VEHICLE electronics

The monthly magazine for automotive electronics engineers

How Snapdragon will be used in Stellantis vehicles

Qualcomm to power Stellantis in-vehicle experiences for years

In a multi-year deal, Stellantis is to use Qualcomm Snapdragon technology for intelligent, customisable and immersive in-vehicle experiences in millions of vehicles across its 14 automotive brands beginning in 2024.

Leveraging the platforms and 5G capabilities for telematics, Stellantis hopes to meet expectations for personalised experiences that are continually upgradeable.

This will facilitate Stellantis' plan to merge all software domains into high performance computers, leveraging the Snapdragon platforms across all major vehicle domains as well as contribute to securing Stellantis' supply chain on strategic components.

The first application will be to power the infotainment system in the Maserati brand.

"Our technology collaboration with Qualcomm is another example of how we are identifying industry leaders to work alongside our passionate and talented internal teams as we transform our vehicles through a software-defined approach," said Carlos Tavares, Stellantis CEO.

Stellantis will use Snapdragon to power the in-car communication and infotainment for STLA SmartCockpit, which is being designed and engineered with Amazon and Foxconn. The platforms are engineered for high-definition graphics in touch- and voice-controlled cockpit consoles, and to deliver an immersive in-cabin experience, enabling premium audio and crystal-clear voice communications throughout the vehicle's cabin.

Snapdragon will also be used to enhance STLA Brain, increasing digital intelligence for convenience and safety, and helping enhance the in-vehicle personal assistant capabilities with intuitive artificial intelligence.

• **Qualcomm completes Arriver buy, p10.**

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GO WITH THE FLOW

Michael Ellinger and Max Hauk say the future of climate comfort optimisation lies in virtualisation

With the introduction of electromobility, the issues of air conditioning and climate comfort are becoming massively more important. This is because, unlike with the combustion engine, which can always provide sufficient waste heat for heating and operates all electrical consumers in the interior via the generator, the driver of an e-car pays dearly for any heating or cooling power required with potential range.

In addition, due to increasing competition in the industry, thermal comfort in the vehicle cabin is increasingly coming into focus as a differentiating feature. This makes it all the more important to optimise thermal management in terms of its quality and efficiency.

To date, this has required lengthy development processes, the results of which are strongly influenced by the subjective perception of the application engineers involved. These ultimately evaluate the thermal comfort in the vehicle.

Consequently, a way must be found to objectify the development of air conditioning and climate comfort. Work is therefore going on to simulate the complex thermal processes using hardware and software dummies, as well as to create a comfort specification.

Based on these results, the application work is to be virtualised to a large extent in the future, thus not only achieving a more objective result, but also saving development time and costs.

According to the LeasePlan Mobility Insights Report of February 2021, in which a total of around 5400 people from 21 European countries and the USA were interviewed, 34 per cent of participants said the limited range reduced their interest in an e-car. In Portugal and Germany, more than six out of ten respondents suffer from what is known as range anxiety with regard to electromobility.

Whereas in conventionally powered vehicles, all electrical consumers are generally operated via the alternator or, like the air conditioning system, directly by the combustion engine and thus do not usually noticeably reduce the range of a tank of fuel, the e-car supplies all functions – from acceleration to on-board infotainment – from the same energy source. It is therefore

The dummy is equipped with sensors for measuring temperatures in the cabin

essential for electromobility to make the thermal management systems in the vehicle as efficient and intelligent as possible to increase the range actually available.

Another phenomenon has been observed in recent years. Partly due to the growing e-mobility start-up scene, competition within the automotive industry is rising rapidly. To increase competitiveness, developers and users alike are placing more and more emphasis on climate comfort in the vehicle interior, particularly in the Asian market, but recently also in Europe and the USA.

Last but not least, autonomous driving will revolutionise previous air-conditioning concepts, with occupants sitting facing each other instead of facing forward, for example, resulting in the need for a completely different distribution of air flows in the passenger compartment.

For these reasons, it is necessary to develop a virtualisation strategy to map and optimise thermal management concepts much faster and better at the same time.

Efficiency

To a certain extent, virtualisation has long since found its way into thermal management development. Nevertheless, a large part of the comprehensive fine-tuning of the interior climate control still depends on the individual sensibilities of the application engineers involved, who have so far only been able to rely on objective measurement results to a very limited extent when evaluating comfort.

The application tests required for this purpose currently not only provide mainly subjective results, but they can also only take place late in the development process, since large parts of the hardware and software must already have been defined and integrated. In addition, these tests involve running numerous load scenarios in different climatic environments.

For this, elaborate test trips are made to sometimes distant locations such as South Africa or Death Valley with test vehicles and personnel, which is lengthy and cost-intensive.

To meet market demands for a high level of comfort in the vehicle in the future from an economic point of view, a

Thermal comfort in the vehicle cabin is increasingly coming into focus as a differentiating feature

development process for air conditioning and climate comfort is necessary, which instead of being based on classic test drives is primarily based on dynamic models and simulations. In this way, expensive application work is to be reduced in the long term and largely replaced by fully transient calculations.

Specialists have designed a general development process that takes into account the individual steps of climate comfort development, starting with benchmark studies, through the design of the circuits and the functional and comfort design of the cabin air conditioning with development of the climate control strategy, to optimisation and validation.

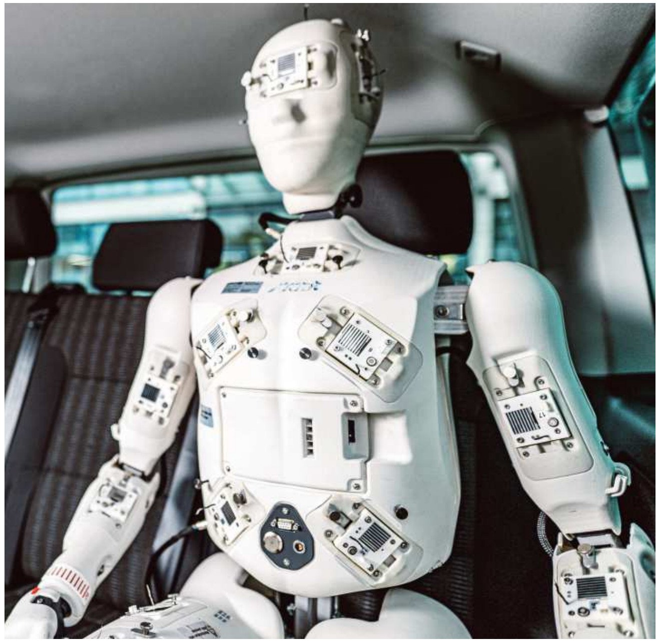
The focus of the current work on the process is on which prerequisites must be created overall to implement the desired virtualisation, and which elements must be worked out in more detail in the simulation.

Dynamics

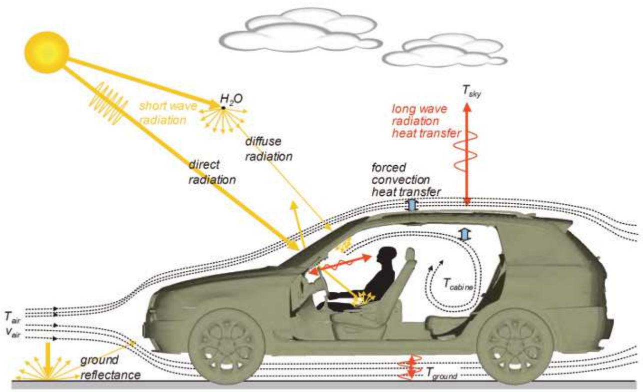
To close the gaps that still exist, engineers are developing different models to represent all the factors involved. This includes, for example, modelling the hvac component, which is the core component for controlling the air conditioning and air distribution in the vehicle cabin.

The focus here is on the one hand on mapping the thermal behaviour of the hvac to determine transiently the inlet and outlet temperatures of the cabin air on the simulation model. On the other hand, the focus is on mapping the hydraulic behaviour of the hvac to obtain a statement about the air distribution in the individual ducts as a function of the individual flap positions in the hvac and thus be able to map the air distribution in the vehicle interior.

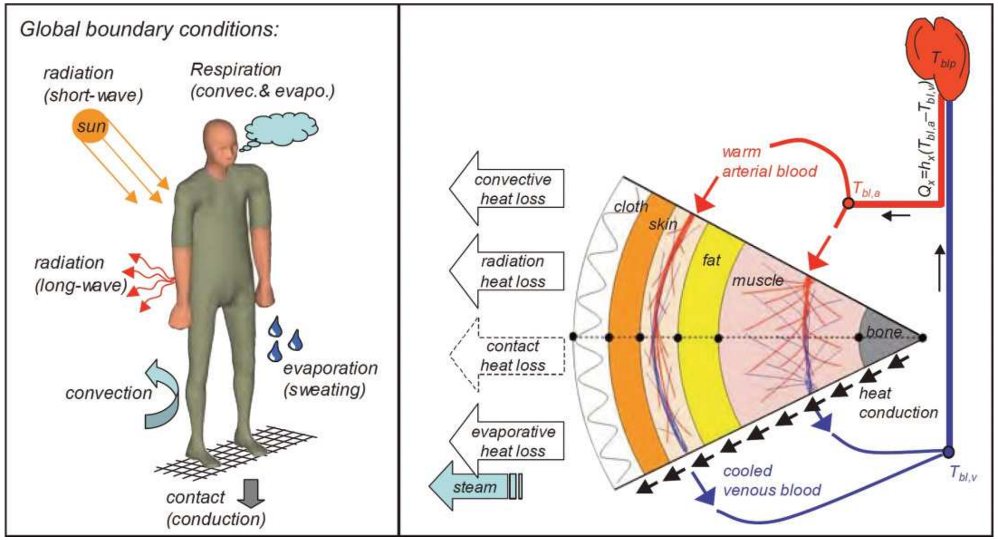
To determine the information required for this, the hvac module is measured in detail in test bench setups. To transfer the hardware measurements to the simulation, a detailed model of the vehicle cabin and occupant is also required, which is created using



The dummy's sensors are evenly distributed over the body



Effects of external climate on a vehicle



Factors measured to simulate human body reactions

simulation software.

To represent the occupants, the tool includes a complex human model that imitates the human body functions relevant for air and heat exchange such as breathing, blood circulation and sweating as well as cold shivering and considers different clothing situations.

To provide detailed boundary conditions on all parts of the body for thermal comfort statements with the human model, the tool enables a very fine and automated discretisation of the total air volume into individual air zones with a newly developed pseudo-3D approach. The simulation speed is enormously increased by the pseudo-3D approach, which is essential for the highly dynamic transient simulations.

Within the air zones, detailed statements can be made in each case about the air velocity, temperature and humidity as well as about the long-wave and short-wave radiation. Of course, in summer load cases, the position of the sun and the areas illuminated or shaded by it are automatically determined as a function of the vehicle and window geometry as well as the vehicle orientation. Since the air and surface temperatures influence each other, radiation, flow and heat conduction processes are considered on a defined component as a coupled system.

Finally, the comfort index according to ISO 14505-2, which describes the thermal sensation in vehicle cabins on the basis of the equivalent temperature, represents the basis for the evaluation of the measured and modelled thermal comfort. With the help of this index, objective statements about the influence of different dynamic factors on the climate comfort in the vehicle interior can be made. These should be available for the definition of general comfort and air conditioning targets, and consequently for the creation of universal specifications.

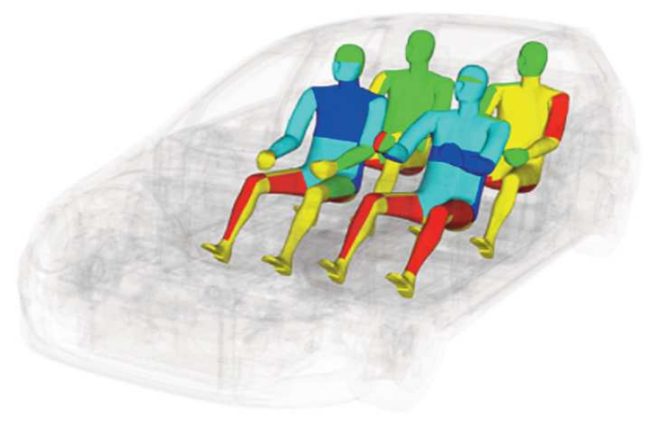
Development

Once the individual models have been correlated, the resulting simulations will have to be compared with real driving data in the coming months and any sources of error and inaccuracies in the calculations identified and compensated for. To this end, test drives have already been carried out with the dummy.

This is equipped with 31 sensors evenly distributed over the body for measuring air temperature and humidity, long- and short-wave radiation, and wind speed. A revised version of the dummy is under development. In the future, it will not only have around three times the number of sensors, but will be able to record additional values such as contact heat flows.

The effects that interact during journeys are caused by the external climate, the course of the road intraurban or out of town, and changing direct and indirect solar radiation from different angles and directions. In addition to external factors, which affect the occupants and the thermal comfort they perceive depending on their age, physical condition and body mass, the respective number of people in the passenger compartment also plays a role.

Once the simulations have been verified, the focus shifts to the final project: the numerous factors influencing the vehicle interior climate and thus the comfort value are to be evaluated and objectified in all their facets.



It is important to consider the number of people in the vehicle

Future

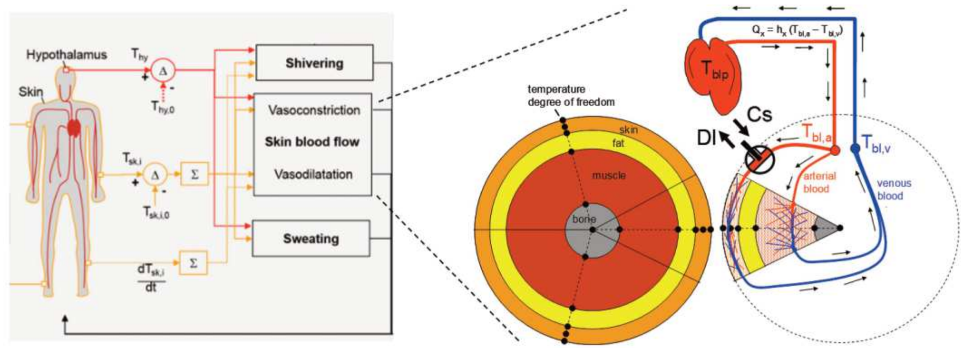
As soon as engineers can simulate these dynamic journeys with sufficient precision and speed, the last major step in the development process for air conditioning and climate comfort will be tackled.

After all, when all the pieces of the puzzle necessary for calculating the transient load cases can be reproduced virtually, this puts the specialists in the promising position of being able to derive concrete effects on the climate-related well-being of the occupants from these values.

Accordingly, objectified action instructions for the thermal management system with integrated control of the hvac system can follow. Once these dynamic processes are recorded in a comfort specification, the actual application work in the test vehicle can be reduced, namely only the fine-tuning on the final vehicle. In this way, the use of the virtual application, which can be used to address changed load cases and boundary conditions early, quickly and easily, will result in significantly reduced development time compared with manual application.

This will fundamentally change the future approach to thermal comfort assessment and application in automotive development.

Michael Ellinger is a group leader and Max Hauk a senior expert on thermal management, both at Arrk Engineering



Thermoregulation of the human body