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Vehicle Motion Management for Vision Zero

As we enter the era of autonomous mobility and electrification, requirements toward reducing system complexity, CO₂ emissions and energy consumption come along with increasing safety, vehicle performance and reliability. We address these requirements, as well as manufacturing aspects – for example in terms of wiring harness or skateboard chassis –, through the design and architecture of our Future Chassis Systems.

Another element of the overall concept is the Future Motion System (FMS) consisting of a centralized Vehicle Motion Controller with integrated propulsion energy management. This fusion provides a pleasant driving experience with a high level of motion comfort, smooth vehicle dynamics control, and extensive safety functions with reliable fallback paths. The system architecture focuses on modularity, centralization, scalability and integration of multi-domain features. It is closely coupled with the evolution of the vehicle's EE architecture, as it moves from a distributed to a standardized, service-oriented approach needed for this evolutionary step.

The underlying Vehicle Motion Control (VMC) refers to our lateral, longitudinal, and vertical control functions, implemented in the vehicle, chassis and corner modules of a modular software architecture and acting as a command center for the vehicle actuators. The VMC resides within an expanded architecture,

the Central Motion Control (CMC). CMC additionally integrates safety and stability functions such as emergency brake assist or active yaw control, energy management functions such as recuperative braking or engine torque arbitration, and an emergency function for SAE L3 spanning from sensors to actuators – following our Sense/Plan/Act approach.

The FMS finally includes the CMC as well as a secondary emergency function for SAE level 4 and up, the so-called tertiary Vehicle Motion Control. The FMS can be integrated into various hardware components, for example computing platform or smart sensors and actuators. This allows tailored solutions to be offered to meet all different requirements. Based on higher computing performance, the experts are already working on the next system design levels. This will enable systems without mechanical fallback levels for pedals and steering wheel and more freedom in packaging – also for the vehicle's interior. In addition, this is aimed at introducing Artificial Intelligence (AI)-supported driving functions to increase energy efficiency and driving comfort.

Our chassis system architecture is modular and scalable by design, offering solutions for all vehicle and propulsion types. In combination with the sensors and actuators, computing and integration platforms within the complete system architecture, this all contributes to the ultimate goal of safe driving, Vision Zero.