average posture of the occupant is defined in the car, allowing the hands to rest on the steering wheel and the feet to operate the pedals. This ideal posture will be used by the seat designers to design the seat in such a way that the actual measured H-Point matches the Seat Reference Point defined by the OEMs. This iterative process can be carried-out virtually with ESI's Virtual Seat Prototyping solution to save time and money.

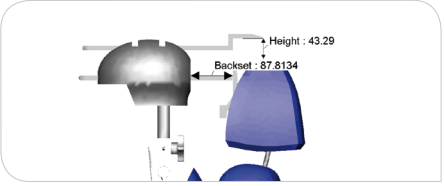
Beyond the checking of H-Point for accessibility, the backset – the distance between the head and the headrest, must be also measured. This is because an excessive distance leads to a greater impact of the head on the headrest in case of crash.

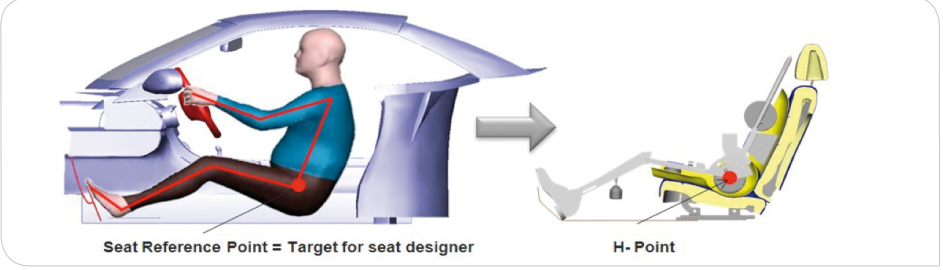
Virtual Seat Prototyping enables short and affordable iterations on seat design, including the effect of components manufacturing to reach the targeted H-Point and backset, thus ensuring the right posture in the seat.

Pressure mapping is one objective way to compare seat comfort. Virtual Seat Prototyping evaluates long-term comfort of the seat through the prediction and analysis of pressure maps for different anthropometries (body sizes), which is crucial for taking into account the specificities of local markets.

Dynamic comfort is also a key parameter for long drive comfort. This enables to virtually assess, a seat's capability to absorb vibrations, and directly improve seat comfort - and this, from a very early stage of the design process.

Finally, as customers also want more luxury features, such as lumbar support, cooling and heating systems, ESI's Virtual Seat Prototyping provides the evaluation of such systems regarding postural and thermal comfort (performance of climate seat or effect of seat heating).





Will the physical seat prototype be certified at first try-out?

The seat is what connects the occupant to the vehicle. In case of a crash, it plays a key role in driver and passenger safety by being firmly anchored to the floor and by holding the occupant's body in place. Standards like EuroNCAP define the nature of the sled test to be performed, but also repeatable processes for the sitting of crash dummies, as well as the outputs to be measured.

To ensure that the seat will be certified at first try-out and therefore reduce the number of physical prototypes, very accurate virtual tests must be performed. By taking into account the past history of the seat, through the simulation of the manufacturing processes, which leads to the final seat assembly, internal stresses can be added to the seat model. This is the key to making the virtual test predictive enough for ensuring the success of the decisive physical tests. These standard protocols can be additionally captured in end-to-end virtual processes, making the virtual certification of each design iteration easier and affordable.

How to guarantee just-in-time delivery with an innovative seat?

Seat suppliers have to ensure worldwide on-time delivery while maintaining high quality. Automotive OEMs need to check that the seat inside the vehicle meet all requirements, especially regarding safety and comfort, and this is where, in an economic context, development programs cost and duration must be scaled down to remain competitive.

The best way to answer these constraints is to anticipate potential performance issues like regulation tests failures or discomfort problems very early. This is even more important with advanced innovations like the use of composites for seat frames or new foam materials. Indeed, the properties of components will be non-uniform and will depend on the manufacturing process as well as on the sitting conditions. Taking this into account prior to comfort and safety performances is mandatory for a reliable prediction and to avoid discovering problems too late in the process.

Another way to answer to time constraints is to discover seat manufacturing problems as early as possible, before the beginning of production phase. ESI's Virtual Seat Prototyping aims at anticipating such kind of craftsmanship issues. For instance, simulation of the foam injection enables the detection of possible air traps. Similarly, simulations of the cover sewing and hooking anticipate the possible appearance of wrinkles or bridging gaps that may occur when the patches design is inadequate. It is also possible to start from an existing seat trim outline, and to generate the initial cover patches and foam shape, including overbuild.

ESI's integrated Virtual Seat Solution

Usually, virtual prototyping approaches require the use of different simulation software in order to address the whole picture. In industrial practice, such multidisciplinary approaches can only be carried-out at a reasonable cost with integrated end-to-end solutions, based on a single core model and a uniform user environment, to avoid time spent on data compatibility and model conversions.

Today, the virtual prototyping of seats is no longer a vision. This development process is increasingly used by the automotive OEMs and seat suppliers, in order to replace the traditional trial-and-error procedures based on physical prototypes. The result is not only a cost and time-to-market reduction, but also an increase of product quality, occupant safety and innovative capability.

"Using PAM-COMFORT, within a short period of time, and with few resources, ***we were able to deliver a new seat design meeting our objectives.****"*

"This simulation input can truly be considered as an ***ultra realistic model****, since it allows the simulation of the whole complex mechanical phenomena of the seat, the non-linearity of the materials, the large displacements of the cushion foam and springs, as well as the effect of the cover trimming."*

Jérôme Makala,
Head of Comfort and Safety Research Department, at Renault Group