Interior Design for Optimal Comfort and Energy Consumption

How Virtual Seat and Cabin Prototyping Support the Challenges of Electric and Autonomous Vehicle Interiors

As mobility is transforming, most automotive manufacturers are either developing or commercializing electric vehicles (EVs). The range of these electric vehicles is a critical hurdle in broadening their adoption. Typically, this is measured for average weather conditions, while in real life the varying conditions (hot, cold) may cause the activation of a cabin HVAC or climate system that reduces the range by up to 40%. In such circumstances, it is not surprising that reducing the energy consumption of every system is a critical concern.

Today, key components of a vehicle are being reinvented to meet the requirements of electric and autonomous vehicles. Here, engineering teams face an arduous challenge as they are called on to reinvent the cabin design while maintaining occupant safety and comfort and delivering highly performant vehicles. With the advent of flexible and sometimes revolutionary interior layouts and the many possible uses of the car cabin, thermal and climate systems have to be rethought to be consistent with cabin configuration and the demand for individualized comfort.

To overcome these challenges, interior and seat engineers must develop new and innovative cabin designs and iterate quickly on different scenarios without impacting the final delivery schedule. With ESI's Virtual Prototyping solutions for seats and interiors, engineering teams test occupant thermal comfort, taking into account heated or ventilated seats and the overall cabin HVAC system. These solutions, applicable from the early stage of the development cycle, support designers and engineers in engineering the thermal equipment of the cabin and seat, assuring it is optimal in terms of passenger comfort and energy consumption, for both nominal and in-operation conditions.

Prediction of seat and cabin thermal behaviors and occupant comfort that is as good as real, human models dedicated to comfort, accurate virtual seat prototypes, and cabin HVAC transient modelling are needed. Also, and most importantly, the correct interaction between all these components must be addressed.

ESI human models represent not only nominal conditions, but also predict the body's thermal behavior (passive behavior and thermoregulation) and provide thermal comfort scores to give objective characterization to an experience – thermal comfort – that may be viewed as highly subjective.

As noted, heated and ventilated seat engineering is quite complex and requires consideration of all the interactions between the occupant, the seat, and the heating or ventilation systems. Even the thermostat rules and sensor location must be defined. With all this modeled faithfully, the movement of the air and fluctuations in temperature in the cabin can be predicted by CFD techniques, to provide continuously updated information to ensure the right thermal exchanges between the seat, the occupant and the cabin.

ESI Interior Solution offers a unique capability for interior engineers to virtually test and optimize innovative cabin layout of electric and autonomous vehicles, while contributing to the car range increase in real driving conditions.

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www.esi-group.com/vehicle-interior