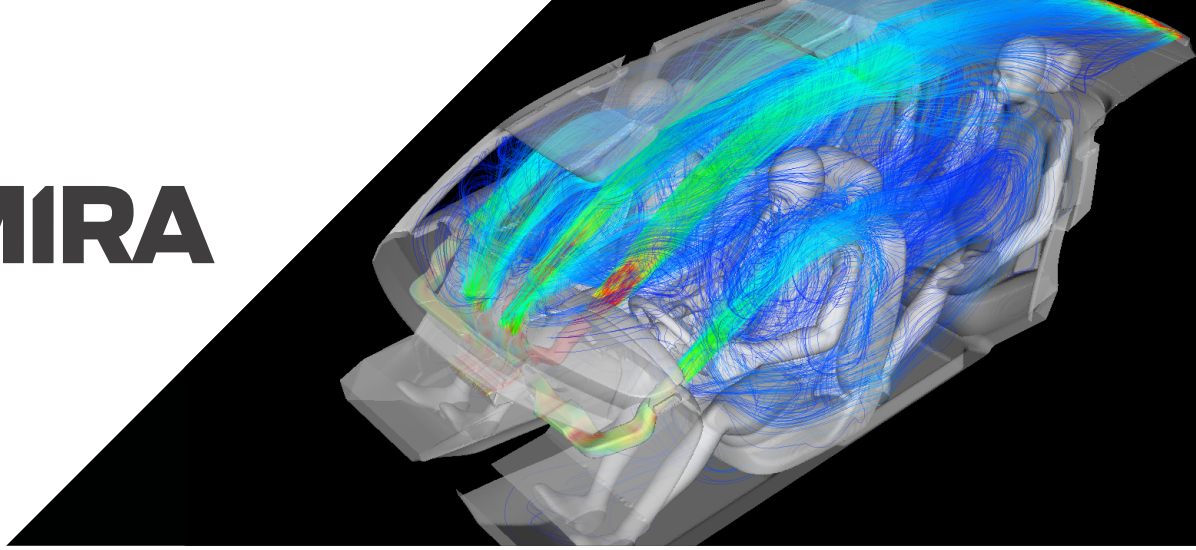


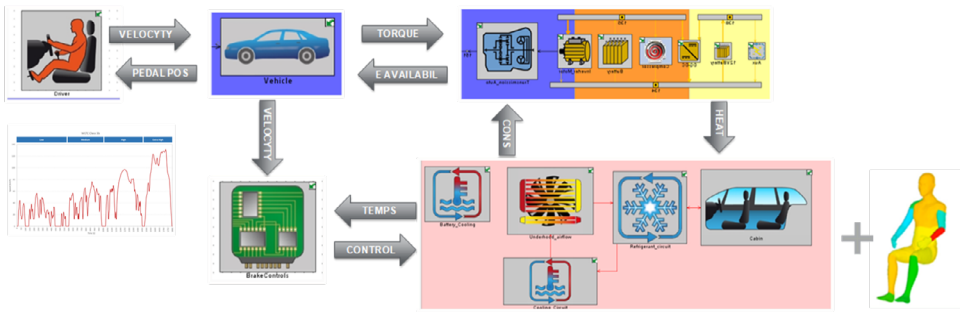
Increasing Energy Efficiency and Occupant Comfort with Thermal Simulation

Currently, the design and control of HVAC systems relies on the required heat load for the cabin that's being designed. However, this approach often fails to optimise occupant comfort directly and doesn't consider real-time variations in occupancy that can affect comfort and energy performance.

To address these limits, HORIBA MIRA has developed an occupancy-based and thermal comfort-driven, co-simulation modelling approach.

This approach links the vehicle platform model (TEMPS) to the vehicle's cabin model and feeds human comfort parameters into the HVAC control strategy to target the desired level of comfort.

The advanced cabin thermal simulation has been linked to the complete vehicle platform to assess the energy impact of each system or subsystem on the vehicle's energy consumption while ensuring passenger comfort.



Vast improvements can be made on the cabin comfort and energy efficiency by:

- Looking at new technologies to speed-up the human comfort exploiting localised effects (radiant panels, ventilated seats) and evaluating their impact on the vehicle's energy consumption
- Evaluating the effectiveness of cabin load reduction technologies (IR glazing, IR paints, cabin materials)

We are also able to develop advanced control strategies:

- Smart comfort focused self-learning algorithms based on user feedback at UI and consumption targets
- User historical based strategies
- Human comfort model integration in the ECU to target comfort instead of temperature
- Introduce a GPS data (grid-to vehicle) smart control strategy that will predict where to blow more air following the sun orientation to maintain passenger comfort
- Simulink/Simscape based cabin model to be integrated with HiL testing

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